# CMR COLLEGE OF ENGINEERING& TECHNOLOGY

**(UGC Autonomous)**

Kandlakoya, Medchal Road, Hyderabad – 501 401

## ACADEMIC REGULATIONS - R 22

## FOR CBCS & OUTCOME BASED B.TECH ( REGULAR, HONOURS and MINOR) PROGRAMMES

(**Effective for the students admitted into I year from the Academic Year 2022-23**)

### 1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

CMR College of Engineering & Technology, Hyderabad offers 4 Years (8 Semesters) Bachelor of Technology (B.Tech.) Regular, Honours and Minor degree Programmes, under Choice Based Credit System (CBCS), with effect from the Academic Year 2022-23 and onwards, in the Branches of Engineering.

### 2.0 Eligibility for Admission

**2.1** Admissions will be done as per the norms prescribed by the Government of Telangana. The Government orders in vogue shall prevail.

**2.2** The candidate should have passed the qualifying examination Intermediate or equivalent on the date of admission.

**2.3** Seats in each program in the college are classified into Category–A (70% of intake) and Category-B (30% of intake) besides Lateral Entry. Category-A seats will be filled by the Convener, TSEAMCET Admissions. Category-B seats will be filled by the College as per the guidelines of the Competent Authority.

**2.4** Lateral Entry seats for 10% of the candidates from the approved strength of the course shall be admitted into the III Semester directly based on the rank secured by the candidate in TSECET in accordance with the guidelines from the Competent Authority.

**2.5** The medium of instructions for the entire undergraduate programme in Engineering &Technology will be **English** only

### 3.0 B.Tech. Programme Structure

**3.1** A student after securing admission shall complete the B.Tech. programme in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight**academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech course. Each student shall secure 160 credits (with CGPA $\geq$ 5) required for the completion of the undergraduate programme and award of the B.Tech. degree.

**3.2** **UGC/ AICTE** specified definitions/ descriptions are adopted appropriately for variousterms and abbreviations used in these academic regulations/ norms, which are listed below.

### 3.2.1 Semester Scheme

Each undergraduate programme is of 4 academic years (8 semesters) with the academic year divided into two semesters (First/Odd and Second/Even). Each Semester shall have a minimum of 90 Instructional Days.

semester - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) indicated by UGC, and curriculum/course structure suggested by AICTE are followed.

### 3.2.2 Credit Courses

All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.

- One credit for one hour/ week/ semester for Theory/ Lecture (L) courses or Tutorials.
- One credit for two hours/ week/ semester for Laboratory/ Practical (P) courses.

Courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab are mandatory courses. These courses will not carry anycredits.

### 3.2.3 Subject Course Classification

All subjects/ courses offered for the undergraduate programme in E&T (B.Tech. degree programmes) are broadly classified as follows. The University has followed almost all the guidelines issued by AICTE/UGC.

| S. No. | Broad Course Classification | Course Group/ Category | Course Description |
|---|---|---|---|
| 1 | Foundation Courses (FnC) | BSC – Basic Sciences | Includes Mathematics, Physics and Chemistry subjects |
| 2 | | ESC - Engineering Sciences | Includes Fundamental Engineering Subjects |
| 3 | | HSMC – Humanities and Social Sciences | Includes subjects related to Humanities, Social Sciences and Management |
| 4 | Core Courses (CoC) | PCC – Professional Core | Includes core subjects related to the parent discipline/ department/ branch of Engineering. |
| 5 | | PEC – Professional Electives | Includes elective subjects related to the parent discipline/ department/ branch of Engineering. |

| | | | |
|---|---|---|---|
| 6 | Elective Courses (EℓC) | OEC – Open Electives | Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering. |
| 7 | Core Courses (PROJ) | Project Work | B.Tech. Project or UG Project or UG Major Project or Project Stage I & II |
| 8 | | Industry Training/ Internship/ Mini-project/ Mini- Project/ Skill Development Courses | Industry Training/ Internship/ Mini-Project/ Mini-Project/ Skill DevelopmentCourses |
| 9 | | Seminar | Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering. |
| 10 | Minor Courses | - | 1 or 2 Credit Courses (subset of HSMC) |
| 11 | Mandatory Courses (MC) | - | Mandatory Courses (non-credit) |

**4.0 Course Registration**

**4.1** A 'faculty advisor or counselor' shall be assigned to a group of 20 students, who will advise the students about the undergraduate programme, its course structure and curriculum, choice/option for subjects/ courses, based on their competence, progress, pre-requisites and interest.

**4.2** The academic section of the college invites 'registration forms' from students before the beginning of the semester through 'on-line registration', ensuring 'date and time stamping'. The online registration requests for any 'current semester' shall be **completed before the commencement of SEEs (Semester End Examinations) of the'preceding semester'**.

**4.3** A student can apply for **on-line** registration, **only after** obtaining the '**written approval**' from faculty advisor/counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with the Head of the Department, Faculty Advisor/ Counselor and the student.

**4.4** A student may be permitted to register for all the subjects/ courses in a semester as specified in the course structure with maximum additional subject(s)/course(s) limitedto 6 Credits (any 2 elective subjects), based on **progress** and SGPA/ CGPA, and completion of the '**pre-requisites'** as indicated for various subjects/ courses, in the department course structure and syllabus contents.

**4.5** Choice for '**additional subjects/courses**', not more than any 2 elective subjects in any Semester, must be clearly indicated, which needs the specific approval and signature ofthe Faculty Advisor/Mentor/HOD.

**4.6** If the student submits ambiguous choices or multiple options or erroneous entries

during **online** registration for the subject(s) / course(s) under a given/ specified course group/ category as listed in the course structure, only the first mentioned subject/ coursein that category will be taken into consideration.

**4.7** Subject/ course options exercised through **on-line** registration are final and **cannot** be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject/ course that has already been listed for registration by the Headof the Department in a semester could not be offered due to any inevitable or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the Headof the Department, with due notification and time-framed schedule, within **a week** afterthe commencement of class-work for that semester.

**4.8** Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor 'within a period of 15 days' from the beginning ofthe current semester.

**4.9** **Open Electives**: The students have to choose three Open Electives (OE-I, II & III) fromthe list of Open Electives given by other departments. However, the student can opt foran Open Elective subject offered by his own (parent) department, if the student has notregistered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat/should not match with any category (Professional Core, Professional Electives, Mandatory Courses etc.)of subjects even in the forthcoming semesters.

**4.10** **Professional Electives**: The students have to choose six Professional Electives (PE-I to VI) from the list of professional electives given.

**5.0** **Subjects/ courses to be offered**

**5.1** A subject/ course may be offered to the students, **only if** a minimum of 15 students optfor it.

**5.2** More than **one faculty member** may offer the **same subject** (lab/ practical may be included with the corresponding theory subject in the same semester) in any semester. However, selection of choice for students will be based on - '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).

**5.3** If more entries for registration of a subject come into picture, then the Head of the Department concerned shall decide, whether or not to offer such a subject/ course for **two (or multiple) sections**.

**5.4** In case of options coming from students of other departments/ branches/ disciplines (not considering **open electives**), first **priority** shall be given to the student of the '**parent department**'.

**6.0 Attendance requirements:**

**6.1** A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses (including attendance in mandatory courses and Additional courses if any) for that semester.**Two periods** of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject.

**6.2** Shortage of attendance in aggregate upto 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

**6.3** A stipulated fee shall be payable for condoning of shortage of attendance.

**6.4** Shortage of attendance below 65% in aggregate shall in **NO** case be condoned.

**6.5** **Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled,** including all academic credentials (internal marks etc.) of that semester. **They will not be promoted to the next semester**. They may seek re-registration for all those subjects registered in that semester in which the student is detained, by seeking re-admission into that semester asand when offered; if there are any professional electives and/ or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

**6.6** A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

**7.0 Academic Requirements**

The following academic requirements have to be satisfied, in addition to the attendancerequirements mentioned in Item No. **6**.

**7.1** A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject/ course.

**7.2** A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Real-time Research Project (or) Field Based Research Project (or) Mini Project (or) Internship (or) Technical Seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student isdeemed to have failed, if he (i) does not submit a report on Mini Project/Internship, or (ii) not make a presentation of the same before the evaluation committee as per

schedule, or (iii) secures less than 40% marks in Real-time Research Project (or) Field Based Research Project (or) Mini Project (or) Internship (or) Technical Seminar evaluations.

A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such 'one reappearance' evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it isscheduled.

### 7.3 Promotion Rules

| S. No. | Promotion | Conditions to be fulfilled |
|---|---|---|
| 1 | **First year first semester to first year second semester** | **Regular course of study of first year first semester.** |
| 2 | **First year second semester to Second year first semester** | **(i) Regular course of study of first year second semester.**<br>**(ii) Must have secured at least 20 credits out of 40 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.** |
| 3. | **Second year first semester to Second year second semester** | **Regular course of study of second year first semester.** |
| 4 | **Second year second semester to Third year first semester** | **(i) Regular course of study of second year second semester.**<br>**(ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.** |
| 5 | **Third year first semester to Third year second semester** | **Regular course of study of third year first semester.** |

| | | |
|---|---|---|
| **6** | **Third year second semester to Fourth year first semester** | **(i) Regular course of study of third year second semester.**<br>**(ii) Must have secured at least 72 credits out of 120 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.** |
| **7** | **Fourth year first semester to Fourth year second semester** | **Regular course of study of fourth year first semester.** |

**7.4** A student (i) shall register for all courses/subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing SGPA ≥ 5.0 (in each semester), andCGPA ≥ 5 (at the end of 8 semesters), (iv) **secured satisfactory grade in all the mandatory courses,** to successfully complete the undergraduate programme. The performance of the student in these 160 credits shall be considered for the calculation of the final CGPA **(at the end of undergraduate programme),** and shall be indicated in the consolidated grade cum credit sheet.

**7.5** If a student registers for '**extra subjects'** (in the parent department or other departments/branches of Engg.) other than those listed subjects totaling to 160 credits as specified in the course structure of his department, the performances in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits) will not be considered while calculating the SGPA and CGPA. For such '**extra subjects'** registered, percentage of marks and letter grade alone will be indicated in the grade card / marks memo as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations Items6 and 7.1 – 7.4 above.

**7.6** A student eligible to appear in the semester end examination for any subject/ course, but absent from it or failed (thereby failing to secure **'C'** grade or above) may reappear for that subject/ course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject/ course will be carried over, and added to the marks to be obtained in the SEE supplementary examination forevaluating performance in that subject.

**7.7** A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfillment of academic requirements**. The academic regulations under which a student has been re-admitted shall be applicable. Further, no grade allotments or SGPA/ CGPA calculations will be done for the entire semester in which the student has been detained.

**7.8** A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of academic credits.** The

academicregulations under which the student has been readmitted shall be applicable to him.

**8.0 Evaluation - Distribution and Weightage of Marks**

**8.1** The performance of a student in every subject/course (including practicals and ProjectStage – I & II) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination).

**8.2** In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks with a total duration of 2 hours as follows:

1. Mid Term Examination for 30 marks:
   a. Part - A : Objective/quiz/short answer paper for 10 marks.
   b. Part - B : Descriptive paper for 20 marks.

The objective/quiz/short answer paper is set with multiple choice, fill-in the blanks, match the following type of questions and short answer questions for a total of 10 marks (10 questions). The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks. The **average of the two Mid Term Examinations** shall be taken as the final marks for Mid Term Examination (for 30 marks).

The remaining 10 marks of Continuous Internal Evaluation are distributed as:

2. Assignment for 5 marks. (**Average of 2 Assignments** each for 5 marks)
3. Subject Viva-Voce/PPT/Poster Presentation/ Case Study/quiz on a topic in theconcerned subject for 5 marks.

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shallbe taken as the final marks for assignment (for 5 marks).

Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the subject concerned for 5 marks before II Mid-Term Examination.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Over all 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

*The student is eligible to write Semester End Examination of the concerned subject,*

*if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.*

*In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.*

There is NO Computer Based Test (CBT)/onetime improvement test of mid examinations for R22 regulations.

The details of the end semester question paper pattern are as follows:

**8.2.1** The semester end examinations (SEE), for theory subjects, will be conducted for 60 marks consisting of two parts viz. i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all unitscarrying equal marks.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.
- The duration of Semester End Examination is 3 hours.

**8.3** For practical subjects there shall be a Continuous Internal Evaluation (CIE) during thesemester for 40 marks and 60 marks for semester end examination. Out of the 40 marksfor internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 10 marks
2. **10 marks for viva-voce (**or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shallbe evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the cluster / other colleges which will be decided by the examination branch of the University.

In the Semester End Examination held for 3 hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
2. 15 for experiment/program

3. 15 for evaluation of results
4. 10 marks for presentation on another experiment/program in the same laboratory course and
5. 10 marks for viva-voce on concerned laboratory course.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Over all 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

*The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.*

*In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.*

**8.4** The evaluation of courses having ONLY internal marks in I Year I Semester and II Year II Semester is as follows:

1. I Year I Semester course ***(ex., Elements of CE/ME/EEE/ECE/CSE etc)*:** The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

**For CSE/IT and allied branches the Continuous Internal Evaluation (CIE) will be for 50 marks. Each Mid-Term examination consists of two parts i) Part – A for 20 marks, ii) Part – B for 20 marks with a total duration of 2 hours.**

**Part A: Objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 20 marks.**

**Part B: Descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks.**

**The remaining 10 marks of Continuous Internal Evaluation are for Assignment (5 marks) and Subject Viva-Voce/PPT/Poster Presentation/ Case Study (5 marks) and the evaluation pattern will remain same as for other theory subjects.**

**For all other branches, the Continuous Internal Evaluation (CIE) will be for 50 marks. Out of the 50 marks for internal evaluation:**

**a) A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 10 marks.**

**b) 10 marks for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.**

**c) Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 15 marks.**

**d) The remaining 15 marks are for Laboratory Report/Project and Presentation, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.**

2. II Year II Semester *Real-Time (or) Field-based Research Project* course: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or
(ii) secures less than 40% marks in this course.

**8.5** There shall be Industry training (or) Internship (or) Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal in collaboration with an industry of their specialization. Students shall register for this immediately after II-Year II Semester Examinations and pursue it during summer vacation/semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Mini Project shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Mini Project (or) Internship etc, Internal Supervisor and a Senior Faculty Member of the Department. There shall be **NO internal marks** for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal.

**8.6** There shall be a **Technical Seminar** presentation in the VIII Semester. For the Technical Seminar, the student shall collect the information on a specialized topic related to his branch other than the Real-Time (or) Field-based Research Project/ Mini project/ Internship/ Major Projects Phase-I & II topic with due approval of the Head of the department and prepare a technical report and submit to the department. The presentation demonstrating understanding of the topic and technical report shall be evaluated by a Departmental committee consisting of the Head of the department, Technical Seminar supervisor and a senior faculty member from the department. The Technical Seminar will be evaluated for 100 marks.

**8.7** The UG project shall be initiated at the end of the IV Year I Semester and the duration of the project work is one semester. The student must present Project Stage – I during

IV Year I Semester before II Mid examinations, in consultation with his Supervisor, the title, objective and plan of action of his Project work to the departmental committee for approval before commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start his project work.

**8.8** UG project work shall be carried out in two stages: Project Stage – I for approval of project before Mid-II examinations in IV Year I Semester and Project Stage – II duringIV Year II Semester. Student has to submit project work report at the end of IV Year II Semester. The project shall be evaluated for 100 marks before commencement of SEETheory examinations.

**8.9** For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall approve the project work to begin before II Mid-Term examination of IV Year I Semester. The student is deemed to be not eligible to register for the Project work, if he does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

**8.10** For Project Stage – II, the external examiner shall evaluate the project work for 60 marks and the internal project committee shall evaluate it for 40 marks. Out of 40 internal marks, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 20 marks and Project Supervisor shall evaluate for 20 marks. The topics for Mini Project/ Internship/SDC etc. and the main Project shall be different from the topic already taken. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project, the External Examiner shall be nominated by the Controller of Examinations from the panel of 3 names of external faculty members (Professors or Associate Professors outside the College) submitted by the HoD.

A student who has failed, may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

**8.11 A student can re-register for subjects in a semester:**

**If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Viva-voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.**

**They may seek re-registration for all those subjects registered in that semester in which the student is failed. The student has to re-appear for CIE and SEE as and when offered.**

**A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork in next academic year. His Continuous Internal Evaluation marks for 40 obtained in the previous attempt stand cancelled. The student has to obtain fresh set of marks for 40 allotted for CIE (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Viva-voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject). Head of the Dept. will take care of this.**

**8.12 For mandatory courses, a student has to secure 40 marks out of 100 marks (i.e. 40% of the 100 marks allotted) in the Continuous Internal Evaluation for passing the subject/course.**

**8.13 No marks or letter grades shall be allotted for mandatory/non-credit courses. Only Pass/Fail shall be indicated in Grade Card.**

## 9.0 Grading Procedure

**9.1** Grades will be awarded to indicate the performance of students in each Theory Subject,Laboratory/Practicals/Mini Project/Internship/SDC and Project Stage. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

**9.2** As a measure of the performance of a student, a 10-point absolute grading system usingthe following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

| % of Marks Secured in a Subject/Course (Class Intervals) | Letter Grade (UGC Guidelines) | Grade Points |
|---|---|---|
| Greater than or equal to 90% | O (Outstanding) | 10 |
| 80 and less than 90% | $A^+$ (Excellent) | 9 |
| 70 and less than 80% | A (Very Good) | 8 |
| 60 and less than 70% | $B^+$ (Good) | 7 |
| 50 and less than 60% | B (Average) | 6 |
| 40 and less than 50% | C (Pass) | 5 |
| Below 40% | F (FAIL) | 0 |
| Absent | Ab | 0 |

**9.3** A student who has obtained an '**F**' grade in any subject shall be deemed to have '**failed**'and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

**9.4** To a student who has not appeared for an examination in any subject, '**Ab**' grade will be allocated in that subject, and he is deemed to have '**Failed**'. A student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remainthe same as those obtained earlier.

**9.5** A letter grade does not indicate any specific percentage of marks secured by the student,but it indicates only the range of percentage of marks.

**9.6** A student earns Grade Point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding 'Credit Points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

**Credit Points (CP) = Grade Point (GP) x Credits …. For a course**

**9.7** A student passes the subject/ course only when **GP ≥ 5 ('C' grade or above)**

**9.8** The Semester Grade Point Average (SGPA) is calculated by dividing the sum of creditpoints (ΣCP) secured from all subjects/ courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimalplaces. SGPA is thus computed as

$$\textbf{SGPA} = \{ \sum_{i=1}^{N} C_i G_i \} / \{ \sum_{i=1}^{N} C_i \} \text{ …. For each semester},$$

where 'i' is the subject indicator index (considering all subjects in a semester), 'N' is the no. of subjects '**registered**' for the semester (as specifically required and listed under the course structure of the parent department), $C_i$ is the no. of credits allotted to the $i^{th}$ subject, and $G_i$ represents the grade points (GP) corresponding to the letter grade awarded for that $i^{th}$ subject.

**9.9** The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses (of 160) in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

$$\textbf{CGPA} = \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \} \text{ … for all S semesters registered}$$

**(i.e., up to and inclusive of S semesters, S ≥ 2)**,

where '**M**' is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has '**registered**' i.e., from the $1^{st}$ semester onwards up to and inclusive of the $8^{th}$ semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), $C_j$ is the no. of credits

allotted to the $j^{th}$ subject, and $G_j$ represents the grade points (GP) corresponding to the letter grade awarded for that $j^{th}$ subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

**Illustration of calculation of SGPA:**

| Course/Subject | Credits | Letter Grade | Grade Points | Credit Points |
|---|---|---|---|---|
| Course 1 | 4 | A | 8 | 4 x 8 = 32 |
| Course 2 | 4 | O | 10 | 4 x 10 = 40 |
| Course 3 | 2 | C | 5 | 2 x 5 = 10 |
| Course 4 | 3 | B | 6 | 3 x 6 = 18 |
| Course 5 | 1 | A+ | 9 | 1 x 9 = 9 |
| Course 6 | 1 | C | 5 | 1 x 5 = 5 |
| Course 7 | 1 | O | 10 | 1 x 10 = 10 |
| Course 8 | 2 | A | 8 | 2 x 8 = 16 |
| Course 9 | 1 | $B^+$ | 7 | 1 x 7 = 7 |
| Course 10 | 1 | $B^+$ | 7 | 1 x 7 = 7 |
| | 20 | | | 154 |

**SGPA = 154/20 = 7.7**

**Illustration of Calculation of CGPA up to 3rd Semester:**

| Semester | Course/ Subject Title | Credits Allotted | Letter Grade Secured | Corresponding Grade Point (GP) | Credit Points (CP) |
|---|---|---|---|---|---|
| I | Course 1 | 4 | A | 8 | 32 |
| I | Course 2 | 4 | O | 10 | 40 |
| I | Course 3 | 2 | B | 6 | 12 |
| I | Course 4 | 3 | A | 8 | 24 |
| I | Course 5 | 1 | A+ | 9 | 9 |
| I | Course 6 | 1 | C | 5 | 5 |
| I | Course 7 | 1 | B | 6 | 6 |
| I | Course 8 | 2 | A | 8 | 16 |
| I | Course 9 | 1 | C | 5 | 5 |
| I | Course 10 | 1 | O | 10 | 10 |
| II | Course 11 | 2 | B+ | 7 | 14 |
| II | Course 12 | 4 | B | 6 | 24 |
| II | Course 13 | 4 | A | 8 | 32 |
| II | Course 14 | 3 | O | 10 | 30 |
| II | Course 15 | 1 | A | 8 | 8 |
| II | Course 16 | 1.5 | C | 5 | 7.5 |
| II | Course 17 | 1.5 | O | 10 | 15 |
| II | Course 18 | 1.5 | B+ | 7 | 10.5 |

| | | | | | |
|---|---|---|---|---|---|
| II | Course 19 | 1.5 | B | 6 | 9 |
| III | Course 20 | 4 | A | 8 | 32 |
| III | Course 21 | 3 | B+ | 7 | 21 |
| III | Course 22 | 3 | A | 8 | 24 |
| III | Course 23 | 3 | O | 10 | 30 |
| III | Course 24 | 3 | A | 8 | 24 |
| III | Course 25 | 2 | C | 5 | 10 |
| III | Course 26 | 1 | O | 10 | 10 |
| III | Course 27 | 1 | B+ | 7 | 7 |
| | **Total Credits** | **60** | | **Total Credit Points** | **467** |

**CGPA = 467/60 = 7.78**

The calculation process of CGPA illustrated above will be followed for each subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech. programme.

**9.10** For merit ranking or comparison purposes or any other listing, **only** the '**rounded off'** values of the CGPAs will be used.

**9.11** SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sitting he passed his last exam in that semester. However, mandatory courses will not be taken into consideration.

## 10.0 Passing Standards

**10.1** A student shall be declared successful or 'passed' in a semester, if he secures a GP ≥ 5 (**'C'** grade or above) in every subject/course in that semester (i.e. when the student gets an SGPA ≥ 5.0 at the end of that particular semester); and he shall be declared successful or 'passed' in the entire undergraduate programme, only when gets a CGPA ≥ 5.00 (**'C'** grade or above) for the award of the degree as required.

**10.2** After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned, etc.) and credits earned. **There is NO exemption of credits in any case.**

## 11.0 Declaration of results

**11.1** Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.

**11.2** For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

**% of Marks = (final CGPA – 0.5) x 10**

**12.0 Award of Degree**

**12.1** A student who registers for all the specified subjects/ courses as listed in the course structure and secures the required number of 160 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified'** for the award of B.Tech. degree in the branch of Engineering selected at the time of admission.

**12.2** A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

**12.3** A student with final CGPA (at the end of the undergraduate programme) ≥ 8.00, and fulfilling the following conditions - shall be placed in '**First Class with Distinction'**. However, he

(i) Should have passed all the subjects/courses in '**First Appearance'** within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

(ii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA ≥ 8 shall be placed in **'First Class'.**

**12.4** Students with final CGPA (at the end of the undergraduate programme) ≥ 7.0 but < 8.00 shall be placed in **'First Class'.**

**12.5** Students with final CGPA (at the end of the undergraduate programme) ≥ 6.00 but < 7.00, shall be placed in '**Second Class'**.

**12.6** All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 6, shall be placed in '**pass class**'.

**12.7** A student with final CGPA (at the end of the undergraduate programme) < 5.00 will not be eligible for the award of the degree.

**12.8** Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of '**Gold Medal**'.

**12.9 Award of 2-Year B.Tech. Diploma Certificate**

*1.* A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) upto B.Tech. II Year II Semester, if the student want to exit the 4-Year B.Tech. program and *requests for the 2 -Year* B. Tech. (*UG) Diploma Certificate.*

*2.* The student **once opted and awarded 2-Year UG Diploma Certificate, the student will be permitted to join** in B. Tech. III Year I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree ONLY in the

next academic year along with next batch students. *However, if any student wishes to continue the study after opting for exit, he/she should register for the subjects/courses in III Year I Semester before commencement of classwork for that semester.*

3. *The students, who exit the 4-Year B. Tech. program after II Year of study and wish to re-join the B.Tech. program, must submit the 2 -Year* B. Tech. (*UG) Diploma Certificate awarded to him, subject to the eligibility for completion of Course/Degree.*

4. A student may be permitted to take one year break after completion of II Year II Semester or B. Tech. III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

## 13.0 Withholding of results

**13.1** If the student has not paid the fees to the College at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

## 14.0 Transitory Regulations

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of R18 Regulations due to lack of attendance, shall be permitted to join I year I Semester of R22 Regulations and he is required to complete the study of B.Tech. programme within the stipulated period of eight academic years from the date of first admission in I Year.

2. A student who has been detained in any semester of II to VIII semesters of R18 regulations for want of attendance, shall be permitted to join the corresponding semester of R22 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The R22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

3. A student of R18 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of R22 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The R22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in R22 Regulations:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R22 Regulations. **There is NO exemption of credits in any case**.
6. If a student is readmitted to R22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R22 Regulations will be substituted by another subject to be suggested by the Board of Studies.
7. The total credits required are 160 including both R18 & R22 regulations, and if the total credits are less than 160 including both R18 & R22 Regulations then an additional course(s) suggested by the Board of Studies may be given to fulfill the minimum requirements of 160 credits.

**Note:** If a student readmitted to R22 Regulations and has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in R22 Regulations, the remedial classes shall be conducted to cover those subjects/topics for the benefit of the students.

## 15.0 Student Transfers

**15.1** There shall be no Branch transfers after the completion of Admission Process.

**15.2** Transfer of candidates from other Institutions will be governed by the regulations of Telangana State Government issued from time to time.

**15.3** The students seeking transfer to colleges affiliated to JNTUH from various other Universities/institutions have to pass the failed subjects which are equivalent to the subjects of JNTUH, and also pass the subjects of JNTUH which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of JNTUH, the students have to study those subjects in JNTUH in spite of the fact that those subjects are repeated.

**15.4** The transferred students from other Universities/Institutions to JNTUH affiliated colleges who are on rolls are to be provided one chance to write the CBT (for internal marks) in the equivalent subject(s) as per the clearance letter issued by the University.

**15.5** The autonomous affiliated colleges have to provide one chance to write the internal examinations in the equivalent subject(s) to the students transferred from other universities/institutions to JNTUH autonomous affiliated colleges who are on rolls, as per the clearance (equivalence) letter issued by the University.

## 16.0 Scope

1. Where the words "he", "him", "his", occur in the write-up of regulations, they include "she", "her", "hers".
2. Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".
3. The Academic Regulations should be read as a whole, for the purpose of any interpretation.
4. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal/College Academic Council/Honourable Vice-Chancellor of JNTUH is final.
5. The College may change or amend the Academic Regulations, Course Structure or Syllabi at any time, and the changes or amendments made shall be applicable to all Students with effect from the dates notified by the College Authorities.

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# ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME)

**(Applicable for the students admitted into II Year B.Tech (Lateral Entry Scheme) from the Academic Year 2023-24 and onwards)**

**1. Eligibility for the award of B.Tech Degree (LES)**

The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

**2.** The student shall register for 120 credits and secure 120 credits with CGPA $\geq 5$ from II year to IV-year B.Tech. programme (LES) for the award of B.Tech. degree.

**3.** The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.

**4.** The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

**5. Promotion rule**

| S. No | Promotion | Conditions to be fulfilled |
|---|---|---|
| 1 | Second year first semester to second year second semester | Regular course of study of second year first semester. |
| 2 | Second year second semester to third year first semester | (i) Regular course of study of second year second semester.<br>(ii) Must have secured at least 24 credits out of 40 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 3 | Third year first semester to third year second semester | Regular course of study of third year first semester. |
| 4 | Third year second semester to fourth year first semester | (i) Regular course of study of third year second semester.<br>(ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 5 | Fourth year first semester to fourth year second semester | Regular course of study of fourth year first semester. |

6. **All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).**

7. **LES students are not eligible for 2-Year B. Tech. Diploma Certificate.**

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# MALPRACTICE RULES

Disciplinary Action for Malpractices/Improper Conduct in Examinations

| | Nature of Malpractices/ Improper conduct | Punishment |
|---|---|---|
| 1.(a) | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers, smart watches, electronic gadgets 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.<br><br>Confiscation of Cell phones, pager, palm computers, smart watches, electronic gadgets etc. and the same would be handed over only after punishment finalized by Malpractice Committee. |
| (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, pager, palm computers, smart watches, electronic gadgets with any candidate 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.<br><br>Confiscation of Cell phones, pager, palm computers, smart watches, electronic gadgets etc. and the same would be handed over only after punishment finalized by Malpractice Committee. |
| 2. | Has copied in the examination hall from any paper, book, programmable calculators, palm computers, cell phones, smart watches, electronic gadgets 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 excluding Project work/ Mandatory Courses /Technical Seminar and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled.<br><br>Confiscation of Cell phones, pager, palm computers, smart watches, electronic gadgets etc. and the same would be handed over only after punishment finalized by Malpractice Committee. |
| 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 |

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|---|---|---|
| | | 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 examinations of the Remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all end semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him. |
| 4. | Smuggles the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination | Expulsion from the examination hall and cancellation of performance in that subject and all the 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/year. The candidate is also debarred for two consecutive semesters from class work and all end semester 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 the 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 and around the or organizes a walk out or instigates others **to** examination hall-walk out, 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 or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College | 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/year. The candidates are also 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. |

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|---|---|---|
| | 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. | |
| 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 performance in that subject and all the 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/year. The candidate is also debarred for two consecutive semesters from class work and all Semester End 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 for the remaining examinations of the subjects of That semester/year. 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. | If the student belongs to the college, expulsion from the examination performance in that subject and all other subjects shall and cancellation of 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/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them. |
| 10. | Comes in a state of inebriated/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 other remaining examinations of the subjects of that semester/year. |
| 11. | Copying detected on the basis of internal evidence, such as, during valuation or during | Cancellation of the performance in that subject and all other subjects the |

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|---|---|---|
| | special scrutiny. | candidate has appeared including practical examinations excluding Project work/ Mandatory Courses /Technical Seminar of that semester/year. |
| 12. | If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the College Academic Committee for further action to award suitable punishment. | |

**Malpractices identified by squad or special invigilators**

Punishments to the candidates as per the above guidelines.

**Malpractice identified at Spot center during valuation**

1) The following procedure is to be followed in the case of malpractice cases detected during valuation, scrutiny etc. at spot center. Malpractice is detected at the spot valuation. The case is to be referred to the malpractice committee. Malpractice committee will meet and discuss/question the candidate and based on the evidences, the committee will recommend suitable action on the candidate.
2) A notice is to be served to the candidate(s) involved through the Principal regarding the malpractice and seek explanations.
3) The involvement of staff who are in charge of conducting examinations, invigilators valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing in correct or misleading information) that infringe upon the course of natural justice to one and all concerned at the examinations shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.
4) Based on the explanation and recommendation of the committee action may be initiated.

**Malpractice committee:**

| | |
|---|---|
| **(a) Chief Superintendent** | Chairman |
| **(b)** Controller of Examinations | Member |
| **(c)** Dean Academics | Member |
| **(d)** Chief Examiner of the Course/ Subject Expert | Member |
| **(e)** Concerned Head of the Department | Member |
| **(f)** Observer | Member |

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**CMR COLLEGE OF ENGINEERING & TECHNOLOGY**
**(Autonomous)**

**DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

**Institute Vision**

To be a premier academic institution striving continuously for excellence in technical education, research and technological service to the nation.

**Institute Mission**

- Create and sustain a community of learning in which students acquire knowledge and learn to apply it professionally with a concern for the society.
- Pursue and disseminate research findings and offer knowledge based technological services to satisfy the needs of society and the industry.
- Promote professional ethics, leadership qualities and social responsibilities.

**Vision of the Department**

- To produce globally competitive engineering graduates with social awareness and become centre of excellence through research in the areas of Electronics & Communication Engineering.

**Mission of the Department**

- To impart quality education to the students through quality faculty in the domain of Electronics & Communication Engineering and related fields to make them globally competitive in employment and higher education.

- To pursue research in Electronics & Communication Engineering and related disciplines in order to serve the needs of the society.

- Develop self-learning abilities and professional ethics to remain professionally competent so as to serve the society.

**Program Educational Objectives (PEOs)**

PEO-1: Excel in their professional career and in higher education in Electronics & Communication Engineering and related fields.

PEO-2: Exhibit leadership through professional ability and team work.

PEO-3: Adapt to emerging trends for sustained growth in their relevant areas of interest and exhibit social responsibility

**Program Outcomes**

PO-1: Ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO-2: Ability to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3: Ability to 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.

PO-4: Ability to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5: Ability to 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.

PO-6: Ability to 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.

PO-7: Ability to understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO-9: Ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10: Ability to 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.

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PO-11: Ability to 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

PO-12: Ability to 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.

## Program Specific Outcomes (PSOs)

**PSO 1:** Able to apply the knowledge of semiconductor technology for the analysis/design of VLSI and Embedded systems.

**PSO 2:** Capable of exploring the knowledge of Electronics & Communication Engineering in core as well as multidisciplinary areas to attain the solution of engineering problems.

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**CMR COLLEGE OF ENGINEERING & TECHNOLOGY**
**(UGC AUTONOMOUS)**
**B. Tech- Electronics & Communication Engineering**
CBCS & OUTCOME BASED COURSE STRUCTURE & SYLLABUS
***(Effective for the students admitted into I year from the Academic Year 2022-23)***

| SEMESTER - I | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. No** | **Course Code** | **Course Title** | **Category** | **Hours per Week** | | | **Credits** | **Maximum Marks** | |
| | | | | **L** | **T** | **P** | | **CIE** | **SEE** |
| 1 | A400001 | Matrices and Calculus | BSC | 3 | 1 | 0 | 4 | 40 | 60 |
| 2 | A400009 | Engineering Chemistry | BSC | 3 | 1 | 0 | 4 | 40 | 60 |
| 3 | A402201 | Basic Electrical Engineering | ESC | 2 | 0 | 0 | 2 | 40 | 60 |
| 4 | A405202 | C Programming and Data Structures | ESC | 3 | 0 | 0 | 3 | 40 | 60 |
| 5 | A400502 | Engineering Chemistry Laboratory | BSC | 0 | 0 | 2 | 1 | 40 | 60 |
| 6 | A404501 | Elements of Electronics and Communication Engineering | ESC | 0 | 0 | 2 | 1 | 50 | - |
| 7 | A402502 | Basic Electrical Engineering Laboratory | ESC | 0 | 0 | 2 | 1 | 40 | 60 |
| 8 | A403502 | Computer Aided Engineering Drawing | ESC | 0 | 1 | 2 | 2 | 40 | 60 |
| 9 | A405503 | C Programming and Data Structures Laboratory | ESC | 0 | 0 | 2 | 1 | 40 | 60 |
| 10 | A400505 | Introduction to Social Innovation | HSMC | 0 | 0 | 2 | 1 | 40 | 60 |
| 11 | A400703 | Constitution of India | MC | 2 | 0 | 0 | 0 | - | - |
| | | **Total:** | | **13** | **3** | **12** | **20** | | |
| | | **Total hours per Week:** | | **28** | | | | | |

| SEMESTER - II | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. No** | **Course Code** | **Course Title** | **Category** | **Hours per Week** | | | **Credits** | **Maximum Marks** | |
| | | | | **L** | **T** | **P** | | **CIE** | **SEE** |
| 1 | A400101 | English for Skill Enhancement | HSMC | 2 | 0 | 0 | 2 | 40 | 60 |
| **2** | A400002 | Ordinary Differential Equations and Vector Calculus | BSC | 3 | 1 | 0 | 4 | 40 | 60 |
| 3 | A400008 | Applied Physics | BSC | 3 | 1 | 0 | 4 | 40 | 60 |
| 4 | A404201 | Basic Electronic Circuits | ESC | 3 | 0 | 0 | 3 | 40 | 60 |
| 5 | A400503 | English Language and Communication Skills Laboratory | HSMC | 0 | 0 | 2 | 1 | 40 | 60 |
| 6 | A400501 | Applied Physics Laboratory | BSC | 0 | 0 | 3 | 1.5 | 40 | 60 |
| 7 | A404502 | Basic Electronic Circuits Laboratory | ESC | 0 | 0 | 3 | 1.5 | 40 | 60 |
| 8 | A405504 | IT Workshop | ESC | 0 | 0 | 3 | 1.5 | 40 | 60 |
| 9 | A400506 | Engineering Exploration & Practice | HSMC | 0 | 0 | 3 | 1.5 | 40 | 60 |
| 10 | A400704 | Universal Human Values | MC | 2 | 0 | 0 | 0 | - | - |
| | | **Total:** | | **13** | **2** | **14** | **20** | | |
| | | **Total hours per Week** | | **29** | | | | | |
| | | **Total Credits in I Year: 40** | | | | | | | |

| SEMESTER – III | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S. No | Course Code | Course Title | Category | Hours per Week | | | Credits | Maximum Marks | |
| | | | | L | T | P | | CIE | SEE |
| 1 | A400007 | Numerical Methods and Complex Variables | BSC | 3 | 1 | 0 | 4 | 40 | 60 |
| 2 | A402205 | Network analysis and Synthesis | ESC | 3 | 0 | 0 | 3 | 40 | 60 |
| 3 | A404301 | Analog Circuits | PCC | 3 | 0 | 0 | 3 | 40 | 60 |
| 4 | A404302 | Probability Theory and Stochastic Processes | PCC | 3 | 0 | 0 | 3 | 40 | 60 |
| 5 | A404303 | Signals & Systems | PCC | 3 | 0 | 0 | 3 | 40 | 60 |
| 6 | A405506 | Python Programming Laboratory | ESC | 0 | 1 | 2 | 2 | 40 | 60 |
| 7 | A404504 | Analog Circuits Laboratory | PCC | 0 | 0 | 2 | 1 | 40 | 60 |
| 8 | A404505 | Basic Simulation Laboratory | PCC | 0 | 0 | 2 | 1 | 40 | 60 |
| 9 | A400702 | Gender Sensitization | MC | 2 | 0 | 0 | 0 | - | - |
| | **Total:** | | | **17** | **2** | **6** | **20** | | |
| | **Total hours per Week:** | | | **25** | | | | | |

| SEMESTER – IV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S. No | Course Code | Course Title | Category | Hours per Week | | | Credits | Maximum Marks | |
| | | | | L | T | P | | CIE | SEE |
| 1 | A404304 | Analog and Digital Communications | PCC | 3 | 0 | 0 | 3 | 40 | 60 |
| 2 | A404305 | Switching Theory and Logic Design | PCC | 2 | 0 | 0 | 2 | 40 | 60 |
| 3 | A404306 | Electromagnetic fields and Transmission Lines | PCC | 3 | 0 | 0 | 3 | 40 | 60 |
| 4 | A404307 | Linear and Digital IC Applications | PCC | 3 | 0 | 0 | 3 | 40 | 60 |
| 5 | A404308 | Electronic Circuit Analysis | PCC | 3 | 0 | 0 | 3 | 40 | 60 |
| 6 | A404507 | Analog and Digital Communications Laboratory | PCC | 0 | 0 | 2 | 1 | 40 | 60 |
| 7 | A404508 | Linear and Digital IC Applications Laboratory | PCC | 0 | 0 | 2 | 1 | 40 | 60 |
| 8 | A404509 | Electronic Circuit Analysis & Switching Theory and Logic Design Laboratory | PCC | 0 | 0 | 2 | 1 | 40 | 60 |
| 9 | A400507 | Social Innovation in Practice | HSMC | 0 | 0 | 2 | 1 | 40 | 60 |
| 10 | A404801 | Real Time project/Field Based Projects | PROJ | 0 | 0 | 4 | 2 | 50 | - |
| 11 | A400701 | Environmental Science | MC | 2 | 0 | 0 | 0 | - | - |
| | **Total:** | | | **16** | **0** | **12** | **20** | | |
| | **Total hours per Week** | | | **28** | | | | | |
| | **Total Credits in II Year: 40** | | | | | | | | |

| SEMESTER - V | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S. No | Course Code | Course Title | Category | Hours per Week | | | Credits | Maximum Marks | |
| | | | | L | T | P | | CIE | SEE |
| 1 | A404309 | Microcontrollers | PCC | 3 | 1 | 0 | 4 | 40 | 60 |
| 2 | A404310 | Antennas and Wave Propagation | PCC | 3 | 0 | 0 | 3 | 40 | 60 |
| 3 | A404311 | CMOS VLSI Design | PCC | 3 | 1 | 0 | 4 | 40 | 60 |
| 4 | A404312 | IoT Architectures and Protocols | PCC | 3 | 0 | 0 | 3 | 40 | 60 |
| 5 | **PE** | **Professional Elective-I** | PEC | 3 | 0 | 0 | 3 | 40 | 60 |
| | A404401 | Computer Organization & Operating Systems | | | | | | | |
| | A404402 | Data Communications and Computer Networks | | | | | | | |
| | A404403 | Electronic Measurements and Instrumentation | | | | | | | |
| 6 | A400504 | Advanced English Communication Skills Laboratory | HSMC | 0 | 0 | 2 | 1 | 40 | 60 |
| 7 | A404511 | Microcontrollers Laboratory | PCC | 0 | 0 | 2 | 1 | 40 | 60 |
| 8 | A404512 | IoT Architectures and Protocols Laboratory | PCC | 0 | 0 | 2 | 1 | 40 | 60 |
| 9 | A400705 | Intellectual property rights | MC | 2 | 0 | 0 | 0 | - | - |
| | | **Total:** | | **17** | **2** | **6** | **20** | | |
| | | **Total hours per Week:** | | **25** | | | | | |

| SEMESTER - VI | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S. No | Course Code | Course Title | Category | Hours per Week | | | Credits | Maximum Marks | |
| | | | | L | T | P | | CIE | SEE |
| 1 | A404314 | Digital Signal Processing | PCC | 3 | 0 | 0 | 3 | 40 | 60 |
| 2 | A404316 | Control Systems | PCC | 3 | 1 | 0 | 4 | 40 | 60 |
| 3 | A404315 | Microwave and Optical Communications | PCC | 3 | 0 | 0 | 3 | 40 | 60 |
| 4 | A404317 | Professional Practice, Law & Ethics | PCC | 2 | 0 | 0 | 2 | 40 | 60 |
| 5 | **PE** | **Professional Elective-II** | PEC | 3 | 0 | 0 | 3 | 40 | 60 |
| | A404404 | Digital Image Processing | | | | | | | |
| | A404405 | Mobile Communications and Networks | | | | | | | |
| | A404406 | Embedded System Design | | | | | | | |
| 6 | A404514 | Digital Signal Processing Laboratory | PCC | 0 | 0 | 2 | 1 | 40 | 60 |
| 7 | A404515 | CMOS VLSI Design Laboratory | PCC | 0 | 0 | 2 | 1 | 40 | 60 |
| 8 | A404516 | Microwave and Optical Communications Laboratory | PCC | 0 | 0 | 2 | 1 | 40 | 60 |
| 9 | A404802 | Industry Oriented Mini Project/Internship | PROJ | 0 | 0 | 4 | 2 | - | 100 |
| | | **Total:** | | **14** | **1** | **10** | **20** | | |
| | | **Total hours per Week** | | **25** | | | | | |
| | | **Total Credits in III Year: 40** | | | | | | | |

| SEMESTER – VII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. No** | **Course Code** | **Course Title** | **Category** | **Hours per Week** | | | **Credits** | **Maximum Marks** | |
| | | | | **L** | **T** | **P** | | **CIE** | **SEE** |
| 1 | A400102 | Business Economics & Financial Analysis | HSMC | 3 | 0 | 0 | 3 | 40 | 60 |
| 2 | **PE** | **Professional Elective-III** | PEC | 3 | 0 | 0 | 3 | 40 | 60 |
| | A404407 | Radar Systems | | | | | | | |
| | A404408 | CMOS Analog IC Design | | | | | | | |
| | A404409 | Artificial Neural Networks | | | | | | | |
| 3 | **PE** | **Professional Elective-IV** | PEC | 3 | 0 | 0 | 3 | 40 | 60 |
| | A404410 | Network Security and Cryptography | | | | | | | |
| | A404411 | Satellite Communications | | | | | | | |
| | A404412 | Biomedical Instrumentation | | | | | | | |
| 4 | **PE** | **Professional Elective-V** | PEC | 3 | 0 | 0 | 3 | 40 | 60 |
| | A404413 | Artificial Intelligence | | | | | | | |
| | A404414 | 5G and beyond Communications | | | | | | | |
| | A404415 | Machine learning | | | | | | | |
| 5 | **OE-I** | **Open Elective – I** | OEC | 3 | 0 | 0 | 3 | 40 | 60 |
| 6 | A404518 | Advanced Communication Laboratory | PCC | 0 | 1 | 2 | 2 | 40 | 60 |
| 7 | A404803 | Major Project Phase-I | PROJ | 0 | 0 | 6 | 3 | 40 | 60 |
| | **Total:** | | | **15** | **1** | **8** | **20** | | |
| | **Total hours per Week:** | | | **24** | | | | | |

| SEMESTER – VIII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. No** | **Course Code** | **Course Title** | **Category** | **Hours per Week** | | | **Credits** | **Maximum Marks** | |
| | | | | **L** | **T** | **P** | | **CIE** | **SEE** |
| 1 | **PE** | **Professional Elective-VI** | PEC | 3 | 0 | 0 | 3 | 40 | 60 |
| | A404416 | Multimedia Database Management Systems | | | | | | | |
| | A404417 | System on Chip Architecture | | | | | | | |
| | A404418 | Wireless sensor Networks | | | | | | | |
| 2 | **OE-II** | **Open Elective – II** | OEC | 3 | 0 | 0 | 3 | 40 | 60 |
| 3 | **OE-III** | **Open Elective – III** | OEC | 3 | 0 | 0 | 3 | 40 | 60 |
| 4 | A404804 | Technical Seminar | PROJ | 0 | 0 | 4 | 2 | - | 100 |
| 5 | A404805 | Major Project Phase-II | PROJ | 0 | 0 | 18 | 9 | 40 | 60 |
| | **Total:** | | | **9** | **0** | **22** | **20** | | |
| | **Total hours per Week** | | | **31** | | | | | |
| | **Total Credits in IV Year: 40** | | | | | | | | |

| OPEN ELECTIVE COURSES | | |
|---|---|---|
| **S. No** | **Course code** | **Course Name** |
| **OPEN ELECTIVE COURSE-I** | | |
| 1 | A404601 | Fundamentals of Internet Of Things |
| 2 | A404602 | Principles of Digital Signal Processing |
| 3 | A405602 | Fundamentals of Operating Systems |
| 4 | A405604 | Java Programming |
| 5 | A402601 | Renewable Energy Sources |
| 6 | A402602 | Basics of Power Electronics & Drives |
| 7 | A403601 | Fundamentals of Engineering Materials |
| 8 | A403602 | Basics of Thermodynamics |
| 9 | A401601 | Disaster Preparedness & Planning Management |
| 10 | A401602 | Environmental Impact Assessment |
| 11 | A400601 | Basics of Logistics And Supply Chain Management |
| 12 | A400602 | Industrial Relations |
| **OPEN ELECTIVE COURSE-II** | | |
| 13 | A404603 | Sensors & Transducers |
| 14 | A404604 | Image Processing |
| 15 | A405601 | Fundamentals of Database Management Systems |
| 16 | A405605 | Web Programming |
| 17 | A402603 | Electrical Vehicle Technology |
| 18 | A402604 | Basics of Power Plant Engineering |
| 19 | A403603 | Fundamentals of Manufacturing Processes |
| 20 | A403604 | Fundamentals of Automobile Engineering |
| 21 | A401603 | Remote Sensing & Geographical Information Systems |
| 22 | A401604 | Solid Waste Management |
| 23 | A400603 | Entrepreneurship |
| 24 | A400604 | Ethics In Business & Corporate Governance |
| **OPEN ELECTIVE COURSE-III** | | |
| 25 | A404605 | Fundamentals Of Embedded Systems |
| 26 | A404606 | Data Communications |
| 27 | A405603 | Fundamentals of Computer Networks |
| 28 | A405606 | Fundamentals of Devops |
| 29 | A405602 | Cloud Computing |
| 30 | A402605 | Nano Technology |
| 31 | A402604 | EV Batteries & Charging System |
| 32 | A403605 | Industrial Safety Engineering |
| 33 | A403606 | Waste To Energy |
| 34 | A401605 | Energy Efficient Buildings |
| 35 | A401606 | Environmental Pollution |
| 36 | A400605 | Basics of Marketing |

## (A400001) MATRICES AND CALCULUS

(Common to All)

**B.Tech (ECE): I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**UNIT-I**

**Matrices:** Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous equations and non-homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

**UNIT-II**

**Eigen values and Eigen vectors:**

Linear Transformation and Orthogonal transformation: Eigen values, Eigen vectors and their properties, Diagonalization of a square matrix, Cayley-Hamilton theorem (without proof) -Inverse and power of a matrix by Cayley-Hamilton theorem, Quadratic forms and nature of the quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformations.

**UNIT-III**

**Calculus:**

**Mean value theorems:** Rolle's theorem, Lagrange's mean value theorem with their geometrical interpretation and applications, Cauchy's mean value theorem, Taylor's series, Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (only in Cartesian coordinates),

**Improper Integral:** Beta, Gamma functions and their applications.

**UNIT-IV**

**Multivariable calculus (Partial Differentiation and applications):**

Partial differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

**UNIT-V**

**Multivariable Calculus (Integration):**

Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and(Cartesian to Spherical and Cylindrical polar coordinates)for triple integrals.

**TEXTBOOKS:**

1. Higher Engineering Mathematics, (36$^{th}$Edition), B.S. Grewal, Khanna Publishers, 2010.
2. Advanced Engineering Mathematics, (5$^{th}$Edition), R.K. Jain and S.R.K Iyengar, NarosaPublications,2016.

**REFERENCE BOOKS:**

1. Advanced Engineering Mathematics, (9$^{th}$ Edition), Erwin kreyszig, John Wiley& Sons,2006.
2. Calculus and Analytic geometry, (9$^{th}$Edition), G.B. Thomas and R.L. Finney, Pearson, Reprint, 2002.
3. A textbook of Engineering Mathematics, (10$^{th}$ Edition), N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2019.
4. Higher Engineering Mathematics, (11$^{th}$Reprint), Ramana B.V., Tata McGraw Hill New Delhi, 2010.

**COURSE OUTCOMES:**

On completion of the course students will be able to

1. Solve linear system of equations represented by matrices
2. Obtain eigen values, eigen vectors and perform diagonalization of a square matrix.
3. Verify mean value theorems & evaluation of improper integrals by using Beta and Gamma functions.
4. Develop the skill of determining optimal values of multivariable functions using classical methods.
5. Evaluate the multiple integrals and apply the concept to find areas, volumes.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | 2 |
| **CO2** | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | 2 |
| **CO3** | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 |
| **CO4** | 3 | 2 | 3 | 3 | - | - | - | - | - | - | - | 3 |
| **CO5** | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | 3 |

## (A400009) ENGINEERING CHEMISTRY

(Common to all Branches)

| B.Tech (ECE): I Semester | L | T | P | C |
|---|---|---|---|---|
| | 3 | 1 | 0 | 4 |

**UNIT-I: Electrochemistry, Batteries and Corrosion**

**Electrochemistry:** Electrode potential, Standard electrode potential and E.M.F of the cell. Electrochemical cell, Nernst equation- derivation and applications, Types of electrodes- Quinhydrone electrode, Calomel electrode and Glass electrode. Electro chemical series and its applications. **Batteries**- primary (Lithium cell), secondary (Lead acid storage battery and Lithium-ion battery) and Fuel cells ($H_2$-$O_2$ and methanol-oxygen), Solar cells - Introduction and applications of Solar cells.

**Corrosion:** Introduction, Definition, Causes and effects of corrosion, Theories of chemical and electrochemical corrosion, Pilling-Bedworth rule, Types of corrosion- Galvanic, Waterline and Pitting corrosion, Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection, Sacrificial anode and Impressed current cathodic methods, Surface coatings- Metallic coatings, hot dipping, galvanizing and tinning, Electroplating- Copper plating and electroless plating - Nickel plating.

**UNIT-II: Material Chemistry - High Polymers**

Types of polymerizations (addition, condensation and copolymerization).

**Plastics:** Thermoplastic and Thermosetting resins, Compounding and fabrication of plastics (compression and injection moulding). Preparation, properties, Engineering applications of PVC, Teflon and Bakelite.

**Fibers:** Characteristics of fibers - preparation, properties and uses of Nylon-6,6 and Dacron, Fiber Reinforced Plastics (FRP) - applications.

**Rubbers:** Natural rubber and its vulcanization. Elastomers: Buna-s, Butyl rubber and Thiokol rubber. **Conducting polymers:** Characteristics and Classification with examples-mechanism of conduction in trans-polyacetylene and applications of conducting polymers.

**Biodegradable polymers:** Preparation and applications of Polyvinyl acetate, Polylactic acid and poly vinyl alcohol.

**UNIT-III: Energy Sources**

Introduction, Calorific value of fuel – HCV, LCV- Dulongs formula. Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages

**UNIT-IV: Water Technology**

Sources of water, Impurities in water, Hardness of water, Temporary and permanent hardness, Units of hardness, Estimation of temporary and permanent hardness of water, EDTA method, Numerical problems, Potable water Treatment-Specifications, Steps involved in Treatment-Sedimentation, Coagulation, Filtration, Sterilization, Desalination of Brackish Water, Reverse Osmosis and Electro dialysis.

Industrial water treatment, Boiler Troubles-Scales and sludges, Caustic embrittlement, Boiler corrosion, Priming and foaming. Hot lime and cold lime soda Process-Numerical problems, Zeolite process and Ion exchange process. Internal conditioning methods like Phosphate, Carbonate, Calgon and Colloidal conditioning.

**UNIT-V: Engineering Materials**

**Cement:** Portland cement, its composition, setting and hardening.

**Smart materials:** Smart materials and their engineering applications

**Advanced Glass Technology**: Structure and nature of glasses, transformation range behaviour, dependence of physico-chemical characteristic of glasses on their constituents. Strength of glass and glass articles.

**Lubricants:** Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

**TEXT BOOKS:**

1. Engineering Chemistry (1st edition), Dr. K. Soujanya, Dr. J. Saroja, Lt. D. Divya, Skytech Publishers, 2022
2. Engineering Chemistry (1st edition), P. C. Jain and M. Jain, Dhanapat Rai& Sons.
3. Engineering chemistry (1st edition), Dr. Bharathikumari, Dr. Jyotsna.

**REFERENCE BOOKS:**


1. Engineering Chemistry (2nd edition), Shikha Agarwal; Cambridge University Press, 2015.
2. Engineering Chemistry (1st edition), Prasanth Rath, Cengage Learning, 2015.
3. Engineering Chemistry (3rd edition), B. Siva Shankar, Tata McGraw Hill Publishing Limited, 2015.
4. Text of Engineering Chemistry (12th edition), S. S. Dara, Mukkanti, S. Chand & Co, New Delhi, 2006.
5. Chemistry of Engineering Materials (5th edition), C. V. Agarwal, C. P. Murthy, A. Naidu, Wiley India, 2013.


**COURSE OUTCOMES:**

After completion of the course students will be able to

1. Apply the principles of electrochemistry, corrosion science and analyse application of battery technologies, fuel cells in practical applications.
2. Acquire knowledge on polymer technology and uses of key polymers in engineering fields.
3. Analyse various types of energy sources and understand the significance of alternative energy sources, including biodiesel and solar energy.
4. Investigate the impact of water hardness in industries, implement water purification technologies to ensure water quality for industrial and domestic use
5. Illustrate the composition, properties and application of engineering materials, including cement, smart materials, glass, and lubricants

.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **-** | **-** | **2** | **-** | **2** | **-** | **-** | **-** | **-** | **-** |
| **CO2** | **3** | **-** | **2** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **1** |
| **CO3** | **3** | **2** | **-** | **-** | **-** | **-** | **3** | **-** | **-** | **-** | **-** | **2** |
| **CO4** | **3** | **-** | **-** | **3** | **-** | **2** | **2** | **-** | **-** | **-** | **-** | **-** |
| **CO5** | **3** | **-** | **2** | **-** | **2** | **-** | **2** | **-** | **-** | **-** | **-** | **-** |

## (A402201) BASIC ELECTRICAL ENGINEERING

**B.Tech (ECE): I Semester**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**UNIT-I:**
**D.C. Circuits:** Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

**UNIT-II:**
**A.C. Circuits:** Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

**UNIT-III:**
**Transformers**: Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

**UNIT-IV:**
**Electrical Machines**: Construction and working principle of dc machine, performance characteristics of dc shunt machine. Generation of rotating magnetic field, Construction and working of a three-phase induction motor, Significance of torque-slip characteristics. Single-phase induction motor, Construction and working. Construction and working of synchronous generator.

**UNIT-V:**
**Electrical Installations**: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

**TEXT BOOKS:**

1. D.P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, “Basic Electrical Engineering”, Tata McGraw Hill, 2nd Edition, 2008.

**REFERENCE BOOKS:**

1. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, “Basic Electrical Engineering”, S. Chand, 2 nd Edition, 2019.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, “Basic Electrical and Electronics Engineering”, Oxford, 1st Edition, 2012.
4. AbhijitChakrabarthi, SudiptaDebnath, Chandan Kumar Chanda, “Basic Electrical Engineering”, 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
6. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
7. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

**COURSE OUTCOMES**:
Upon the completion of the course the student will be able to

1. Understand and analyze basic concepts of DC Circuits
2. Understand and analyze basic concepts of AC Circuits
3. Discus the technical aspects of transformers
4. Study the working principles of Electrical Machines.
5. Introduce components of Low Voltage Electrical Installations

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | P09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | | **1** | | | | **2** | **3** | **2** | | **1** |
| **CO2** | **3** | **3** | | **1** | | | | **2** | **3** | **2** | | **1** |
| **CO3** | **3** | **3** | | **1** | | | | **2** | **3** | **2** | | **1** |
| **CO4** | **3** | **3** | | **1** | | | | **2** | **3** | **2** | | **1** |
| **CO5** | **3** | **3** | | **1** | | | | **2** | **3** | **2** | | **1** |

## (A405202) C PROGRAMMING& DATA STRUCTURES

(Common to ECE, EEE, Mech & Civil)

**B.Tech (ECE): I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT-I**

**Overview of C**: Basic structure of C programs, programming style, Executing a C program.

**Constants, Variables, and Data Types:** Introduction, Character set, C-Tokens, keywords and identifiers, constants, variables, Data types, declaration of variables, declaration of Storage class, assigning values to variables, defining symbolic constant.

**Operators& Expressions:** Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment & Decrement Operators, Conditional Operators, Bitwise Operator, Special Operators. Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators.

**UNIT-II**

**Decision Making:** Introduction, Decision making with *if* statement, simple *if* statement, the *if*---*else*---statement, Nesting of ***if*---*else*---**statements. The ***else-if*** ladder, the ***switch*** statement, the? operator, the go to statement.

**Looping:** Introduction, the ***while*** statement, the ***do -while*** statement, ***for*** statement, break and continue statements.

**Arrays:** Introduction, One-Dimensional Arrays, Declaration of One-Dimensional Arrays, Initialization of One-Dimensional Arrays, Two-Dimensional Arrays, Initializing two dimensional arrays.

**UNIT-III**

**Character Arrays and Strings:** Introduction, declaring and initializing string variables, reading strings from terminal, writing strings to screen, string-handling functions.

**Functions:** Introduction, definition of functions, return values, function calls, function declaration, scope, visibility and lifetime of variables.

**Pointers:** Idea of pointers, defining pointers, Pointers to Arrays and Structures, Use of Pointers in self-referential structures, usage of self-referential structures in linked list (no implementation)

**UNIT-IV**

Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks- Operations, array and linked representations of stacks, stack applications, Queues- operations, array, and linked representations.

**UNIT-V**

Searching and Sorting: Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms), Basic concept of order of complexity through the example programs.

**TEXTBOOKS**

1. Programming in ANSI C, 8th Edition, E.Balagurusamy McGraw Hill Educationpublication,2019.
2. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.

**REFERENCE BOOKS**

1. C Programming Absolute Beginner's Guide,3rd Edition, Pearson Education ,2014.
2. Learn C the Hard Way,1st Edition,Zed A.Shaw, Pearson Education,2018
3. The C-Programming Language,2nd Edition, Brian Kernighan and Dennis Ritchie, Pearson Education,2014.
4. Data Structures using C – A. S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.

**COURSE OUTCOMES**

Students shall be able

1. Describe the structure of C program and explain the various components of it.
2. Use iterative statements for writing the C programs.
3. Organize data in Arrays and perform operations on data stored in Arrays.
4. Define & describe user defined functions in C language.
5. Differentiate structures, unions and manipulate data using pointers.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **1** | | | | | | | | | |
| **CO2** | **3** | **1** | **3** | | | | | | | | | |
| **CO3** | **3** | **2** | **2** | | | | | | | | | |
| **CO4** | **2** | **2** | **3** | | | | | | | | | |
| **CO5** | **3** | **2** | **2** | | | | | | | | | |

## (A400502) ENGINEERING CHEMISTRY LABORATORY

(Common to all Branches)

**B. Tech (ECE): I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**LAB EXPERIMENTS:**

1. Estimation of Hardness of water by EDTA Method.
2. Estimation of Alkalinity of Water.
3. Estimation of Copper by Colorimetric Method.
4. Conductometric Titration of a Strong Acid vs a Strong Base.
5. Conductometric Titration of a Weak Acid vs a Strong Base.
6. Potentiometric Titration of a Strong Acid vs a Strong Base.
7. Potentiometric Titration of Ferrous Ammonium Sulphate (FAS) vs Potassium Dichromate.
8. Preparation of Thiokol Rubber.
9. Determination of Viscosity of a Liquid.
10. Determination of Surface Tension of a liquid.
11. Adsorption of acetic acid on Activated charcoal.
12. Estimation of Iodine in Table Salt (by potentiometric)
13. Thin Layer Chromatography (Ortho-Nitro phenol &Para-Nitro phenol).
14. Determination of rate constant of acid catalyzed hydrolysis of methyl acetate.

.

**TEXTBOOKS:**

1. Engineering Chemistry Lab Manual (1st edition), Dr. K. Soujanya, Dr. J. Saroja, Lt. D. Divya, Skytech Publishers, 2022

**REFERENCE BOOKS:**

1. Engineering Chemistry Lab Manual (1st edition), Glaze Publishers 2018.
2. Engineering chemistry (1st edition), B. Rama Devi & Ch. Venkata Ramana Reddy; Cengage Learning, 2012.
3. A Textbook of Engineering Chemistry (1st edition), Sashi Chawla, Dhanapath Rai& Sons.

**COURSE OUTCOMES:**

At the end of the course the student will be able to

1. Determine the extent of hardness of water and Assess the alkalinity and its consequences in industrial operations
2. Understand the principles, preparation and applications of key polymers like Thiokol rubber
3. Assess the properties of titrations involving acids, bases, redox reactions using potentiometric and conductometric analysis.
4. Develop proficiency in colorimetric analysis to accurately determine the amount of metals present in various industrial effluents
5. Apply analytical tools such as viscosity, and surface tension measurements to evaluate the physicochemical properties of liquid samples.

**CO-PO MAPPING:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | 2 | - | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | 2 | - | 3 | - | 2 | - | - | - | - | - |
| CO3 | 3 | - | - | 3 | 2 | - | - | - | - | - | - | - |
| CO4 | 3 | - | - | 3 | 3 | - | 2 | - | - | - | - | - |
| CO5 | 3 | - | - | 3 | 2 | - | - | - | - | - | - | - |

## (A404501) ELEMENTS OF ELECTRONICS AND COMMUNICATION ENGINEERING

**B. Tech (ECE): I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**LIST OF EXPERIMENTS:**

1. Understand the significance of Electronics and communications subjects
2. Identify the different passive and active components
3. Color code of resistors, finding the types and values of capacitors
4. Measure the voltage and current using voltmeter and ammeter
5. Measure the voltage, current with Multimeter and study the other measurements using Multimeter
6. Study the CRO and measure the frequency and phase of given signal
7. Draw the various Lissajous figures using CRO
8. Study the function generator for various signal generations
9. Study of Spectrum analyzer and measure the spectrum
10. Operate Regulated power supply for different supply voltages
11. Study the various gates module and write down the truth table of them
12. Identify various Digital and Analog ICs
13. Observe the various types of modulated signals.
14. Know the available Softwares for Electronics and communication application

**TEXT BOOKS:**

1. Electronic Devices and Circuits-R.L.Boylestad and Louis Nashelsky, 9 ed., 2006, PEI/PHI.
2. Kennedy, G., Electronic Communication Systems, McGraw-Hill (2008) 4th ed.

**COURSE OUTCOMES:**

At the end of the course the student will be able to

1. Understand the significance of various Electronics devices and communications systems
2. Identify different components used in the electronics and communication applications.
3. Measure various parameters by using different basic electronic measurement devices.
4. Identify the different Software's used for the Electronics & communication engineering.
5. Discriminate different signals and modulations used for the analog and digital communication systems.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 1 | 1 | - | - | 1 | - | - | 1 |
| CO2 | 3 | 2 | 1 | 1 | 1 | 1 | - | - | 1 | - | - | 1 |
| CO3 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | 1 | - | - | 1 |
| CO4 | 3 | 2 | 1 | 1 | 2 | 1 | - | - | 1 | - | - | 1 |
| CO5 | 3 | 3 | 2 | 1 | 1 | 2 | - | - | 1 | - | - | 1 |

## (A402502) BASIC ELECTRICAL ENGINEERING LABORATORY

**B.Tech(ECE): I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**LIST OF EXPERIMENTS/DEMONSTRATIONS:**
**PART- A (compulsory)**

1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RL, RC and RLC series Circuits.
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

**PART-B (any two experiments from the given list)**

1. Verification of Superposition theorem.
2. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. Magnetization Characteristics of DC Shunt Generator.

**TEXT BOOKS:**

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition,2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition,2008.

**REFERENCE BOOKS:**

1. P. Ramana, M. Suryakalavathi, G.T.Chandrasheker,"Basic Electrical Engineering", S. Chand,2nd Edition, 2019.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, SudiptaDebnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
6. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
7. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

**COURSE OUTCOMES:**

After completion of the course student will be able to

1. Verify the basic Electrical circuits through different experiments.
2. Analyze the transient responses of R, L and C circuits for different input conditions.
3. Calculate the of Impedance and Current of RL, RC and RLC series Circuits.
4. Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.
5. Measure the Active and Reactive Power in a single phase transformer

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | P09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 3 | 2 | 2 | 1 |
| CO2 | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 3 | 2 | 2 | 1 |
| CO3 | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 3 | 2 | 2 | 1 |
| CO4 | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 3 | 2 | 2 | 1 |
| CO5 | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 2 | 3 | 2 | 2 | 1 |

## (A403502) COMPUTER AIDED ENGINEERING DRAWING

**B.Tech (ECE): I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 1 | 2 | 2 |

**UNIT – I:**

**Introduction to Engineering Drawing:** Principles of Engineering Drawing and their Significance, Introduction to Computer aided drafting – views, commands.

Computer aided drafting of conic Sections: Ellipse, Parabola and Hyperbola – General Method (eccentricity) only.

Computer aided drafting of Cycloid, Epicycloids and Hypocycloid.

**UNIT- II:**

**Orthographic Projections:** Introduction to Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures.

Computer aided orthographic projections – points, lines and planes

**UNIT – III:**

**Projections of Regular Solids:** Introduction to Regular Solids – Prism, Cylinder, Pyramid, Cone Computer aided projections of solids – Regular views

**UNIT – IV:**

**Isometric Projections:** Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric

Projection of objects having non- isometric lines, Isometric Projection of Spherical Parts using computer aided drafting.

**UNIT – V:**

**Conversion of Isometric Views to Orthographic Views** and Vice-versa – Conventions

**Conversion of orthographic projection into isometric view** and vice versa using computer aided drafting.

**TEXT BOOKS:**

1. Engineering Drawing, 51st Edition, N.D. Bhatt, Charotar Pub, 2012
2. Computer Aided Engineering Drawing, 2nd Edition, K. Balaveera Reddy et al, CBS Publishers, 2015

**REFERENCE BOOKS:**

1. Engineering Drawing, 2nd Edition, Basant Agrawal and C M Agrawal, McGraw Hill, 2014
2. Engineering Drawing, 1st Edition, M. B. Shah, B.C. Rane, Pearson, 2015
3. Engineering Drawing, 1st Edition, N. S. Parthasarathy and Vela Murali, Oxford, 2015
4. Engineering Drawing and graphics Using AutoCAD, 3rd Edition, T. Jeyapoovan, Vikas, S.Chand and Company Ltd, 2000.

**COURSE OUTCOMES:**

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

1. Apply computer aided drafting tools to create 2D objects like Conic section and Cycloidal curves
2. Sketch the Orthographic projection of Point, Line and Plane objects by drafting tools
3. Create, read and interpret engineering drawings of Solids by computer tools
4. Create and interpret 2D and 3D Isometric objects by drafting tools
5. Conversion of orthographic projection into isometric view and vice versa by using computer aided drafting tools

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 3 | - | 3 | - | - | 2 | 3 | 3 | 1 | 2 |
| CO2 | 3 | 1 | 3 | - | 3 | - | - | 2 | 3 | 3 | 1 | 2 |
| CO3 | 3 | 1 | 3 | - | 3 | - | - | 2 | 3 | 3 | 1 | 2 |
| CO4 | 3 | 1 | 3 | - | 3 | - | - | 2 | 3 | 3 | 1 | 2 |
| CO5 | 3 | 1 | 3 | - | 3 | - | - | 2 | 3 | 3 | 1 | 2 |

## (A405503) C PROGRAMMING AND DATA STRUCTURES LABORATORY

**B.Tech (ECE): I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

[Note:The programs may be executed using any available Open Source/ Freely available IDE
Some of the Tools available are:
Code Lite: https://codelite.org/
Code: Blocks: http://www.codeblocks.org/
DevCpp : http://www.bloodshed.net/devcpp.html
Eclipse: http://www.eclipse.org
This list is not exhaustive and is NOT in any order of preference]

### I. OPERATORS AND EVALUATION OF EXPRESSIONS

**Demonstration**

1. Write a C program to print greetings message on the screen.
2. Write a C program to illustrate usage of comments in C.
3. Write a simple program that prints the results of all the operators available in C (Including pre/post increment, bitwise and/or/not. etc.). Read required operand values from standard input.
4. Write a C program that converts given data type to another using auto conversion and casting. Take the values from standard input.
5. Write a program for finding the max and min from the three numbers (using ternary operator).

**Experiment**

6. Write a C program to compute simple, compound interest.
7. Write a C program that declares Class awarded for a given percentage of marks, where mark = 70% = Distinction. (Read percentage from standard input.)

### II. Expression Evaluation

**Demonstration**

1. A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula $s = ut+(1/2)at^2$ where u and a are the initial velocity in m/sec (= 0) and acceleration in $m/sec^2$ (= 9.8 $m/s^2$)).
2. Write a program that asks the user to enter the highest rainfall ever in one season for a country, and the rainfall in the current year for that country, obtains the values from the user, checks if the current rainfall exceed the highest rainfall and prints an appropriate message on the screen. If the current rainfall is higher, it assigns that value as the highest rainfall ever. Use only the single-selection form of the if statement.

**Experiment**

3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C program to find the roots of a Quadratic equation.

### III. Iterative statements

**Demonstration**

1. Write a program that reads an integer (5 digits or fewer) and determines and prints how many digits in the integer are 9s.
2. Write a program that keeps printing the powers of the integer 3, namely 3, 9, 27, 91, 273, and so on. Your loop should not terminate (i.e., you should create an infinite loop). What happens when you run this program?
3. Write a program that reads the radius of a circle (as a float value) and computes and prints the diameter, the circumference and the area. Use the value 3.14159 for $\pi$

**Experiment**

4. Write a menu driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.

5. Write a C program to construct a pyramid of numbers as follows:

```
1                       1
1  2                    2  2
1  2  3                 3  3  3
1  2  3  4              4  4  4  4
1  2  3  4  5           5  5  5  5  5
```

**IV. Arrays, Pointers, and Functions**

**Demonstration**

1.Write a C program to find the minimum, maximum and average in an array of integers.

2.Write a function to compute mean, variance, Standard Deviation, sorting of n elements in a single dimension array.

3. Write a C program that uses functions to perform the following:

i. Addition of Two Matrices ii. Multiplication of Two Matrices iii. Transpose of a matrix.

**Experiment**

4. Write a C program to find the GCD (greatest common divisor) of two given integers.

5. Write a C program to compute $x^n$

**V. Strings**

**Demonstration**

1. Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.

2. Write a C program that converts a number ranging from 1 to 50 to Roman equivalent c.

3. Write a C program that uses functions to perform the following operations:

- To insert a sub-string into a given main string from a given position.
- To delete n Characters from a given position in a given string.

**Experiment**

4.Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)

5.Write a C program that displays the position of a character ch in the string S or – 1 if S doesn't contain ch.

6.Write a C program to count the lines, words and characters in a given text.

**VI Data Structures**

**Demonstration**

1. Write a program that uses functions to perform the following operations on singly linked list

i) Creation ii) Insertion iii) Deletion iv) Traversal

**2.** Write a program that implement stack (its operations) using

i) Arrays ii) Pointers

3.Write a program that implement Queue (its operations) using

i) Arrays ii) Pointers

**Experiment**

4.Write a program that uses functions to perform the following operations on doubly linked List.

i) Creation ii) Insertion iii) Deletion iv) Traversal

5.Write a program that uses functions to perform the following operations on circular linked List. i) Creation ii) Insertion iii) Deletion iv) Traversal

**VII Searching & Sorting**

**Demonstration**

1.Write a C program that uses non recursive function to search for a Key value in a given list of integers using linear search method.

2.Write a C program that uses non recursive function to search for a Key value in a given sorted list of integers using binary search method.

3.Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.

**Experiment**

4.Write a C program that sorts the given array of integers using selection sort in descending order

5. Write a C program that sorts the given array of integers using insertion sort in ascending order

**TEXTBOOKS**

1. Programming in ANSI C, 8th Edition, E. Balagurusamy McGraw Hill Education publication,2019.
2. Fundamentals of Data Structures in C, 2 nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.

**REFERENCE BOOKS**

1. C Programming Absolute Beginner's Guide,3rd Edition, Pearson Education ,2014.
2. Learn C the Hard Way,1st Edition, Zed A. Shaw, Pearson Education,2018
3. The C-Programming Language,2nd Edition, Brian Kernighan and Dennis Ritchie, Pearson Education, 2014.
4. Data Structures using C – A. S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.

**COURSE OUTCOMES:**

At the end Students shall be able to:

1. Formulate the algorithms for simple problems and translate given algorithms to a working and correct program
2. Correct syntax errors as reported by the compilers identify and correct logical errors encountered during execution
3. Represent and manipulate data with arrays, strings and structures and
4. Develop applications using pointer concept.
5. Develop reusable code with the help C-functions

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **1** | **2** | **1** | | | | | | | |
| **CO2** | | | **3** | **3** | **1** | | | | | | **2** | **2** |
| **CO3** | **3** | **3** | | **2** | | | | | | | | |
| **CO4** | | | **3** | | **2** | | | | | | **2** | |
| **CO5** | **2** | **2** | **3** | | | | | | | | **1** | **1** |

**(A400505) INTRODUCTION TO SOCIAL INNOVATION**
**(Common to all branches)**

**B.Tech (ECE): I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**WEEK-1**

Types and features of community- Rural, Suburban, Urban and Regional

**WEEK-2**

Service based learning, Aims of Community based projects, Sustainable Development Goals

**WEEK-3**

Community visit, Report Writing, Resource Diagram, Chapati Diagram, Transect Walk

**WEEK-4**

The non-profit sector, public sector, the private sector, the informal sector

**WEEK-5**

Poster presentation on four sectors

**WEEK-6**

Process of Design Thinking

**WEEK-7**

Social organizations and enterprises, social movements

**WEEK-8**

Social softwares and open-source methods

**WEEK-9**

Introduction to Ethics, moral values, significance of professional ethics

code of conduct for engineers

**WEEK-10**

Identify ethical dilemmas in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas

**WEEK-11**

Case studies on Engineering Ethics

**WEEK-12**

Documentation, Steps for Patent filing and Startups, Poster presentation

**TEXT BOOKS:**

1. Social Entrepreneurship for the 21st Century: Innovation Across the Non Profit, Private and Public Sectors; Georgia Levenson Keohane; Tata McGraw Hill
2. Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author)

**REFERENCE BOOKS:**

1. Fundamentals of Intellectual Property (English) 1st Edition (Paperback, Dr. Kalyan C. Kankanala) Publisher:Asia Law House ISBN: 9789381849514, 938184951X Edition: 1st Edition, 2012.
2. Indian Patent Law (English, Paperback, Kalyan C. Kankanala) Publisher: Oxford University Press- NewDelhi, ISBN: 9780198089605, 0198089600 Edition: 2012.
3. Social Enterprises: An Organizational Perspective edited; Benjamin Gidron, YeheskelHasenfeld; Palgrave Macmillan

4. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011.
5. Engineering Ethics: An Industrial Perspective; Gail Baura; Elsevier
6. Intellectual Property and Financing Strategies for Technology Startups; Gerald B. Halt, Jr., John C. Donch,Jr., Amber R. Stiles, Robert Fesnak; Springer

**COURSE OUTCOMES:**

On Completion of the course, the students will be able to

1. Identify community issues through community Interaction
2. Illustrate the factors affecting social innovation in various sectors
3. Apply design thinking concept to analyze the community problems
4. Adopt the ethical values in implementing the Social innovation
5. Describe the process of property rights and patent filing.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | **1** | **2** | | **3** | **2** | | |
| **CO2** | | | | | | **2** | **2** | | **3** | **3** | | |
| **CO3** | | | | **2** | | **2** | **3** | | **2** | **3** | | |
| **CO4** | | | | | | **2** | **3** | **3** | **2** | **2** | | |
| **CO5** | | **2** | | **2** | | **2** | **3** | | **2** | **3** | | |

**(A400703) CONSTITUTION OF INDIA**
**(Common to all branches)**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 0 |

**B.Tech (ECE): I Semester**

**UNIT - 1**
History of Making of the Indian Constitution- History of Drafting Committee.

**UNIT - 2**
Philosophy of the Indian Constitution- Preamble Salient Features

**UNIT - 3**
Contours of Constitutional Rights & Duties - Fundamental Rights

- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

**UNIT - 4**
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

**UNIT - 5**
Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

**REFERENCE BOOKS**

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. B. R. Ambedkar framing of Indian Constitution, Dr. S. N. Busi, 1st Edition, 2015.
3. Indian Constitution Law (7thEdn), M. P. Jain, Lexis Nexis, 2014.
4. Introduction to the Constitution of India, D.D. Basu, Lexis Nexis, 2015.

**COURSE OUTCOMES**:
On completion of the course students will be able to

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru.
4. Discuss the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution
5. Discuss the passage of the Hindu Code Bill of 1956.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO3 | - | - | - | - | - | 2 | - | - | - | - | - | - |
| CO4 | - | - | - | 2 | - | 3 | - | - | - | - | - | - |
| CO5 | - | 2 | - | - | - | - | - | - | - | - | - | - |

**(A400101) ENGLISH FOR SKILL ENHANCEMENT**
**(Common to all branches)**

**B.Tech (ECE): II Semester**

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**UNIT - I**

**Chapter entitled 'Toasted English' by R.K. Narayan from "English: Language, Context and Culture" published by Orient Black Swan, Hyderabad.**

**Vocabulary:** The Concept of Word Formation -The Use of Prefixes and Suffixes -Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives -Synonyms and Antonyms

**Grammar:** Identifying Common Errors in Writing with Reference to Articles and Prepositions.

**Reading:** Reading and Its Importance- Techniques for Effective Reading.

**Writing**: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

**UNIT – II**

**Chapter entitled 'Appro JRD ' by Sudha Murthy from " English Language , Context and Culture" published by Orient Black Swan ,Hyderabad.**

**Vocabulary**: Words Often Misspelt - Homophones, Homonyms and Homographs Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

**Reading:** Sub-Skills of Reading – Skimming and Scanning

**UNIT – III**

**Chapter entitled 'Lessons from Online Learning' by F.Haider Alvi, Deborah Hurst et al from "English: Language, Context and Culture" published by Orient BlackSwan, Hyderabad**.

**Vocabulary**: Words Often Confused - Words from Foreign Languages and their Use in English.

**Grammar**: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

**Reading**: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.

**Writing**: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

**UNIT - IV**

**Chapter entitled 'Art and Literature' by Abdul Kalam from "English: Language, Context and Culture" published by Orient BlackSwan, Hyderabad**.

**Vocabulary**: Standard Abbreviations in English Grammar: Redundancies and Clichés in Orland Written Communication.

**Reading**: Writing: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice Writing Practices

**Essay Writing**-Writing Introduction and Conclusion -Précis Writing

**UNIT - V**

**Grammar**: Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)

**Reading**: Writing: Reading Comprehension-Exercises for Practice Technical Reports- Introduction.

**NOTE:**

Listening and Speaking Skills which are given under in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.

- NOTE 1: As the syllabus of English given in AICTE Model Curriculum-2018 for B.Tech First Year is Open-ended, besides following the prescribed textbook, it is required to prepare teaching/learning

materials by the teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.

- NOTE 2: Based on the recommendations of NEP2020, teachers are requested to be flexible to adopt Blended Learning in dealing with the course contents. They are advised to teach 40percent of each topic from the syllabus in blended mode.

**TEXT BOOK:**

1. "English: Language, Context and Culture" by Orient Black Swan Pvt. Ltd, Hyderabad. 2022. Print.

**REFERENCE BOOKS:**

1. Effective Academic Writing, (2nd edition) by Liss and Davis (OUP)2014.
2. Richards, Jack C. Interchange Series. Introduction, (4th edition), Cambridge University Press 2022
3. Remedial English Grammar by Wood F.T, Macmillan.2007.
4. Learn English: A Fun Book of Functional Language, Grammar and Vocabulary, (2nd edition) Chaudhuri, Santanu Sinha, Sage Publications India Pvt. Ltd.2018
5. Technical Communication, (1st edition), Wiley India Pvt. Ltd.2019
6. English for Technical Communication for Engineering, Vishwamohan, Aysha 2013

**COURSE OUTCOMES:**

On completion of the course students will be able to

1. Understand the importance of vocabulary and sentence structures.
2. Choose appropriate vocabulary and sentence structures for their oral and written communication.
3. Demonstrate their understanding of the rules of functional grammar.
4. Develop comprehension skills from the known passages.
5. Acquire basic proficiency in reading and writing modules of English and take an active part in drafting paragraphs, letters, essays, abstracts, precis, and reports in various contexts.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | - | - | - | 2 | 3 | - | - |
| **CO2** | - | - | - | - | - | - | - | - | - | 2 | 2 | |
| **CO3** | - | - | - | - | - | - | - | - | - | 2 | - | - |
| **CO4** | - | - | - | - | - | - | - | - | | 3 | - | 2 |
| **CO5** | - | - | | | | | | | | 2 | | 3 |

## (A400002) ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

(Common to All)

**B.Tech(ECE): II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**UNIT-I**

**First Order ODE:**

Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's differentia equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

**UNIT-II**

**Ordinary Differential Equations of Higher Order:**

Second and higher order linear differential equations with constant coefficients: Non-Homogeneous terms of the type $e^{ax}$, sin $ax$, cos $ax$, polynomials in $x$, $e(x)$and $xV(x)$, method of variation of parameters.

**UNIT-III**

**Laplace transforms:**

Laplace Transforms: Laplace Transform of standard functions, first shifting theorem and Second shifting theorem. Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't'. Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions. Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

**UNIT-IV**

**Vector Differentiation:**

Vector point functions and scalar point functions, Gradient, Tangent plane and normal line, Directional derivatives, Divergence and Curl, Solenoidal and Irrational vectors, Scalar potential functions, Vector Identities.

**UNIT-V**

**Vector Integration:**

Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stoke's (without proofs) and their applications.

**TEXT BOOKS:**


1. Higher Engineering Mathematics, (36thEdition), B.S. Grewal, Khanna Publishers, 2010.
2. Advanced Engineering Mathematics, (5thEdition), R.K. JainandS.R.K. Iyengar, NarosaPublications,2016.


**REFERENCE BOOKS:**


1. Advanced Engineering Mathematics, (9th Edition), Erwinkreyszig, John Wiley& Sons,2006.
2. Calculus and Analytic geometry, (9thEdition), G.B. Thomas and R.L. Finney, Pearson, Reprint, 2002.
3. A text book of Engineering Mathematics, (10thEdition), N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2019.
4. Higher Engineering Mathematics, (9thEdition), H.K. Dass and Er. RajnishVerma, S Chand and company Limited, New Delhi, 2011.


**COURSE OUTCOMES:**

On completion of the course students will be able to

1. Determine first order differential equations and obtain solutions.
2. Solve the Higher order differential equations and apply the differential equation concepts to real world problems.
3. Use the Laplace transforms techniques for solving ODE's.
4. Evaluate Gradient – Divergence – Curl, Directional derivatives.
5. Evaluate the line, surface and volume integrals and converting them from one to another.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | | | | | | | 2 |
| CO2 | 3 | 3 | | | | | | | | | | 2 |
| CO3 | 3 | 3 | | | | | | | | | | 2 |
| CO4 | 3 | 3 | | | | | | | | | | 2 |
| CO5 | 3 | 3 | | | | | | | | | | 2 |

**(A400008) APPLIED PHYSICS**
**(Common to all branches)**

**B.Tech(ECE) - II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**UNIT – I**
**QUANTUM MECHANICS:**
Introduction to quantum physics, blackbody radiation – Stefan-Boltzmann's law, Wein's and Rayleigh-Jean's law, Planck's radiation law - photoelectric effect – de Broglie hypothesis- Davisson and Germer experiment – Heisenberg uncertainty principle - Born interpretation of the wave function – time independent Schrodinger wave equation - particle in one dimensional potential box.
**ELECTRIC PROPERTIES OF SOLIDS:**
Free electron theory (Drude& Lorentz, Sommerfeld) - Fermi-Dirac distribution - Bloch's theorem -Kronig-Penney model – E-K diagram- effective mass of electron-origin of energy bands- classification of solids.

**UNIT – II**
**SEMICONDUCTORS AND DEVICES:**
Intrinsic and extrinsic semiconductors, Variation of Fermi level with temperature – Hall Effect - Construction, principle of operation and characteristics of P-N Junction diode, Zener diode
**PHOTONIC DEVICES**
Direct and indirect band gap semiconductors –LED, PIN diode, avalanche photo diode (APD) and solar cells, their structure, materials, working principle and characteristics.

**UNIT – III**
**LASERS**
Laser beam characteristics-three quantum processes-Einstein coefficients and their relations- lasing action - pumping methods- ruby laser, He-Ne laser, $CO_2$ laser - semiconductor laser-applications of laser.
**FIBER OPTICS:**
Introduction to optical fiber - advantages of optical fibers - total internal reflection- construction of optical fiber - acceptance angle - numerical aperture- classification of optical fibers- losses in optical fiber - optical fiber for communication system - applications.

**UNIT - IV**
**DIELECTRIC MATERIALS**
Dielectric Materials: Basic definitions- types of polarizations (qualitative) –Local field, Clasius-Mossoti Equation ferroelectric, piezoelectric, and pyro electric materials – applications
**MAGNETIC MATERIALS:**
Introduction to magnetic materials - Hysteresis-soft and hard magnetic materials- magnetostriction, magnetoresistance - applications - bubble memory devices, magnetic field sensors and multiferroics.

**UNIT - V**
**ENERGY MATERIALS:**
Conductivity of liquid and solid electrolytes- superionic conductors - materials and electrolytes for super capacitors - rechargeable ion batteries, solid fuel cells.
**NANOTECHNOLOGY**
Nanoscale, quantum confinement, surface to volume ratio, bottom-up fabrication: sol-gel, precipitation, combustion methods – top-down fabrication: ball milling - physical vapour deposition (PVD) - chemical vapor deposition (CVD) - characterization techniques - XRD, SEM &TEM - applications of nanomaterials.

**TEXT BOOKS**
1. Engineering Physics (3rd edition), PK Palanisamy, SciTech Publications, 2015.
2. Essentials of Nan science & Nanotechnology (1st Edition), Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 2021.

**REFERENCES**
1. Fundamentals of Physics. (6th edition), Halliday, R.Resnick and J.Walker,John Wiley and Sons, 2001.
2. Quantum Physics, (2nd edition), H.C. Verma, TBS Publication, 2012
3. Introduction to Solid State Physics, (7th edition), Charles Kittel, Wiley Eastern, 2019.

**COURSE OUTCOMES**

On completion of the course students will be able to

1. Understand the concepts of Quantum mechanics and visualize the differences between the solids by their classification.
2. Identify and analyse the importance of semiconductors and semiconductor devices in science. and Engineering Applications.
3. Appreciate the features and applications of Lasers and Optical fibres.
4. Applying the fundamental properties of dielectric and magnetic materials in different engineering fields.
5. Evaluate various aspects of Energy Materials and Nano - materials and their applications in diverse fields.

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **2** | **1** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **1** |
| **CO2** | **3** | **3** | **2** | **1** | **1** | **1** | **1** | **-** | **-** | **1** | **-** | **2** |
| **CO3** | **3** | **3** | **2** | **1** | **1** | **1** | **1** | **-** | **-** | **1** | **-** | **2** |
| **CO4** | **3** | **3** | **2** | **1** | **1** | **-** | **-** | **-** | **-** | **1** | **-** | **1** |
| **CO5** | **3** | **3** | **2** | **1** | **1** | **1** | **1** | **1** | **-** | **1** | **-** | **2** |

## (A404201) BASIC ELECTRONIC CIRCUITS

**B. Tech. (ECE) II-Semester**

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| 3 | 0 | 0 | 3 |

**UNIT - I**

**Diodes:** Diode - Static and Dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances, V-I Characteristics, Diode as a switch- switching times.

**UNIT - II**

**Diode Applications:** Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive and Inductive Filters, Clippers-Clipping at two independent levels, Clamper-Clamping Circuit Theorem, Clamping Operation, Types of Clampers.

**UNIT - III**

**Bipolar Junction Transistor (BJT):** Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times, **BJT Biasing:** Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self-Bias, Bias Stability, Bias Compensation using Diode.

**UNIT - IV**

**Junction Field Effect Transistor (FET):** Construction, Principle of Operation, Pinch-Off Voltage, Volt- Ampere Characteristic, Comparison of BJT and FET, FET as Voltage Variable Resistor, FET- Biasing Techniques, MOSFET, MOSTET as a capacitor.

**UNIT – V**

**Special Purpose Devices:** Zener Diode - Characteristics, Zener diode as Voltage Regulator, Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode, Photo diode, Solar cell, LED, Schottky diode.

**TEXT BOOKS:**

1. Jacob Millman - Electronic Devices and Circuits, McGraw Hill Education
2. Robert L. Boylestead, Louis Nashelsky- Electronic Devices and Circuits theory, 11th Edition, 2009, Pearson**.**

**REFERENCE BOOKS:**

1. Horowitz -Electronic Devices and Circuits, David A. Bell – 5thEdition, Oxford.
2. Chinmoy Saha, Arindam Halder, Debaati Ganguly - Basic Electronics-Principles andApplications, Cambridge, 2018.

**COURSE OUTCOMES**

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

1. Acquire the knowledge of PN junction Diode characteristics and switching times.
2. Acquire the knowledge of various electronic circuits like rectifiers, clippers, Clampers and their use on real life
3. Acquire the knowledge about construction, working of BJT and analyze various biasing, stabilization techniques for transistor amplifier design.
4. Acquire the knowledge about construction, working of FET, MOSFET and analyze various biasing, techniques for FET amplifier design.
5. Acquire the knowledge about the role of special purpose devices and their applications.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | 1 | | | | | | | 1 |
| CO2 | 3 | | | | 1 | | | | | | | 1 |
| CO3 | 3 | 2 | | | 2 | | | | | | | 1 |
| CO4 | 3 | 2 | | | 2 | | | | | | | 1 |
| CO5 | 3 | 2 | | | | | | | | | | 1 |

**(A400503) ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY**
**(Common to all branches)**

**B.Tech - II Semester**

| L | T | P | C |
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The English Language and Communication Skills (ELCS) Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

English Language and Communication Skills Lab (ELCS) shall have two parts:

b. Computer Assisted Language Learning (CALL) Lab
c. Interactive Communication Skills (ICS) Lab

**Listening Skills Objectives**

1. To enable students, develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions. Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.
   - Listening for general content
   - Listening to fill up information
   - Intensive listening
   - Listening for specific information

**Speaking Skills Objectives**

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional
   - Oral practice
   - Describing objects/situations/people
   - Role play – Individual/Group activities
   - Just A Minute (JAM) Sessions

The following course content is prescribed for the English Language and Communication Skills Lab

**Exercise – I**

**CALL Lab:** Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening. Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs - Past Tense Marker and Plural Marker- Testing Exercises

**ICS Lab:** Understand: Spoken vs. Written language- Formal and Informal English. Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

**Exercise – II**

**CALL Lab:** Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress pattern in sentences – Intonation. Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern in sentences – Intonation - Testing Exercises.

**ICS Lab:** Understand: Features of Good Conversation – Strategies for Effective Communication. Practice: Situational Dialogues – Role Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

**Exercise – III**

**CALL Lab:** Understand: Errors in Pronunciation-Neutralizing Mother Tongue Interference (MTI). Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation -Testing Exercises

**ICS Lab:** Understand: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding –

Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

**Exercise – IV**

**CALL Lab:** Understand: Listening for General Details. Practice: Listening Comprehension Tests - Testing Exercises

**ICS Lab:** Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication Presentation Skills. Practice: Making a Short Speech – Extempore- Making a Presentation.

**Exercise – V**

**CALL Lab:** Understand: Listening for Specific Details. Practice: Listening Comprehension Tests -Testing Exercises

**ICS Lab:** Understand: Group Discussion Practice: Group Discussion

**Minimum Requirement of infrastructural facilities for ELCS Lab:**

1. **Computer Assisted Language Learning (CALL) Lab:** The Computer Assisted Language Learning Lab has to accommodate 30 students with 30 systems, with one Master Console, LAN facility and English language learning software for self- study by students. System Requirement (Hardware component): Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications: i) Computers with Suitable Configuration ii) High Fidelity Headphones
2. **Interactive Communication Skills (ICS) Lab:** The Interactive Communication Skills Lab: A Spacious room with movable chairs and audiovisual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio & video system and camcorder etc. Source of Material (Master Copy): • Exercises in Spoken English. Part 1,2,3. CIEFL and Oxford University Press Note: Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus

**REFERENCE BOOKS**:


1. English Language Communication Skills Lab Manual cum Workbook, (1st edition), by Rajesh Kumar Cengage Learning India Pvt. Ltd,2022
2. Communicative English - A workbook, (Revised Edition) by Shobha, KN &Rayen, J. Lourdes, Cambridge University Press, 2019.
3. Communication Skills: A Workbook. Kumar, (2nd edition) by Sanjay &Lata, Pushp, Oxford University Press, 2019.
4. ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities, (Board of Editors), Orient Black Swan Pvt. Ltd, 2016
5. English Language Skills: A Practical Approach, Mishra, Veerendra et al., Cambridge University Press, 2020.


**COURSE OUTCOMES**:

On completion of the course students will be able to

1. Understand the nuances of English language through audio- visual experience and group activities.
2. Neutralize their accent for intelligibility.
3. Speak with clarity and confidence which in turn enhances their employability skills
4. Students will learn public speaking skills and overcome stage fear.
5. Express clarity of thoughts, capability to hold the discussion with everyone and develop analytical thinking.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | - | - | - | | **2** | - | - |
| **CO2** | - | - | - | - | - | - | - | - | - | **2** | - | - |
| **CO3** | - | - | - | - | - | - | - | - | - | **3** | **2** | - |
| **CO4** | - | - | - | - | - | - | - | - | - | **3** | - | **2** |
| **CO5** | - | - | - | - | - | - | - | - | - | **2** | - | **2** |

## (A400501) APPLIED PHYSICS LABORATORY

**B.Tech (ECE): II Semester**

| L | T | P | C |
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**(Any 8 experiments are to be performed)**

1. Determination of work function and Planck's constant using photoelectric effect.
2. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode
5. a) V-I and L-I characteristics of light emitting diode (LED)
   b) V-I Characteristics of solar cell
6. Determination of Energy gap of a semiconductor.
7. Determination of the resistivity of semiconductor by two probe method.
8. Study of B-H curve of a magnetic material.
9. Determination of dielectric constant of a given material
10. a) Determination of the beam divergence of the given LASER beam
    b) Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
11. Understanding the method of least squares – torsional pendulum as an example.
12. Diffraction grating: Determination of wavelength of a source (LASER).

**LABORATORY MANUAL:**

1. Applied Lab (2nd Edition) Dr M Chandra Shekhar Reddy, Dr Neelima Patnaik, Jaya Prakash Reddy Kasu, Skytech Publications, 2022.

**COURSE OUTCOMES**

On completion of the course students will be able to

1. Appreciate quantum physics in optoelectronics.
2. Determine the Planck's constant using Photo electric effect
3. Determine energy gap of a semiconductor diode and magnetic fields.
4. Identify the material whether it is n-type or p-type by Hall experiment.
5. Evaluate the basic properties of lasers and optical fibers.

**CO PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 |
| CO2 | 3 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 |
| CO3 | 3 | 3 | 2 | 1 | - | - | 1 | - | - | 1 | - | 1 |
| CO4 | 3 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 |
| CO5 | 3 | 3 | 2 | 1 | - | - | 1 | - | - | 1 | - | 1 |

## (A404502) BASIC ELECTRONIC CIRCUITS LABORATORY

**B. Tech. (ECE) II-Semester**

| L | T | P | C |
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| 0 | 0 | 3 | 1.5 |

**List of Experiments (Twelve experiments to be done):**

Verify any twelve experiments in H/W Laboratory

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Full Wave Rectifier with & without filters
3. Types of Clippers at different reference voltages
4. Types of Clampers at different reference voltages
5. The steady state output waveform of clampers for a square wave input
6. Input and output characteristics of BJT in CB Configuration
7. Input and output characteristics of BJT in CE Configuration
8. Input and output characteristics of BJT in CC Configuration
9. Input and output characteristics of MOS FET in CS Configuration
10. Input and output characteristics of MOS FET in CD Configuration
11. Switching characteristics of a transistor
12. Zener diode characteristics and Zener as voltage Regulator
13. SCR Characteristics.
14. UJT Characteristics and identify negative region
15. Photo diode characteristics
16. Solar cell characteristics
17. LED Characteristics
    *Design a circuit to switch on and off LED using diode/BJT/FET as a switch.

**Major Equipment required for Laboratories:**

1. Regulated Power Suppliers, 0-30V
2. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
3. Functions Generators-Sine and Square wave signals
4. Multimeters, voltmeters and Ammeters
5. Electronic Components and devices

**COURSE OUTCOMES**

On Completion of the course, students will be able to

1. Acquire the knowledge of various semiconductor devices, electronic Circuits and their use in real life.
2. Acquire the knowledge about Input and output Characteristics of BJT, MOSFET in various configurations.
3. Design aspects of biasing and keep them in active region of the device for functional circuits
4. Acquire the knowledge about the V-I characteristics of UJT and SCR.
5. Acquire the knowledge about the role of special purpose devices and their applications

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | 1 | | | | | | | 1 |
| CO2 | 3 | 2 | | | 1 | | | | | | | 1 |
| CO3 | 3 | 2 | | | 1 | | | | | | | 1 |
| CO4 | 3 | 1 | | | 1 | | | | | | | 1 |
| CO5 | 3 | 1 | | | | | | | | | | 1 |

**(A405504) IT WORKSHOP**
**(Common to all branches)**

| | L | T | P | C |
|---|---|---|---|---|
| **B.Tech (ECE): II Semester** | **0** | **0** | **3** | **1.5** |

**PC Hardware**

**Task 1:** Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

**Task 2:** Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

**Task 3:** Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

**Task 4:** Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

**Internet & World Wide Web**

**Task1:** Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there are no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

**Task 2:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

**Task 3:** Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

**Task 4:** Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

**LaTeX and WORD**

**Task 1** – Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

**Task 2:** Using LaTeX and Word to create a project certificate. Features to be covered: - Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

**Task 3:** Creating project abstract Features to be covered: -Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

**Task 4:** Creating a Newsletter: Features to be covered: - Table of Content, Newspaper columns, Images from files and clipart, drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

**Excel**

**Excel Orientation:** The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

**Task 1:** Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

**Task 2:** Calculating GPA - Features to be covered: - Cell Referencing, Formulae in excel – average, std. deviation,

Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP

**Task 3:** Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

**Power point**

**Task 1:** Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

**Task 2:** Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

**Task 3:** Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notesetc), and Inserting – Background, textures, Design Templates, Hidden slides.

**REFERENCE BOOKS:**


1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech
2. The Complete Computer upgrade and repair book, 3rd edition Cheryl A Schmidt, WILEY Dreamtech
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. PC Hardware - A Handbook – Kate J. Chase PHI (Microsoft)
5. LaTeX Companion – Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinsonand Ken Quamme. –CISCO Press, Pearson Education.
7. IT Essentials PC Hardware and Software Labs and Study Guide Third Edition by Patrick Regan– CISCO Press, Pearson Education.


**COURSE OUTCOMES:**

Students shall be able to:

1. Identify various hardware components of a system and their significances
2. Assemble and disassemble the computer.
3. Use various Microsoft tools for text processing, visual presentations, and number crunching
4. Retrieve the information from Internet using web browsers.
5. Safeguard the system from external and internal threats.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | | | **2** | | | **1** | | | | | **1** |
| **CO2** | **3** | | | **2** | **2** | **1** | | | | | | **1** |
| **CO3** | | | | | **3** | | | | | **2** | | **2** |
| **CO4** | | **2** | | **2** | **3** | **1** | | **1** | | **2** | | **2** |
| **CO5** | | | | | **3** | **3** | **2** | **2** | | | | **3** |

**(A400506) ENGINEERING EXPLORATION & PRACTICE**
**(Common to all branches)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1.5 |

**B.Tech II Semester**

**Week-1**
Difference between Science and Engineering, Scientist and Engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer. Significance of teamwork, Importance of communication in engineering profession
**Week-2**
Engineering Design Process, Need statement to Problem conversion, Pair wise comparison chart, decision matrix, Concepts of reverse engineering
**Week-3**
Project management tools: Checklist, Timeline, Gantt chart, Requirement Analysis
**Week-4**
Basic Components of a Mechanism, Degrees of Freedom or Mobility of a Mechanism, 4 Bar Chain, Crank Rocker Mechanism, Slider Crank Mechanism
**Week-5**
3-D Modelling of a Box with two holes and curvature
**Week-6**
3-D Modelling of Electronic Enclosure and Assembly of two parts
**Week-7**
Introduction to various platform-based development, Introduction to basic components, transducers, actuators and sensors, Introduction to Tinkercad
**Week-8**
Introduction to Arduino, basics of programming
**Week-9**
Interfacing Arduino with actuators and transducers
**Week-10**
Interfacing Arduino with Sensors, Liquid Crystal Display (LCD)
**Week-11**
Assembly and Crafting the Prototype
**Week-12**
Test and Validate the Prototype, Documentation, Panel Presentation

**TEXT BOOKS**

1. Engineering Fundamentals: An Introduction to Engineering (Mind Tap Course List) 5th Edition by SaeedMoaveni
2. Concepts in Engineering Design – 2016; by Sumesh Krishnan (Author), Dr. Mukul Shukla (Author),Publisher: Notion Press.

**REFERENCE BOOKS**

1. A Ghosh and AK Malik: Theory of Mechanism and Machine; East West Press (Pvt) Ltd., New Delhi.
2. Arduino Cookbook, 2nd Edition by Michael Margolis: O'Reilly Media
3. Introduction to autocad®2017-2D and 3D design by Bernd S. Palm and Alf Yarwood, Routledge (Taylorand Francis group)
4. Software Project Management (SIE), (Fifth Edition); Bob Hughes, Mike Cotterell, Rajib Mall; Publishedby Tata McGraw-Hill Education Pvt. Ltd (2011) ; ISBN 10: 0071072748 ISBN 13: 9780071072748

**COURSE OUTCOMES**
On Completion of the course, the students will be able to

1. Explain the importance of engineering profession in the world.
2. Identify multi-disciplinary approach required in solving an engineering problem
3. Build a mechanism for a given application
4. Create basic 3D models and animations
5. Design a mechatronic system using Arduino and electronic components

**CO-PO Mapping:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | | | | | 3 | 3 | 2 | | 3 | |
| **CO2** | | 3 | 1 | 3 | 2 | | | | 3 | | 3 | |
| **CO3** | 3 | | 2 | | 3 | | | | 3 | | 3 | |
| **CO4** | 2 | 3 | 2 | | 3 | | | | 3 | 2 | 3 | |
| **CO5** | | | 2 | 1 | 2 | | 3 | | 3 | | 3 | |

**(A400704) UNIVERSAL HUMAN VALUES**
**(Common to all branches)**

**B.Tech (ECE): II Semester**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 0 |

**UNIT - I**

Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

**UNIT - II**

Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) • Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**UNIT – III**

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence • Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals • Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc., Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

**UNIT - IV**

Understanding Harmony in the Nature and Existence – Whole existence as Coexistence

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all- pervasive space

- Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

**UNIT – V**

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics:
  a. Ability to utilize the professional competence for augmenting universal human order
  b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,
  c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
- Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

**TEXTBOOKS:**

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019.

**REFERENCE BOOKS:**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, JeevanVidya Prakashan, Amar kantak, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth" .

**COURSE OUTCOMES**:

On completion of the course

1. Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. •
3. They would have better critical ability about various issues in life.
4. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | **2** | - | - | - | - | - | - |
| **CO2** | - | - | **2** | - | - | - | - | - | - | - | - | - |
| **CO3** | - | - | - | - | - | - | - | - | **2** | - | - | - |
| **CO4** | - | - | - | - | - | - | - | **2** | - | - | - | - |
| **CO5** | - | - | - | - | - | - | - | - | - | - | - | **2** |

## (A400007) NUMERICAL METHODS AND COMPLEX VARIABLES
## (Common to EEE and ECE)

| B.Tech. III Semester | L | T | P | C |
|---|---|---|---|---|
| | 3 | 1 | 0 | 4 |

**UNIT-I**
**NUMERICAL METHODS-I:**
**Solution of polynomial and transcendental equations:** Bisection method, Iteration method, Newton-Raphson method and Regular-False method.
**Interpolation:** Finite differences, Forward differences, Backward differences, Central differences, Symbolic relations and separation of symbols, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation, Gauss's forward and backward formulae, Lagrange's method of interpolation.

**UNIT-II**
**NUMERICAL METHODS-II:**
**Numerical integration:** Trapezoidal rule, Simpson's 1/3rd and 3/8 rules.
**Numerical Solutions of Ordinary Differential Equations** -Taylor's series, Picard's method, Euler and modified Euler's methods, Runge-Kutta method of fourth order.

**UNIT-III**
**COMPLEX VARIABLES: DIFFERENTIATION**
Limit, Continuity and Differentiation of Complex functions. Cauchy-Riemann equations (without proof), Milne-Thomson's methods, Analytic function, Harmonic function, Finding harmonic conjugate, Conformal mapping and Mobius transformations.

**UNIT-IV**
**COMPLEX VARIABLES: INTEGRATION**
Line integrals, Cauchy's theorem, Cauchy's Integral formula, Liouville's theorem, Maximum-Modulus theorem (All theorems without proof), Zeros of analytic functions, singularities.
**Complex Power series:** Taylor's series, Laurent's series, Residues, Cauchy Residue theorem (without proof)
.
**UNIT-V**
**FOURIERSERIES &FOURIERTRANSFORMS:**
Fourier series - Dirichlet's Conditions - Half-range Fourier series - Fourier Transforms: Fourier Sineandcosine Transforms-Inverse Fourier transforms.

**TEXT BOOKS:**
1. Higher Engineering Mathematics, (36$^{th}$Edition), B.S. Grewal, Khanna Publishers, 2010.
2. Advanced Engineering Mathematics, (5$^{th}$Edition), R.K. JainandS.R.K. Iyengar, NarosaPublications,2016.

**REFERENCE BOOKS:**
1. Advanced Engineering Mathematics, (9$^{th}$ Edition), Erwinkreyszig, John Wiley& Sons,2006.
2. Calculus and Analytic geometry, (9$^{th}$Edition), G.B. Thomas and R.L. Finney, Pearson, Reprint, 2002.
3. Introductory methods of Numerical Analysis, (4$^{th}$ Edition), S.S. Sastry, PHI, 2005.
4. Complex Variables and Applications, (7$^{th}$Edition), J. W. Brown and R. V. Churchill, Mc-Graw Hill, 2004.

**COURSE OUTCOMES:**
On completion of the course students will be able to
1. Find the root of given equation and estimate unknown value using interpolation.
2. Find numerical solutions of ordinary differential equations.
3. Analyze the complex function with reference to their analyticity.
4. Evaluate integrals using Cauchy's integral and residue theorems, Taylor's and Laurent's series expansions of complex function.
5. Express any periodic function in terms of sine and cosine.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | | | | | | | 2 |
| CO2 | 3 | 3 | | | | | | | | | | 2 |
| CO3 | 3 | 3 | | | | | | | | | | 2 |
| CO4 | 3 | 3 | | | | | | | | | | 2 |
| CO5 | 3 | 3 | | | | | | | | | | 2 |

## (A402205) NETWORK ANALYSIS AND SYNTHESIS

**B.Tech (ECE): III Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

**Network Topology:** Basic cutset and tie set matrices for planar networks, Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

**UNIT - II**

**Transient and Steady state analysis:** RC, RL and RLC Circuits, Sinusoidal, Step and Square responses. RC Circuits as integrator and differentiators. 2nd order series and parallel RLC Circuits, Root locus, damping factor, over damped, under damped, critically damped cases, quality factor and bandwidth for series and parallel resonance, resonance curves.

**UNIT - III**

**Two port network parameters:** Z, Y, ABCD, h and g parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard T, $\pi$, L Sections, Characteristic impedance, image transfer constants, Design of Attenuators, impedance matching network.

**UNIT-IV**

**Filters:** Classification of Filters, Filter Networks, Constant-K Filters-Low pass, high pass, Band pass, band-stop filters, M-derived Filters- T and $\pi$ filters- Low pass, high pass

**Attenuators:** Types – T, $\pi$ , L, Bridge T and lattice ,Asymmetrical Attenuators T, $\pi$ , L Equalizers- Types-Series, Shunt, Constant resistance, bridge T attenuation, bridge T phase, Lattice attenuation, lattice Phase equalizers

**UNIT – V**

**Network Synthesis:** Driving point impedance and admittance, transfer impedance and admittance, network functions of Ladder and non-ladder networks, Poles, Zeros analysis of network functions**,** Hurwitz polynomials, Positive Real Functions, synthesis of LC, RC and RL Functions by foster andcauser methods.

**TEXT BOOKS:**

1. Van Valkenburg -Network Analysis, 3rd Ed., Pearson, 216.
2. JD Ryder - Networks, Lines and Fields, 2nd Ed., PHI, 1999.

**REFERENCE BOOKS:**

1. J. Edminister and M. Nahvi - Electric Circuits, Schaum's Outlines, Mc Graw Hills Education,1999.
2. A. Sudhakar and Shyammohan S Palli - Networks & Circuits, 4th Ed., Tata McGraw-HillPublications
3. William Hayt and Jack E. Kimmerley - Engineering Circuit Analysis, 6th Ed., William Hayt andJack E. Kimmerley, McGraw Hill Company

**COURSE OUTCOMES:**

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

1. Gain the knowledge on basic RLC circuit's behaviour.
2. Analyse the Steady state and transient analysis of RLC Circuits.
3. Characterization of two port network parameters.
4. Analyse the Design aspect of various filters and attenuators.
5. Analyse and Synthesise different network functions

**CO-PO Mapping:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | - | - | - | 1 | - | - | - | - | 1 |
| CO2 | 2 | 3 | 2 | - | - | - | 1 | - | - | - | - | 1 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 |
| CO4 | 2 | 3 | 3 | - | - | - | 1 | - | - | - | - | 1 |
| CO5 | 2 | 3 | 3 | - | - | - | 1 | - | - | - | - | 1 |

## (A404301) ANALOG CIRCUITS

**B. Tech. (ECE) III-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT-I**

**Analysis and Design of Small Signal Low Frequency BJT Amplifiers:** Transistor Hybrid model, Determination of h-parameters from transistor characteristics, Typical values of h- parameters in CE, CB and CC configurations, Transistor amplifying action, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

**UNIT - II**

**FET Amplifiers:** Analysis of CS, CD, CG JFET Amplifiers, comparison of performance with BJT Amplifiers, Basic Concepts of MOSFET Amplifiers, MOS Small signal model, Common source amplifier with resistive, Diode connected and Current source loads, Source follower, Common Gate Stage, Cascode and Folded Cascode Amplifier – frequency response.

**UNIT - III**

**Multistage Amplifiers:** Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Cascade RC Coupled amplifiers, Cascode amplifier, Darlington pair.

**Transistor at High Frequency:** Hybrid -$\pi$model of Common Emitter transistor model, f$\alpha$, f$\beta$ and unity gain bandwidth, Gain-bandwidth product.

**UNIT - IV**

**Feedback Amplifiers:** Concepts of feedback – Classification of feedback amplifiers – General characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current Shunt Feedback configurations – Simple problems.

**UNIT - V**

**Oscillators:** Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators, Crystal Oscillator.

**TEXT BOOKS:**

1. Jacob Millman, Christos C Halkias -Integrated Electronics, McGraw Hill Education.
2. Robert L. Boylestead, Louis Nashelsky -Electronic Devices and Circuits theory, 11th Edition,2009, Pearson

**REFERENCE BOOKS:**

1. David A. Bell – Electronic Devices and Circuits, 5th Edition, Oxford.
2. Adel S. Sedra, Kenneth C. Smith- Microelectronic Circuits- Theory and Applications, Oxford.
3. Chinmoy Saha, Arindam Halder, Debaati Ganguly -Basic Electronics-Principles and Applications, 2018, Cambridge.

**COURSE OUTCOMES**

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

1. Design single stage amplifiers using BJT
2. Design single stage amplifiers using FET
3. Design multistage amplifiers and understand the concepts of High Frequency Analysis of BJT.
4. Utilize the Concepts of negative feedback to improve the stability of amplifiers
5. Utilize the Concepts of positivefeedback to generate sustained oscillations.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | | | | | | | | | 2 |
| CO2 | 3 | 3 | 2 | | | | | | | | | 2 |
| CO3 | 3 | 3 | 2 | | | | | | | | | 2 |
| CO4 | 3 | 3 | 2 | | | | | | | | | 2 |
| CO5 | 3 | 3 | 2 | | | | | | | | | 2 |

## (A404302) PROBABILITY THEORY AND STOCHASTIC PROCESSES

**B. Tech. (ECE) III-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

**Probability & Random Variable**: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events, *Random Variable*-Definition, Conditions for a Function to be a Random Variable,Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.

**UNIT - II**

**Operations on Single & Multiple Random Variables – Expectations**: Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic and Non-Monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable.

Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence.

Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected). Unequal Distribution, Equal Distributions. Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

**UNIT - III**

**Random Processes – Temporal Characteristics:** The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelationFunction of Response, Cross-Correlation Functions of Input and Output.

**UNIT - IV**

**Random Processes – Spectral Characteristics:** The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

**UNIT - V**

**Noise Sources & Information Theory:** Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties. Entropy, Information rate, Source coding: Huffman coding, Shannon Fano coding, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade -off betweenbandwidth and SNR.

**TEXT BOOKS:**

1. Peyton Z. Peebles - Probability, Random Variables & Random Signal Principles, 4th Ed, TMH,2001.
2. Taub and Schilling - Principles of Communication systems, TMH, 2008

**REFERENCE BOOKS:**

1. Bruce Hajck - Random Processes for Engineers, Cambridge unipress, 2015
2. Athanasios Papoulis and S. Unnikrishna Pillai - Probability, Random Variables and Stochastic Processes, 4th Ed., PHI, 2002.
3. B.P. Lathi - Signals, Systems & Communications, B.S. Publications, 2003.
4. S.P Eugene Xavier -Statistical Theory of Communication, New Age Publications, 2003

**COURSE OUTCOMES:**

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

1. Perform operations on single and multiple Random variables.
2. Determine the Spectral and temporal characteristics of Random Signals.
3. Characterize LTI systems driven by stationary random process by using ACFs and PSDs.
4. Understand the concepts of Noise and Information theory n Communication systems
5. Analyze the response of a linear time invariant (LTI) system driven by stationary random processes using the time domain and frequency domain description of random processes.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **1** | - | - | - | - | - | - | **3** | - | - |
| **CO2** | **2** | **2** | **3** | - | - | - | - | - | - | **2** | - | - |
| **CO3** | **1** | **2** | **2** | - | - | - | - | - | - | **3** | - | - |
| **CO4** | **3** | **2** | **1** | - | - | - | - | - | - | **2** | - | - |
| **CO5** | **3** | **3** | **2** | - | - | - | - | - | - | **2** | - | - |

## (A404303) SIGNALS & SYSTEMS

**B. Tech. (ECE) III-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

**Signal Analysis:** Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

**UNIT – II**

**Fourier series:** Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

**Fourier Transforms:** Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction toHilbert Transform.

**UNIT - III**

**Signal Transmission through Linear Systems:** Linear System, Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.

**UNIT – IV**

**Laplace Transforms:** Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

**Z–Transforms:** Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

**UNIT - V**

**Sampling theorem**: Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat-top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling.

**Correlation:** Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parsevals Theorem, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Relation between Convolution and Correlation, Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of Signal from Noise by Filtering.

**TEXT BOOKS**

1. B.P. Lathi -Signals, Systems & Communications, BSP, 2013.
2. A.V. Oppenheim, A.S. Willsky and S.H. Nawabi -Signals and Systems, 2nd Ed., Prentice Hall

**REFERENCE BOOKS**

1. Signals and Systems – A. Anand Kumar, PHI Publications, 3rd edition,2013
2. Simon Haykin and Van Veen, A. Rama Krishna Rao, -Signals and Systems, TMH, 2008.
3. Michel J. Robert - Fundamentals of Signals and Systems, MGH International Edition, 2008.
4. C. L. Philips, J. M. Parr and Eve A. Riskin -Signals, Systems and Transforms, 3rd Ed., PE,2004.

**COURSE OUTCOMES**

Upon completing this course the students will be able to:

1. Characterize various signals and systems.
2. Analyze signals in time and frequency domain using various transform techniques.
3. Identify the conditions for transmission of signals through systems and conditions for physical realization of systems.
4. Use sampling theorem for baseband and band pass signals for various types of sampling andfor different duty cycles.
5. Apply the correlation and PSD functions for various applications.

**CO-PO MAPPING**:

| CO's | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** |
| **CO2** | **3** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** |
| **CO3** | **3** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** |
| **CO4** | **3** | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** |
| **CO5** | **3** | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** |

## (A405506) PYTHON PROGRAMMING LABORATORY

(Common to all)

| B.Tech (ECE): III Semester | L | T | P | C |
|---|---|---|---|---|
| | 0 | 1 | 2 | 2 |

**Week 1.**

*(Python Language Fundamentals-Installation -Identifiers, Reserved Words, Data Types, Type Casting, Immutability)*

**Demonstration**

Experiment-1: Install Anaconda open-source framework for python.

Experiment-2: Write a program to display 'Hello World'.

**Experimentation**

Experiment-3: Explore various IDEs for python program development.

Experiment-4: The volume of a sphere with radius r is 4/3 $\pi r^3$. Write a Python program to find the volume of a sphere with radius 5?

**Week 2.**

*(Arithmetic Operators, Relational Operators, Logical operators, Bitwise operators, Assignment operators, Special operators)*

**Demonstration**

Experiment-1; Write a python program to find minimum and maximum of given three numbers.

Experiment-2: Suppose the cover price of a book is $24.95, but bookstores get a 40% discount.
Shipping costs $3 for the first copy and 75 cents for each additional copy. Write a python program to compute the total wholesale cost for 60 copies?

**Experimentation**

Experiment-3: Write a Python Program to Find the Square Root of a number without using sort function.

Experiment-4: Python Program to Convert Celsius to Fahrenheit.

Experiment-5: Python program to find the maximum of two numbers using ternary operator

**Week 3.**

*(Mathematical Functions, Input and Output statements, Command Line Arguments, String Functions)*

**Demonstration**

Experiment-1: Write a Python program to find area of circle.

Experiment-2: Write a program to read Employee data from the keyboard and print that data.

**Experimentation**

Experiment-3: Write a program to read 3 float numbers from the keyboard with comma separator and print their sum.

Experiment-4: Write a Program to display Command Line Arguments.

**Week 4.**

*(Flow Control Statements-Conditional Statements, Transfer Statements, Iterative Statements)*

**Demonstration**

Experiment-1. Write a Python program to take a single digit number from the key board and print is value in English word?

Experiment-2. Write a Python Program to check whether an n-digit integer is an Armstrong number or not.

**Experimentation**

Experiment-3. Write a Python program to display *'s in pyramid style (also known as equivalent triangle).

Experiment-4. Write a Python Program to Display the multiplication Table.

**Week 5.**

*(Functions-Built in functions, user defined functions, Parameters, return statement, returning multiple values from function, type of arguments, Types of variables-global, local. Recursive functions, Lambda functions, filter function, reduce function, Function aliasing, Function decorators, Generators)*

**Demonstration**

Experiment-1: Write a python function to find factorial of given number?

Experiment-2: Write a program to create a lambda function to find square of given number?

**Experimentation**

Experiment-3: Lambda Function to find biggest of given values.

Experiment-4: Program to filter only even numbers from the list by using filter () function?

**Week 6.**

*(Working with Strings-Defining String, Multi-line Strings, Accessing characters of a string, Mathematical operators for strings, Membership operator, Comparison of Strings, Removing spaces from the string, Finding Substring, String replacement, Splitting of Strings, Changing cases of a string, Formatting the strings)*

**Demonstration**

Experiment-1: Write a program to accept some string from the keyboard and display its characters by index wise (both positive and negative index).

Experiment-2: Write a program to access each character of string in forward and backward direction by using while loop?

**Experimentation**

Experiment-3: Program to display all positions of substring in a given main string.

Experiment-4: Write a program to reverse the given String.

**Week 7.**

*(Python Data Structures-List: Creating a list- Accessing elements of a List, Traversing the List, List Manipulation, Ordering the elements of a List, Mathematical Operators for List objects, Membership Operator, Nested Lists, List Comprehensions)*

**Demonstration**

Experiment-1: Write a Python program to display unique vowels present in the given word.

Experiment-2: Write a Python program to Count the Occurrence of an Item in a List.

**Experimentation**

Experiment-3: Write a Python program to segregate even and odd numbers from the given list of numbers.

Experimnet-4: Write a Python program to find the cumulative sum of elements of the list.

**Week 8.**

*(Python Data Structures-Tuple: Creating a Tuple, Accessing the elements of a tuple, mathematical operators for tuple,*

*Tuple packing and Unpacking)*

**Demonstration**

Experiment-1: Python program for adding a Tuple to List and Vice-Versa.

Experiment-2: Write a Python program to perform the summation of all elements of each tuple from the list of tuples.

**Experimentation**

Experiment-3: Write a Python program to multiply adjacent elements of a tuple.

Experiment-4: Write a Python program to find the maximum element in the tuple list.

**Week 9.**

*(Python Data Structures-Set: Creating a Set object, functions of set, Mathematical operations on set, Membership Operators, Set Comprehension, Python Data Structures-Dictionary: Creating a Dictionary Object, accessing data from the dictionary, updating dictionaries, Deleting from dictionary, Functions on dictionary, dictionary comprehension)*

**Demonstration**

Experiment-1. Write a Python program to perform set operations.

Experiment-2: Write a program to print different vowels present in the given word?

Experiment-3: Write a Python program to generate powers of 2 using set comprehensions.

Experiment-4: Write a program to eliminate duplicates present in the list using set

Experiment-5: Write a Python program to enter name and percentage marks in a dictionary and display information on the console.

**Experimentation**

Experiment-6: Write a program to take dictionary from the keyboard and print the sum of values?

Experiment-7: Write a program to find number of occurrences of each letter present in the given string using dictionary.

Experiment-8: Write a program to accept student name and marks from the keyboard and creates a dictionary. Also display student marks by taking student name as input?

**Week 10.**

*(Python Modules-Creating Modules, Accessing members, module aliasing, member aliasing, reloading a module, The special variable: __name___. Working with Math, random modules, Python Packages. Python-File Handling-Types of Files, Opening a file, closing a file, properties of File object, writing data to text file, Reading character data from text files, seek (), tell () functions.)*

**Demonstration**

Experiment-1: Create a module **fibo.py** containing Fibonacci(**n**) function(s) and import fibo module in a python script to print Fibonacci series upto **n**.

Experiment-2: Write a python program to print all the contents of a given module.

Experiment-3: Write a python program to create a package containing two or modules.

Experiment-4: Write a python program to import module from a package created in Experiment-3.

**Experimentation**

Experiment-5: Write a program to check whether the given file exists or not. If it is available then print its content?

Experiment-6: Write a python Program to print the number of lines, words and characters present in the given file?

Experiment-7: Program to read image file and write to a new image file?

Experiment-8: Write a python program to read and write to a CSV file.

Note:

***Experiments under Demonstration section are to be demonstrated by the concerned faculty and the experiments under Experimentation section must be performed by the students individually.***

**REFERENCE BOOKS:**

1.Allen B. Downey, "Think Python", 2nd edition, SPD/O'Reilly, 2016.
2. Martin C.Brown, "The Complete Reference: Python", McGraw-Hill, 2018.
3. Kenneth A. Lambert, B.L. Juneja, "Fundamentals of Python", CENGAGE, 2015.
4. R. Nageswara Rao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019.

**Web links:**

1. https://docs.python.org/3/tutorial/modules.html#packages
2. https://www.includehelp.com/python/programs.aspx.
3. https://www.anaconda.com/products/individual
4. https://www.jetbrains.com/pycharm/

**COURSE OUTCOMES**

Students shall be able to:

1. Design solutions to computational problems using Python programming language constructs.
2. Write python programs to manipulate string objects.
3. Use Appropriate Data structures to organize and manipulate data items.
4. Design modular application using python module & package concepts.
5. Develop application to read and write from various file formats.

**CO PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 3 | 2 | 2 | - | - | - | - | - | - | 1 |
| CO2 | 2 | 2 | 3 | 1 | 3 | - | - | - | - | - | - | 1 |
| CO3 | 3 | 2 | 2 | 1 | 3 | - | - | - | - | - | - | 1 |
| CO4 | 1 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | 1 |
| CO5 | - | 2 | 1 | 1 | 3 | - | - | - | - | - | - | 1 |

## (A404504) ANALOG CIRCUITS LABORATORY

**B. Tech. (ECE) III-Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**LIST OF EXPERIMENTS:**

Experiments marked with ***** has to be designed, simulated and verified in hardware (Simulation & Hardware)
Minimum of 9 experiments to be done in hardware

1. Perform an experiment to choose Q-point for a Transistor that operate in active region andobserve the effect of external Load resistance on Q-point.
2. Design a Self-Bias Circuit and determine the Q-point of the Transistor and its Stability factor.
3. Obtain the I/O Characteristics of CE, CB, CC configurations. Calculate h-parameters from the Characteristics.
4. Design a Common Drain Amplifier with voltage divider bias and determine the Stability factor.
5. Obtain the Drain and Transfer characteristics of CD, CS configurations of JFET. Calculate gm, $r_d$ from the Characteristics.
6. By experiment prove that the voltage gain of Emitter Follower Circuit is one.
7. *Design a Common Emitter Amplifier with a gain of 30db and Bandwidth of 10KHZ and plot thefrequency response practically.
8. *Design a two stage RC Coupled amplifier and prove that gain is increased and analyze theeffects of coupling capacitance.
9. *Practically prove that the Darlington pair has high input impedance and high current gain.
10. Draw the high frequency response of common emitter transistor amplifier and calculate fα, fβ and gain bandwidth product.
11. *Design MOSFET Amplifier and verify the input and output characteristics.
12. Design four topologies of feedback amplifiers and draw the frequency response of them withand without feedback.
13. *Design an RC phase shift oscillator circuit and derive the gain condition for oscillations practically for given frequency.
14. Design a Colpitts oscillator circuit for the given frequency and draw the output waveform.

**Major Equipment required for Laboratories:**

1. Computer System with latest specifications connected
2. Window XP or equivalent
3. Simulation Software-Multisim or any equivalent simulation software
4. Regulated Power Suppliers, 0-30V
5. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
6. Functions Generators-Sine and Square wave signals
7. Multimeters
8. Electronic devices

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Design amplifiers with required Q point and analyse amplifier characteristics
2. Examine the effect multistage amplification on frequency response
3. Investigate feedback concept in amplifiers and oscillator.
4. Utilize the Concepts of negative feedback to improve the stability of amplifiers
5. Utilize the Concepts of positivefeedback to generate sustained oscillations

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | | | 2 |
| CO2 | 3 | 2 | 2 | | | | | | | | | 2 |
| CO3 | 3 | 3 | 2 | | | | | | | | | 2 |
| CO4 | 3 | 2 | 2 | | | | | | | | | 2 |
| CO5 | 3 | 2 | 2 | | | | | | | | | 2 |

## (A404505) BASIC SIMULATION LABORATORY

**B. Tech. (ECE) III-Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Note: Minimum of 12 experiments to be conducted from the following.**

**LIST OF EXPERIMENTS:**

1. Basic Operations on Matrices.
2. Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
3. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting,Folding, Computation of Energy and Average Power.
4. Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal.
5. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum
6. Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System.
7. Computation of Unit sample, Unit step and Sinusoidal responses of the given LTI system andverifying its physical realizability and stability properties.
8. Convolution for Signals and sequences.
9. Waveform Synthesis using Laplace Transform.
10. Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.
11. Verification of Sampling Theorem.
12. Auto Correlation and Cross Correlation for Signals and Sequences.
13. Removal of noise by Autocorrelation / Cross correlation.
14. Extraction of Periodic Signal masked by noise using Correlation.

**Major Equipment required for Laboratories:**

1. Computer System with latest specifications connected
2. Window Xp or equivalent
3. Simulation software-MAT Lab or any equivalent simulation software

**COURSE OUTCOMES**

Upon completing this course, the student will be able to:

1. Examine various signals/sequences and demonstrate different operations on signals/sequences using MATLAB.
2. Evaluate the Fourier transform of a signal and plot its magnitude and phase spectrum.
3. Analyze and characterize continuous time systems in both time and frequency domain.
4. Test the sampling theorem using MAT lab.
5. Describe the waveform synthesis using Laplace transform and plot pole -zero maps in s plane and z plane.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 3 | 2 | - | - | 3 | 1 | - | 1 |
| CO2 | 3 | 2 | 3 | 3 | 3 | 2 | - | - | 3 | 1 | - | 1 |
| CO3 | 3 | 2 | 3 | 3 | 3 | 2 | - | - | 3 | 1 | - | 1 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 2 | - | - | 3 | 1 | - | 1 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 2 | - | - | 3 | 1 | - | 1 |

**(A400702) GENDER SENSITIZATION**
**(Common to all branches)**

**B. Tech. (ECE) III-Semester**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 0 |

**UNIT-I: UNDERSTANDING GENDER**

**Introduction:** Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood-Growing up Male, First lessons in Caste.

**UNIT – II: GENDER ROLES AND RELATIONS**

**Two or Many?** -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences Declining Sex Ratio-Demographic Consequences-Gender Spectrum: Beyond the Binary

**UNIT – III: GENDER AND LABOUR**

**Division and Valuation of Labour-Housework:** The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work.–Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

**UNIT – IV: GENDER - BASED VIOLENCE**

**The Concept of Violence**- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No!-Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment-Further Reading: "Chupulu". Domestic Violence: Speaking Out Is Home a Safe Place? –When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life…."

**UNIT – V: GENDER AND CULTURE**

**Gender and Film**-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature – Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters-Mothers and Fathers- Rosa Parks the Brave Heart.

**REFERENCE BOOKS**

1. Towards a World of Equals: A Bilingual Textbook on Gender, A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu published by Telugu Akademi, Telangana Government, 2015.

**COURSE OUTCOMES:**

On completion of the course students will be able to

1. Students will have developed a better understanding of important issues related to gender in contemporary India.
2. Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. (This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film).
3. Students will attain a finer grasp of how gender discrimination works in our society and acquire insight into the gendered division of labour and its relation to politics and economics.
4. Men and women students and professionals will be better equipped to work and live together as equals.
5. Students will develop a sense of appreciation of women in all walks of life by going through accounts of studies and movements as well as the new laws that provide protection and relief to women.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | 2 | - | - | - | - | - | - |
| **CO2** | 2 | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | - | - | - | - | - | 2 | - | - | - | - | - | - |
| **CO4** | - | - | - | 2 | - | - | - | - | - | - | - | - |
| **CO5** | - | - | 3 | - | - | -- | - | - | - | - | - | - |

## (A404304) ANALOG AND DIGITAL COMMUNICATIONS

**B. Tech. (ECE) IV-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

**Amplitude Modulation:** Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, COSTAS Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation.

**UNIT - II**

**Angle Modulation:** Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal- Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM., Concept of Pre-emphasis and de-emphasis.

**UNIT - III**

**Transmitters:** Classification of Transmitters, AM Transmitters, FM Transmitters

**Receivers:** Radio Receiver - Receiver Types - Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM Receiver, Comparison of AM and FM Receivers.

**UNIT - IV**

**Pulse Modulation:** Types of Pulse modulation- PAM, PWM and PPM. Comparison of FDM and TDM. **Pulse Code Modulation:** PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, Adaptive DPCM, DM and Adaptive DM, Noise in PCM and DM.

**UNIT - V**

**Digital Modulation Techniques:** ASK- Modulator, Coherent ASK Detector, FSK- Modulator, Non- Coherent FSK Detector, BPSK- Modulator, Coherent BPSK Detection. Principles of QPSK, Differential PSK and QAM.

**Baseband Transmission and Optimal Reception of Digital Signal:** A Baseband Signal Receiver, Probability of Error, Optimum Receiver, Coherent Reception, ISI, Eye Diagrams.

**TEXT BOOKS**

1. Simon Haykin -Analog and Digital Communications, John Wiley, 2005.
2. Wayne Tomasi - Electronics Communication Systems-Fundamentals through Advanced, 5th Ed., PHI, 2009.

**REFERENCE BOOKS**

1. Herbert Taub, Donald L Schilling, Goutam Saha, -Principles of Communication Systems, 3rd Ed., McGraw-Hill, 2008.
2. Dennis Roddy and John Coolean - Electronic Communications, 4th Ed., PEA, 2004
3. George Kennedy and Bernard Davis - Electronics & Communication System, TMH, 2004
4. K. Sam Shanmugam - Analog and Digital Communication, Willey, 2005

**COURSE OUTCOMES**

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

1. Design and analyze various Amplitude Modulation and Demodulation techniques.
2. Design and analyze various Angle Modulation and Demodulation techniques.
3. Analyze various Transmitters and Receivers used in Communication.

4. Understand Pulse& c o d e Modulation Techniques in various applications.
5. Design and analyze various Digital Modulation and Detection techniques

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **2** | **2** | **1** | | | | | | | |
| **CO2** | **3** | **3** | **2** | **1** | | | | | | | | |
| **CO3** | **2** | **2** | **2** | **1** | | | | | | | | |
| **CO4** | **2** | **2** | **1** | **1** | | | | | | | | |
| **CO5** | **3** | **2** | **2** | **1** | | | | | | | | |

## (A404305) SWITCHING THEORY AND LOGIC DESIGN

**B. Tech. (ECE) IV-Semester**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**UNIT-I**

**Number Systems: N**umber systems, Complements of Numbers, Codes- Weighted and Non-weightedcodes and its Properties, Parity check code and Hamming code.

**Boolean algebra:** Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

**UNIT-II**

**Minimization of Boolean functions:** Karnaugh Map Method - Up to five Variables, Don't Care Map Entries, Tabular Method

**Combinational Logic Circuits:** Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters,

**UNIT-III**

**Sequential Circuits Fundamentals:** Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.

.

**UNIT-IV**

**Registers and Counters:** Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

**Sequential Machines:** Finite State Machines, Synthesis of Synchronous Sequential Circuits- Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N –Counters.

**UNIT-V**

**Finite state machine:** capabilities and limitations, Mealy and Moore models, State equivalence and machine minimization, simplification of incompletely specified machines, Merger graphs.

**TEXT BOOKS**

1. Zvi Kohavi &Niraj K. Jha, - Switching and Finite Automata Theory, 3rd Ed., Cambridge, 2010.
2. Digital Design -Morris Mano, PHI, 3rd Edition, 2006.

**REFERENCE BOOKS**

1. R. P. Jain - Modern Digital Electronics, 3rd Edition, 2007- Tata McGraw-Hill
2. Charles H. Roth - Fundamentals of Logic Design, 5th ED., Cengage Learning, 2004.

**COURSE OUTCOMES**

Upon Completion of the Course, Students will be able to

1. Identify the various number systems.
2. Apply the basic theorems to simply the Boolean Functions.
3. Design Combinational circuits for various applications.
4. Design simple Sequential Circuits.
5. Distinguish the Finite State Machines and Algorithmic StateMachines Charts.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **2** | | | | | | | | | **2** |
| **CO2** | **3** | **3** | **2** | | | | | | | | | **2** |
| **CO3** | **3** | **3** | **2** | | | | | | | | | **2** |
| **CO4** | **3** | **3** | **2** | | | | | | | | | **2** |
| **CO5** | **3** | **3** | **2** | | | | | | | | | **2** |

## (A404306) ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

**B. Tech. (ECE) IV-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT – I**

**Electrostatics:** Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Energy Density. Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors.

**UNIT – II**

**Magnetostatics:** Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law.

**UNIT – III**

**Maxwell's Equations (Time Varying Fields):** Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Two Equations for Magnetostatic Fields, Maxwell's Two Equations for Electrostatic Fields Maxwell's Equations in Different Forms, Conditions at a Boundary Surface - Dielectric-Dielectric and Dielectric-Conductor Interfaces.

**UNIT – IV**

**EM Wave Characteristics:** Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definitions, Relation between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem.

**UNIT – V**

Transmission Lines: Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Equivalent Circuit, Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless / Low Loss Characterization, Condition for Distortion less line, Minimum Attenuation, Loading - Types of Loading.SC and OC Lines, $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines, Reflection Coefficient, VSWR Smith Chart – Configuration and Applications, Single Stub Matching.

**TEXT BOOKS:**


1. Matthew N.O. sadiku and S.V. Kulkarni - Principles of Electromagnetics, 4th Ed., Oxford University Press, Aisan Edition, 2015.
2. Umesh Sinha, Satya Prakashan -Transmission Lines and Networks, (Tech. India Publications), New Delhi, 2001


**REFERENCE BOOKS:**


1. JD. Kraus -Electromagnetics with Applications ,5th Ed., TMH
2. William H. Hayt Jr. and John A. Buck- Engineering Electromagnetics, 8th Ed., McGraw Hill,2014
3. JD Ryder -Networks, Lines and Fields, 2nd Ed., PHI, 1999


**COURSE OUTCOMES:**

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

1. Explain the concepts of electrostatics using vector calculus and coordinate systems.
2. Explain the magnetic field intensity using Biot-Savart's law and Ampere's law.
3. Explain the concepts of Time varying fields using Maxwell's Equations.
4. Analyze the characteristics of electromagnetic waves and describe Pointing theorem .

5. Summarize the various characteristics of transmission line and stub matching using Smith chart.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | | | | | 1 | | | | | 1 |
| **CO2** | 2 | 3 | 1 | | | | 1 | | | | | 1 |
| **CO3** | 2 | 3 | 1 | | | | 1 | | | | | 1 |
| **CO4** | 3 | 2 | 1 | 1 | | | 1 | | | | | 1 |
| **CO5** | 3 | 2 | 2 | 1 | | | 1 | | | | | 1 |

## (A404307) LINEAR AND DIGITAL IC APPLICATIONS

**B. Tech. (ECE) IV-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

**Operational Amplifier:** Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, features of 741 Op-Amp, Modes of Operation-Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

**UNIT - II**

**Op-Amp, IC-555 & IC565 Applications:** Introduction to Active Filters, Characteristics of Bandpass, Bandreject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer-Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL-Block Schematic, principle and Applications.

**UNIT - III**

**Data Converters:** Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs – Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

**UNIT - IV**

**Combinational Logic ICs:** Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

**UNIT - V**

**Sequential Logic IC's and Memories:** Familiarity with commonly available 74XX & CMOS40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.
Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

**TEXT BOOKS:**

1. Ramakanth A. Gayakwad - Op-Amps & Linear ICs, PHI, 2003.
2. Floydand Jain- Digital Fundamentals, 8th Ed., Pearson Education,2005.

**REFERENCE BOOKS:**

1. D. Roy Chowdhury – Linear Integrated Circuits, New Age International(p)Ltd,2nd Ed., 2003.
2. John. F. Wakerly – Digital Design Principles and Practices, 3rdEd., Pearson, ,2009.
3. Salivahana -Linear Integrated Circuits and Applications, TMH, 2008.
4. William D.Stanley- Operational Amplifiers with Linear Integrated Circuits, 4thEd., Pearson Education India, 2009.

**COURSE OUTCOMES**

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

1. A thorough understanding of operational amplifiers with linear integrated circuits.
2. Attain the knowledge of functional diagrams and design applications of IC555 and IC565.
3. Acquire the knowledge and design the Data converters.
4. Choose the proper Combinational digital integrated circuits by knowing their characteristics.
5. Choose the proper Sequential digital integrated circuits by knowing their characteristics

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | | | | | | | | | 2 |
| **CO2** | 3 | 3 | 2 | | | | | | | | | 2 |
| **CO3** | 3 | 3 | 2 | | | | | | | | | 2 |
| **CO4** | 3 | 3 | 2 | | | | | | | | | 2 |
| **CO5** | 3 | 3 | 2 | | | | | | | | | 2 |

## (A404308) ELECTRONIC CIRCUIT ANALYSIS

**B. Tech. (ECE) IV-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

**Large Signal Amplifiers:** Class A Power Amplifier- Series fed and Transformer coupled, Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Principle of operation of Class AB and Class –C and D Amplifiers.

**UNIT- II**

**Tuned Amplifiers:** Introduction, single Tuned Amplifiers – Q-factor, frequency response, Double Tuned Amplifiers – Q-factor, frequency response, Concept of stagger tuning and synchronous tuning.

**UNIT - III**

**Multivibrators**: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

**UNIT - IV**

**Time Base Generators:** General features of a Time base Signal, Methods of Generating Time Base Waveform, concepts of Transistor Miller and Bootstrap Time Base Generator, Methods of Linearity improvement.

**UNIT - V**

**Synchronization and Frequency Division:** Pulse Synchronization of Relaxation Devices, Frequency division in Sweep Circuits, Stability of Relaxation Devices, Astable Relaxation Circuits, Monostable Relaxation Circuits, Synchronization of a Sweep Circuit with Symmetrical Signals, Sine wave frequency division with a Sweep Circuit, A Sinusoidal Divider using Regeneration and Modulation.

**Sampling Gates:** Basic operating principles of Sampling Gates, Unidirectional and Bi-directional Sampling Gates, Four Diode Sampling Gate, Reduction of pedestal in Gate Circuits

**TEXT BOOKS:**

1. Jacob Millman, Christos C Halkias - Integrated Electronics, , McGraw Hill Education.
2. J. Millman, H. Taub and Mothiki S. PrakashRao - Pulse, Digital and Switching Waveforms –2nd Ed., TMH, 2008.

**REFERENCE BOOKS:**

1. David A. Bell - Electronic Devices and Circuits, 5th Ed., Oxford.
2. Robert L. Boylestead, Louis Nashelsky - Electronic Devices and Circuits theory, 11th Ed.,Pearson, 2009
3. Ronald J. Tocci - Fundamentals of Pulse and Digital Circuits, 3rd Ed., 2008.
4. David A. Bell - Pulse, Switching and Digital Circuits, 5th Ed., Oxford, 2015.

**COURSE OUTCOMES :**

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

1. Design the power amplifiers
2. Design the tuned amplifiers and analyse its frequency response
3. Design Multivibrators and Schmitt trigger circuits.
4. Design sweep circuits for various applications.
5. Utilize the concepts of synchronization, frequency division and sampling gates.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **2** | | | | | | | | | **2** |
| **CO2** | **3** | **3** | **2** | | | | | | | | | **2** |
| **CO3** | **3** | **3** | **2** | | | | | | | | | **2** |
| **CO4** | **3** | **3** | **2** | | | | | | | | | **2** |
| **CO5** | **3** | **3** | **2** | | | | | | | | | **2** |

## (A404507) ANALOG AND DIGITAL COMMUNICATIONS LABORATORY

**B. Tech. (ECE) IV-Semester**

| L | T | P | C |
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| 0 | 0 | 2 | 1 |

**Note:**

- Minimum 12 experiments should be conducted:

All these experiments are to be simulated first either using MATLAB, COMSIM or any other simulation package and then to be realized in hardware

**LIST OF EXPERIMENTS:**

1. (i) Amplitude modulation and demodulation (ii) Spectrum analysis of AM
2. (i) Frequency modulation and demodulation (ii) Spectrum analysis of FM
3. DSB-SC Modulator & Detector
4. SSB-SC Modulator & Detector (Phase Shift Method)
5. Frequency Division Multiplexing & De multiplexing
6. Pulse Amplitude Modulation & Demodulation
7. Pulse Width Modulation & Demodulation
8. Pulse Position Modulation & Demodulation
9. PCM Generation and Detection
10. Delta Modulation
11. DPCM Generation and Detection
12. Frequency Shift Keying: Generation and Detection
13. Binary Phase Shift Keying: Generation and Detection
14. Generation and Detection (i) DPSK (ii) QPSK
15. Generate FSK modulated signal using PLL

*Prove practically the Figure of Merit of DSB-SC is unity for single tone modulation

**Major Equipment required for Laboratories:**

1. CROs: 20MHz
2. Function Generators: 2MHz
3. Spectrum Analyzer
4. Trainer kits
5. MAT Lab/Equivalent Simulation Package with Communication tool box.

**COURSE OUTCOMES**

Upon completing this course, the student will be able to

1. Design and implement various Analog modulation and demodulation Techniques and observe the time and frequency domain characteristics
2. Design and implement various Pulse modulation and demodulation Techniques and observe the time and frequency domain characteristics
3. Apply Frequency Division Concepts in Different Modulation Techniques.
4. Apply different types of Sampling with various Sampling rates and duty Cycles
5. Design and implement various Digital modulation and demodulation Techniques and observe the waveforms of these modulated Signals practically.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 3 | | | | | | | | |
| CO2 | 2 | 2 | 1 | 3 | | | | | | | | |
| CO3 | 2 | 1 | 1 | 3 | | | | | | | | |
| CO4 | 2 | 2 | 1 | 3 | | | | | | | | |
| CO5 | 2 | 2 | 1 | 3 | | | | | | | | |

## (A404508) LINEAR AND DIGITAL IC APPLICATIONS LABORATORY

**B. Tech. (ECE) IV-Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Note:**

- Minimum 12 experiments should be conducted.
- Verify the functionality of the IC in the given application.

**Design and Implementation of:**

1. Design an Inverting and Non-Inverting Amplifier using Op Amp and calculate gain.
2. Design Adder and Subtractor using Op Amp and verify addition and subtraction process.
3. Design a Comparator using Op Amp and draw the comparison results of A=B, A<B, A>B.
4. Design an Integrator and Differentiator Circuits using IC741 and derive the required conditionpractically.
5. Design an Active LPF, HPF cutoff frequency of 2 KHZ and find the roll off of it.
6. Design a Circuit using IC741 to generate sine/square/triangular wave with period of 1KHZ anddraw the output waveform.
7. Construct Mono-stableMultivibratorusingIC555 and draw its output waveform.
8. Construct Astable Multivibrator using IC555 and draw its output waveform and also find its dutycycle.
9. Design a Schmitt Trigger Circuit and find its LTP and UTP.
10. Design Weighted register DAC and find its resolution and write a truth table with respective voltages.
11. Design VoltageRegulatorusingIC723, IC 7805/7809/7912 and find its load regulation factor.
12. Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages.
13. Design Parallel comparator type/ counter type/ successive approximation ADC and find its efficiency.
14. Design BCD to 7- Segment Converter and verify its truth table.
15. Verify the functionality of JK Master - Slave flipflop (74LS73).
16. Design a 8x1 multiplexer using digital ICs.
17. Design a 4-bit Adder/Subtractor using digital ICs and Add/Sub the following bits.(i)1010 (ii)0101 (iii)1011
    0100 0010 1001.
18. Design a Decade counter and verify its truth table and draw respective waveforms.
19. Design a Up/down counter usingIC74163 and draw read/write waveforms.
20. Design a Universal shift register using IC 74194/195 and verify its shifting operation.
21. Design a 16x4 RAM using 74189 and draw its read/write operation.
22. Design a 8x3 encoder/3x8 decoder and verify its truth table.

**Major Equipment required for Laboratories:**

1. 5 V Fixed Regulated Power Supply/ 0-5V or more Regulated Power Supply; Multimeter
2. 20 MHz Oscilloscope with Dual Channel; Bread board and components/Trainer Kit;

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Design and implementation of various analog circuits using 741 ICs.
2. Design and implementation of various Multivibrators using 555 timer.
3. Design and implement various Cominational circuits using digital ICs.
4. Design and implement various Sequential circuits using digital ICs
5. Design and implement ADC, DAC and voltage regulators

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **2** | **3** | | | | | | | | **1** |
| **CO2** | **3** | **2** | **1** | **3** | | | | | | | | **1** |
| **CO3** | **3** | **1** | **1** | **3** | | | | | | | | **1** |
| **CO4** | **3** | **2** | **1** | **3** | | | | | | | | **1** |
| **CO5** | **3** | **2** | **1** | **3** | | | | | | | | **1** |

## (A404509) ELECTRONIC CIRCUIT ANALYSIS & SWITCHING THEORY AND LOGIC DESIGN LABORATORY

**B. Tech. (ECE) IV-Semester**

| L | T | P | C |
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| 0 | 0 | 2 | 1 |

**ECA LAB EXPERIMENTS:**

**Hardware Testing in Laboratory: (Minimum 6 experiments to be done)**

1. Design transformer coupled class A power amplifier and draw the input and output waveformsfind its efficiency
2. Prove that the complementary symmetry push pull amplifier eliminate cross over distortion.
3. Design class C power amplifier and draw the input and output waveforms
4. Design a single tuned amplifier and determine the Q of its tuned circuit practically.
5. Design a Bistable Multivibrator and analyze the effect of commutating capacitors anddraw the wave forms at base and collector of transistors.
6. Design an Astable Multivibrator and draw the wave forms at base and collector oftransistors.
7. Design a Monostable Multivibrator and draw the input and output waveforms
8. Draw the response of Schmitt trigger for gain of greater than and less than one.
9. Design a Bootstrap sweep circuit using BJT and draw its output time base waveform

**STLD LAB EXPERIMENTS:**

**(Minimum 6 experiments to be done)**

1. Realization of given Boolean function using universal gates and minimizing the same. Compare the gate count before and after minimization.
2. Design and realize Full Adder circuit using gates/universal gates. Implement Full Subtractor using fladder.
3. Realize 2:1 MUX using the given gates and Design 8:1 using 2:1 MUX.
4. Realize a 2x4 Decoder using logic gates and implement 3x8 Decoder using 2x4 Decoder.
5. Verification of truth tables of flip-flops using different clocks (level triggering, positive and negativeedge triggering) also converts the given flipflop from one type to other.
6. Designing of Universal n-bit shift register using flipflops and Multiplexers. Draw the timing diagramof the Shift Register.
7. Design a Synchronous binary counter using D-flipflop/given flipflop.
8. Designing of MOD 8 Counter using JK flipflops.
9. Designing of sequence detecting State Machine with minimal states using the given flipflops.

**Major Equipment required for Laboratories:**

1. Regulated Power Suppliers, 0-30V
2. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
3. Functions Generators-Sine and Square wave signals
4. Multimeters
5. Electronic Components
6. 5 V Fixed Regulated Power Supply/ 0-5V or more Regulated Power Supply.
7. Bread board and components/ Trainer Kit

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Design power amplifiers and find its efficiency
2. Design tuned amplifiers and find its Q-factor
3. Design various Multivibrators and sweep circuits. Understand the necessity of linearity
4. Understand the working of logic families and logic gates.
5. Design and implement Combinational and Sequential logic circuits.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **2** | **3** | | | | | | | | **1** |
| **CO2** | **3** | **2** | **1** | **3** | | | | | | | | **1** |
| **CO3** | **3** | **1** | **1** | **3** | | | | | | | | **1** |
| **CO4** | **3** | **2** | **1** | **3** | | | | | | | | **1** |
| **CO5** | **3** | **2** | **1** | **3** | | | | | | | | **1** |

## (A400507) SOCIAL INNOVATION IN PRACTICE
## (Common for all branches)

**B. Tech. (ECE) IV-Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Week-1**
Identify community issues to be addressed, Requirements Analysis: Extensive User requirements analysis
**Week-2**
Generating effective System Requirement document
**Week-3**
Social Innovation – Case Studies
**Week-4**
Impact of Social Innovation on communities
**Week-5**
Process of Social Innovation Prompts – identifying needs, Proposals –generating ideas,
Prototyping – testing the idea in practice,
**Week-6**
Sustaining-developing a business model, Scaling and diffusion-growing social innovations, Systematic change
**Week-7**
Introduction to sustainability, Sustainability leadership, Life cycle assessment
**Week-8**
Carbon footprint Calculation
**Week-9**
Types of Start-Ups, Types of business models, Market risks and Marketing strategies
**Week-10**
Verification of Business Model and Validation
**Week-11**
Business Model Development
**Week-12**
Documentation and Panel presentation

**TEXT BOOKS:**

1. Requirements Analysis: From Business Views to Architecture; David C. Hay; Prentice Hall Professional
2. Social Enterprises: An Organizational Perspective edited; Benjamin Gidron, Yeheskel Hasenfeld; PalgraveMacmillan

**REFERENCE BOOKS**:

1. Social Enterprise Law: Trust, Public Benefit and Capital Markets By Dana Brakman Reiser & Steven A. Dean
2. Introduction to Sustainability by Robert Brinkmann, Wiley-Blackwell

**COURSE OUTCOMES:**
On Completion of the course, the students will be able to

1. Identify several social issues to be addressed
2. Analyze the impact of social innovations on the society
3. Illustrate the process of social innovation for a community problem
4. Demonstrate the solution from sustainability perspectives.
5. Develop a scalable business model

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 2 | | | | 3 | | | | | 1 |
| CO2 | | | 2 | | | | 3 | | | | | 1 |
| CO3 | | | 2 | | | | 3 | | | | | 1 |
| CO4 | | | 2 | | | | 3 | | | | | 1 |
| CO5 | | | 2 | | | | 3 | | | | | 1 |

**(A400701) ENVIRONMENTAL SCIENCE**
**(Common to All Branches)**

**B. Tech. (ECE) IV-Semester**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 0 |

**UNIT-I**
Environmental Studies: Introduction, Definition, scope and importance, Ecosystems: Introduction, types, characteristic features, structure and functions of ecosystems, Bio-geo chemical cycle, Classification of Eco system.

**UNIT-II**
Natural Resources: Classification of Resources, Land resources, Land as resource, Common property resources, Land degradation, Soil erosion and desertification, Effects of modern agriculture, fertilizer –pesticide problems, Forest resources, Use and over-exploitation.
Mining and dams – their effects on forest and tribal people, Water resources, Use and over- utilization of surface and groundwater, Floods, droughts, Water logging and salinity, Dams –benefits and costs, Conflicts over Water, Energy resources.

**UNIT-III**
Bio-diversity and its conservation, Value of bio-diversity-consumptive and productive use, social, ethical, aesthetic and option values, Bio-geographical classification of India – India as a mega diversity habitat, Threats to bio-diversity –Hot-spots, habitat loss, poaching of wild life, loss of species, seeds, etc. Conservation of bio-diversity– In-situ and Ex-situ conservation.

**UNIT-IV**
Environmental Pollution–Local and Global Issues, Nature of thermal pollution and nuclear hazards, Global warming, Acid rain, Ozone depletion, Environmental case studies.

**UNIT-V**
Environmental Problems in India, drinking water, sanitation and public health, Effects of the activities on the quality of environment, Water scarcity and groundwater depletion, Controversies on major dams – resettlement and rehabilitation of people: problems and concerns, Rainwater harvesting, cloud seeding and watershed management. Economy and Environment, The economy and environment interaction, Economics of development, preservation and conservation, Sustainability: theory and practices, Limits to growth, Equitable use of resources for sustainable life styles, Environmental Impact Assessment.

**TEXT BOOKS:**
1. Environmental Science (1st edition), Y. Anjaneyulu, B S Publications.
2. Environmental studies (1st edition), Deekshadave, Cengage learning India Pvt. Ltd.

**REFERENCE BOOKS:**
1. Environmental sciences and Engineering (1st edition), P. Venugopal Rao, PHI learning Pvt. Ltd.,
2. Environmental Science and Technology (1st edition), M. Anji Reddy, B S Publications.
3. Environmental Encyclopedia (Cunningham, W.P., et al., Jaico Publishing House, Mumbai, 2003.

**COURSE OUTCOMES:**

On successful completion of this course, it is expected that students should be able to
1. Understand the basic concepts, scope, and importance of environmental studies
2. Acquire knowledge on natural resources and analyze the impacts of modern agriculture
3. Evaluate the value, threats, and conservation methods of biodiversity, understand India's as a mega diversity habitat.
4. Analyze global environmental pollution issues and understand the hazardous effects of environmental pollution
5. Examine environmental problems in India, and understand various environmental issues to focus on sustainable practices for Environmental Impact Assessment

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | - | - | 2 | 3 | 1 | - | 1 | - | 2 |
| CO2 | 3 | 3 | 2 | 2 | - | 2 | 3 | 1 | - | - | - | 2 |
| CO3 | 2 | 2 | 3 | 1 | - | 2 | 3 | 1 | - | - | - | 2 |
| CO4 | 2 | 3 | 2 | 2 | - | 2 | 3 | 1 | - | - | - | 2 |
| CO5 | 2 | 2 | 3 | 3 | - | 3 | 3 | 1 | - | - | - | 2 |

## (A404309) MICROCONTROLLERS

**B. Tech. (ECE) V-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**UNIT -I**

8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086. Instruction Set and Assembly Language Programming of 8086: Instruction formats, addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

**UNIT -II**

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051. 8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

**UNIT –III**

I/O and Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051. Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB.

**UNIT –IV**

ARM Architecture: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

**UNIT – V**

Advanced ARM Processors: Introduction to CORTEX processor and its architecture, OMAP Processor and its Architecture.

**TEXT BOOKS:**

1. A. K. Ray and K. M. Bhurchandani -Advanced Microprocessors and Peripherals, TMH, 2nd Edition 2006. Andrew N SLOSS, Dominic SYMES, Chris WRIGHT -ARM System Developers guide, Elsevier, 2012

**REFERENCE BOOKS:**

1. Kenneth. J. Ayala-The 8051 Microcontroller, Cengage Learning, 3rd Ed, 2004.
2. D. V. Hall -Microprocessors and Interfacing, TMGH, 2nd Edition, 2006.
3. K. Uma Rao, Andhe Pallavi-The 8051 Microcontrollers, Architecture and Programming and Applications, Pearson, 2009.
4. Donald Reay-Digital Signal Processing and Applications with the OMAP- L138 Experimenter, WILEY 2012.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Describe the architecture, addressing modes and assembly language programming of 8086 microprocessor
2. Describe the architecture, organization and assembly language programming of 8051 microcontroller
3. Write assembly language program for interfacing various I/O devices to 8086 & 8051.
4. Describe the architecture of ARM processor.
5. Describe the basic concepts of advanced ARM processor.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | | 1 | | | | 1 | | 2 | 3 |
| CO2 | 2 | 3 | 3 | | 1 | | | | 2 | | 3 | 3 |
| CO3 | 2 | 2 | 3 | | 1 | | | | 1 | | 2 | 3 |
| CO4 | 2 | 2 | 3 | | 1 | | | | 1 | | 2 | 3 |
| CO5 | 1 | 2 | | | 1 | | | | 1 | | 2 | 3 |

## (A404310) ANTENNAS AND WAVE PROPAGATION

**B. Tech. (ECE) V-Semester**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**UNIT - I**

**Antenna Basics**: Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height. Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Antenna Theorems, Radiation, Retarded Potentials – Helmholtz Theorem Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths. Loop Antennas - Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).

**UNIT - II:**

**VHF, UHF and Microwave Antennas** - I: Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas – Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns.

**UNIT - III**

**VHF, UHF and Microwave Antennas - II:** Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip Antennas. Reflector Antennas – Introduction, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features.

**UNIT - IV**

**Antenna Arrays**: Point Sources – Definition, Patterns, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-Uniform Amplitude Distributions – General Considerations and Binomial Arrays.

**Antenna Measurements:** Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors. Patterns to be Measured, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods).

**UNIT - V**

**Wave Propagation** - Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts,

**Ground Wave Propagation** –Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections.

**Space Wave Propagation** –Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Troposphere Propagation.

**Sky Wave Propagation** –Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multi-hop Propagation.

**TEXT BOOKS:**

1. J.D. Kraus, R.J. Marhefka and Ahmad S. Khan -Antennas and Wave Propagation, 4th ed., (Special Indian Edition), TMH, New Delhi, 2010.
2. E.C. Jordan and K.G. Balmain -Electromagnetic Waves and Radiating Systems, PHI, 2nd ed., 2000.

**REFERENCE BOOKS:**

1. C.A. Balanis - Antenna Theory, 3rd Edition. John Wiley & Sons, 2005.
2. K.D. Prasad, Satya Prakashan - Antennas and Wave Propagation, Tech India Publications, New Delhi, 2001.
3. Keith henney - Radio Engineering Handbook, 3rd edition TMH.
4. John Leonidas Volakis -Antenna Engineering Handbook, 3rd edition, 2007

**COURSE OUTCOMES:**

Upon completing this course,

1. Explain the basic concept of radiation mechanism of antenna, define basic antenna Parameters and derive relation between them.
2. Explain constructional details, working principle and characteristics of different microwave antennas.
3. Explain constructional details, working principle and characteristics of different linear antennas, VHF, and UHF Antennas.
4. Analyze the antenna array concepts, apply this knowledge to design them and demonstrate techniques of measuring different antenna parameters.
5. Explain different modes of propagation, their characteristics and applications.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 1 | 1 | 1 | 1 | | | | 1 | 1 |
| **CO2** | 2 | 2 | 3 | 2 | 2 | 1 | 1 | | | 1 | 2 | 3 |
| **CO3** | 2 | 2 | 3 | 2 | 2 | 1 | 1 | | | 1 | 2 | 3 |
| **CO4** | 2 | 3 | 3 | 2 | 2 | 1 | 1 | | | 1 | 2 | 2 |
| **CO5** | 1 | | 1 | 2 | 1 | 3 | 3 | | | | | 3 |

## (A404311) CMOS VLSI DESIGN

**B. Tech. (ECE) V-Semester**

| L | T | P | C |
|---|---|---|---|
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**UNIT - I**

**Introduction: Introduction to IC Technology** – MOS, PMOS, NMOS, CMOS &BiCMOS Basic Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

**UNIT - II**

**VLSI Circuit Design Processes:** VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

**UNIT - III**

**Gate Level Design:** Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out.

**UNIT - IV**

**Data Path Subsystems**: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters. Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories.

**UNIT - V**

**Programmable Logic Devices**: Design Approach – PLA, PAL, Standard Cells FPGAs, CPLDs. CMOS Testing: CMOS Testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

**TEXT BOOKS**:

1. Kamran Eshraghian, Eshraghian Dougles and A. Pucknell - Essentials of VLSI circuits and systems, PHI, 2005
2. Neil H. E Weste, David Harris, Ayan Banerjee - CMOS VLSI Design – A Circuits and Systems Perspective, 3rd Edition, Pearson, 2009.

**REFERENCE BOOKS**:

1. Ming-BO Lin - Introduction to VLSI Systems: A Logic, Circuit and System Perspective, CRC Press, 2011
2. John. P. Uyemura - CMOS logic circuit Design, Springer, 2007.
3. Wayne Wolf - Modern VLSI Design, 3rd Edition, Pearson Education, 1997.
4. K. Lal Kishore, V. S. V. Prabhakar -VLSI Design, I.K International, 2009.

**COURSE OUTCOMES**

Upon completing this course,

1. Apply basic electrical properties of MOSFET in circuit design, also Design CMOS, BICMOS inverter circuits.
2. Illustrate fabrication process of MOSFET and CMOS designs, Understand VLSI design flow and draw the Stick diagrams, Layouts for different circuits using layout design rules.
3. Apply alternate gate circuit Logics to design various circuit design and estimate their time delays.
4. Design numerous sub system circuits and memory elements like RAM, ROM, other memories.
5. Design different logic modules through FPGAs and CPLDs with the help of PLA, PALs, and analyse various VLSI testing techniques to validate their functionality.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | | | | | | 2 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 | | | | | | 3 | 2 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | | | | | | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | | | | | | 3 | 2 |

## (A404312) IOT ARCHITECTURES AND PROTOCOLS

**B. Tech. (ECE) V-Semester**

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**UNIT- I**

IOT introduction: Introduction and definition of IoT, Evolution of IoT, IoT growth, Application areas of IoT, Characteristics of IoT, IoT stack, Enabling technologies, IoT levels, IoT sensing and actuation, Sensing types, Actuator types.

**UNIT - II**

IOT and M2M: M2M to IoT – A Basic Perspective– Introduction, Differences and similarities between M2M and IoT, SDN and NFV for IoT, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, international driven global value chain and global information monopolies. IOT Architecture: IoT Architecture components, Comparing IoT Architectures, A simplified IoT Architecture, core IoT functional stack, IoT data management and compute stack

**UNIT- III**

IOT Data link layer and Network layer protocols: PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP

**UNIT- IV**

Transport and Session layer protocols: Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer HTTP, CoAP, XMPP, AMQP, MQTT

**UNIT- V**

**Service layer protocols and Security**:

Service Layer –one M2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 6LoWPAN, RPL, Application Layer.

**TEXT BOOKS**:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy -Introduction to IOT, Cambridge University Press.
2. David Hanes, Gonzalo salgueiro, Patrick Grossetete, Rob barton, Jerome henry-IoT Fundamentals Networking Technologies, Protocols and Usecases for IoT", Cisco Press.

**REFERENCE BOOKS:**

1. Cunopfister-Getting started with the internet of things, O Reilly Media, 2011
2. Francis daCosta,-Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications.
3. Arshdeep Bahga, Vijay Madisetti -Internet of Things A Hands-on approach, Universities Press
4. Shriram K Vasudevan, RMD Sundaram, Abhishek S Nagarajan-Internet of things, John Wiley and Sons.
5. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Explore the evaluation of IoT, its growth and applications
2. Know the components of IoT and compare various architectures of IoT
3. Establish the knowledge on various IoT protocols like data link and network layer
4. Analyse various IoT transport layer and session layer protocols
5. Understand service layer Protocol's and security.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | 1 | | 2 | | | | 2 |
| CO2 | 2 | 2 | | 2 | | | 1 | | | | 2 | |
| CO3 | 2 | 2 | | | 3 | | | 2 | | | | 2 |
| CO4 | 3 | 3 | 2 | | | 2 | | | | | 2 | |
| CO5 | 3 | 2 | 2 | | 3 | | 2 | | | | 3 | 3 |

**(A404401) COMPUTER ORGANIZATION & OPERATING SYSTEMS**
**(Professional Elective-I)**

**B. Tech. (ECE) V-Semester**

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**UNIT** - I

Basic Structure of Computers: Computer Types, Functional Unit, Basic operational Concepts Bus Structures, Software, Performance, Multiprocessors and Multi Computers, Data Representation, Fixed Point Representation, Floating – Point Representation. Register Transfer Language and Micro Operations: Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers Computer Instructions – Instruction Cycle, Memory – Reference Instructions, Input – Output and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, DATA Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

**UNIT - II**

Micro Programmed Control: Control Memory, Address Sequencing, Microprogram Examples, Design of Control Unit, Hard Wired Control, Microprogrammed Control The Memory System: Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache Memories Performance Considerations, Virtual Memories Secondary Storage, Introduction to RAID.

**UNIT - III**

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input –Output Processor (IOP), Serial Communication; Introduction to Peripheral Components, Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols like RS232, USB, IEEE 1394

**UNIT – IV**

Operating Systems Overview: Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating Systems Structures-Operating System Services and Systems Calls, System Programs, Operating Systems Generation Memory Management: Swapping, Contiguous Memory Allocation, Paging, Structure of The Page Table, Segmentation, Virtual Memory, Demand Paging, Page-Replacement Algorithms, Allocation of Frames, Thrashing Case Studies - UNIX, Linux, Windows Principles of Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

**UNIT – V**

File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection. File System Implementation: File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

**TEXT BOOKS:**


1. Carl Hamacher, Zvonks Vranesic, Safea Zaky - Computer Organization, 5th Edition, McGraw Hill.
2. M. Moris Mano -Computer Systems Architecture, 3rd Edition, Pearson
3. Abraham Silberchatz, Peter B. Galvin, Greg Gagne -Operating System Concepts, 8th Edition, John Wiley.


**REFERENCE BOOKS:**


1. William Stallings- Computer Organization and Architecture, 6th Edition, Pearson
2. Andrew S. Tanenbaum -Structured Computer Organization, 4th Edition, PHI
3. Sivaraama Dandamudi - Fundamentals of Computer Organization and Design, Springer Int. Edition.
4. Stallings -Operating Systems – Internals and Design Principles, 6th Edition, Pearson Education, 2009.
5. Modern Operating Systems, Andrew S Tanenbaum 2nd Edition, PHI.
6. Principles of Operating Systems, B.L. Stuart, Cengage Learning, India Edition.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Analyze the design principles and functionalities of various computer system components.
2. Design and implement efficient memory management techniques using cache and virtual memory concepts.
3. Evaluate and select appropriate I/O interfaces and protocols for different device interactions.
4. Implement process scheduling algorithms in an operating system to optimize resource utilization
5. Analyze and design file systems and network communication protocols using sockets

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | **2** | | | | | **1** | | | | | |
| **CO2** | | | **3** | **2** | | | | | **1** | | | |
| **CO3** | | | | | **3** | | | | **1** | | | |
| **CO4** | 2 | | | | | **3** | **1** | | | | | |
| **CO5** | | | | | **3** | | | **2** | | **2** | | |

## (A404402) DATA COMMUNICATIONS AND COMPUTER NETWORKS
## ((Professional Elective-I)

**B. Tech. (ECE) V-Semester**

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**UNIT - I**

Introduction to Data Communications: Components, Data Representation, Data Flow, Networks Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards - Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite, Addressing Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs -The 802.11 Architecture.

**UNIT - II**

Data Link Layer: Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11 Frame

**UNIT - III**

The Network Layer: Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol (IP): Forwarding and Addressing in the Internet- Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), IPv6

**UNIT - IV**

Transport Layer: Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go Back-N(GBN), Selective Repeat(SR), Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control

**UNIT - V**

Application Layer: Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the File Transfer: FTP, - FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages.

**TEXT BOOKS**:

1. Kurose James F, Keith W- Computer Networking A Top-Down Approach, 6th Edition, Pearson.
2. Behrouz A. Forouzan - Data Communications and Networking, 4th Edition, McGraw-Hill Education

**REFERENCE BOOKS**:

1. Bhusan Trivedi - Data communication and Networks, Oxford university press, 2016
2. Andrew S Tanenbaum - Computer Networks, 4th Edition, Pearson Education
3. W. A. Shay - Understanding Communications and Networks, 3rd Edition, Cengage Learning.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Student will be able to understand network communication using the layered concept, Open System Interconnect (OSI) and the Internet Model.

2. Student will be able to understand the concept of flow control, error control and LAN protocols; and apply those using standard data link layer protocols.
3. Student will understand the functions of network layer and network service models; *Design subnets and* calculate the IP addresses to fulfil network requirements of an organization.
4. Student shall understand the details of Transport Layer Protocols (UDP, TCP) and suggest appropriate protocol in reliable/unreliable communication.
5. Student shall understand the principles and operations behind various application layer protocols like HTTP, SMTP, FTP.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **1** | **1** | | | | | | | **1** | **2** |
| **CO2** | **3** | **3** | **3** | **1** | | | | | | | **2** | **2** |
| **CO3** | **3** | **2** | **3** | **1** | | | | | | | **2** | **2** |
| **CO4** | **2** | **2** | **2** | **1** | | | | | | | **2** | **2** |
| **CO5** | **2** | **2** | **2** | **1** | | | | | | | **2** | **2** |

## (A404403) ELECTRONIC MEASUREMENTS AND INSTRUMENTATION
## ((Professional Elective-I)

**B. Tech. (ECE) V-Semester**

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**UNIT - I**

Block Schematics of Measuring Systems: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

**UNIT - II**

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications.

**UNIT - III**

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications. Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

**UNIT - IV**

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers, gyroscopes, accelerometers.

**UNIT - V**

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge. Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure – High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems.

**TEXT BOOKS**:

1. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W. D. Cooper: PHI 5th Edition 2003.
2. Electronic Instrumentation: H. S. Kalsi – TMH, 2nd Edition 2004.

**REFERENCE BOOKS:**

1. Electrical and Electronic Measurement and Measuring Instruments – A K Sawhney, Dhanpat Rai & Sons, 2013.
2. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
3. Industrial Instrumentation: T.R. Padmanabham Springer 2009.
4. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010

**COURSE OUTCOMES:**

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

1. Explain the working principles of different electronic meters & Generators and explain the performance characteristics of measuring instruments.
2. Describe the concepts of different wave analyzers and their design.
3. Explain the constructional features, operations and applications of general and special purpose CROs.
4. Describe the working principle and Applications of different types of Sensors and Transducers.
5. Analyze different types of AC & DC Bridges and their applications.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 1 | 1 | 1 | | | 3 | 2 |
| CO2 | 3 | 2 | 2 | 2 | | 1 | | 1 | 2 | | 3 | 2 |
| CO3 | 3 | 2 | | | | | | | 2 | | 3 | 2 |
| CO4 | 2 | 2 | 1 | | | 1 | 1 | | 2 | | 3 | 2 |
| CO5 | 2 | 2 | 1 | | | | | | 2 | | 3 | 2 |

## (A400504) ADVANCED ENGLISH COMMUNICATION SKILLS LABORATORY

**B. Tech. (ECE) V-Semester**

| L | T | P | C |
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### 1.INTRODUCTION:

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

### 2.OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

### 3.SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** -

Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

**2.Activities on Reading Comprehension** –

General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.

**3.Activities on Writing Skills-**

Structure and presentation of different types of writing – letter writing/Resume writing/ e-correspondence/Technical report writing/ – planning for writing – improving one's writing.

**4. Activities on Presentation Skills** –

Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ emails/assignments etc.

**5.Activities on Group Discussion and Interview Skills** –

Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

### 4.MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.

- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

**5.SUGGESTED SOFTWARE**:

The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS**)**

**TEXT BOOKS:**

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2 nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

**REFERENCES:**

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey& Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Explain the rules of formal and informal situational dialogues and develop verbal & nonverbal communication skills
2. Build academic vocabulary, use a variety of accurate sentence structure and utilize digital literacy tools to develop writing and grammar skills.
3. Express clarity of thoughts, capability to hold the discussion with everyone and develop analytical thinking.
4. Develop the skills needed for approaching different types of interviews Illustrate the report writing and summarize the main ideas of report; apply key elements of structure and style in drafting loner documents.
5. Read an increasing range of different types of texts by combining contextual, semantic, grammatical and phonic knowledge and summarize the personal details, Customize the objectives statement for each position they are applying for job.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | | | **3** | | |
| **CO2** | | | | | | | | | **3** | | | |
| **CO3** | | | | | | | | | **2** | **3** | | |
| **CO4** | | | | | | | | | **3** | | | |
| **CO5** | | | | | | | | | | **3** | | |

## (A404511) MICROCONTROLLERS LABORATORY

**B. Tech. (ECE) V-Semester** **L T P C**

**0 0 2 1**

**Cycle 1:**
Using 8086 Processor Kits and/or Assembler • Assembly Language Programs to 8086 to Perform

1. Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.
2. Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations.

**Cycle 2**:
Using 8051 Microcontroller Kit • Introduction to IDE

1. Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions.
2. Time delay Generation Using Timers of 8051.
3. Serial Communication from / to 8051 to / from I/O devices.
4. Program Using Interrupts to Generate Square Wave 10 KHZ Frequency on P2.1 Using Timer 0 8051 in 8 bit Auto reload Mode and Connect a 1 HZ Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHZ

**Cycle 3:**
Interfacing I/O Devices to 8051

1. Segment Display to 8051.
2. Matrix Keypad to 8051.
3. Sequence Generator Using Serial Interface in 8051.
4. 8-bit ADC Interface to 8051.
5. Triangular Wave Generator through DAC interfaces to 8051.

**Cycle 4:**
Experiments to be carried out on Cortex-M3 development boards and using GNU toolchain

1. Blink an LED with software delay, delay generated using the SysTick timer.
2. System clock real time alteration using the PLL modules.
3. Control intensity of an LED using PWM implemented in software and hardware.
4. Control an LED using switch by polling method, by interrupt method and flash the LED once every five switch presses.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Apply the programming knowledge on 8086 microprocessor.
2. Apply the programming knowledge on 8051 microcontroller
3. Apply the programming knowledge of 8051 microcontroller to generate different waveforms using interrupt & timers.
4. Analyze the interfacing of 8051 microcontroller with peripherals
5. Demonstrate different programs on Cortex-M3 development boards and using GNU tool chain.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | 2 | | | 2 |
| CO2 | 3 | 2 | | | | | | | 2 | | | 2 |
| CO3 | 3 | 3 | | | | | | | 2 | | | 2 |
| CO4 | 3 | | | | | | | | 2 | | | 2 |
| CO5 | 3 | | | | | | | | 2 | | | 2 |

## (A404512) IOT ARCHITECTURES AND PROTOCOLS LABORATORY

**B. Tech. (ECE) V-Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Note:** - Minimum of 12 experiments has to be conducted.

**LIST OF EXPERIMENTS:**

1. Demonstrate blinking of an LED at every 5 seconds and to control the brightness of an LED.
2. Read Humidity and Room Temperature using DHT sensor and display the readings.
3. Send the recorded values of Temperature/Humidity to the Internet via GSM module using Arduino/NodeMCU/Raspberry Pi.
4. Demonstrate Interfacing NodeMCU/Raspberry Pi with the Cloud using REST API and MQTT protocol.
5. Demonstrate Switching lights on /off remotely using Arduino/NodeMCU/Raspberry Pi.
6. Voice-based Home Automation for switching lights on/off using Google Assistant, IFTTT and MQTT.
7. Interfacing DHT11 sensor with Raspberry pi/equivalent and upload temperature and humidity values to the cloud.
8. Design an obstacle detection unit using ultrasonic sensor.
9. Capture images from web camera using Raspberry Pi/equivalent and apply filters in increase image quality.
10. Access a remote computer from Raspberry Pi and display the remote screen.
11. Design an automatic water sprinkler based on soil moisture using Arduino/NodeMCU/Raspberry Pi.
12. Design an RFID based attendance system using Arduino/NodeMCU/Raspberry Pi.
13. Write an arduino program to demonstrate interrupts
14. Write an arduino program to demonstrate UART communication protocol
15. Write an arduino program to demonstrate I2C communication protocol
16. Write an arduino program to demonstrate SPI communication protocol

**COURSE OUTCOMES**:

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

1. Utilize the various sensors like DHT, Room temperature and humidity
2. Interface microcontrollers with the cloud using MQTT and rest API
3. Interface the sensors and processors for transmission of data
4. captures the images and processes it on Arduino /Node MCU/ Raspberry Pi.
5. Know the utilization of various protocols I2C, UART and SPI Communication Protocols.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | 1 | | 2 | | | | 2 |
| CO2 | 2 | 2 | | 2 | | | 1 | | | | 2 | |
| CO3 | 2 | 2 | | | 3 | | | 2 | | | | 2 |
| CO4 | 3 | 3 | 2 | | | 2 | | | | | 2 | |
| CO5 | 3 | 2 | 2 | | 3 | | 2 | | | | 3 | 3 |

**(A400705) INTELLECTUAL PROPERTY RIGHTS**
**(MC)**

**B. Tech. (ECE) V-Semester**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 0 |

**UNIT – I**
Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT – II**
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

**UNIT – III**
Law of copyrights: Fundamental of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, International copyright law.
**Law of patents**: Foundation of patent law, patent searching process, ownership rights and transfer

**UNIT – IV**
Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation.
**Unfair competition**: Misappropriation right of publicity, false advertising.

**UNIT – V**
New development of intellectual property: new developments in trade mark law; copyright law, patent law, intellectual property audits.
International overview on intellectual property, international – trade mark law, copyright law, international patent law, and international development in trade secrets law.

**TEXT BOOK:**

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

**REFERENCE BOOK:**

1. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

**COURSE OUTCOMES**:
At the end of the course the student will be able to:

1. Skill to understand the concept of intellectual property rights.
2. Develops procedural knowledge to Legal System and solving the problem relating Patents.
3. Gain knowledge on development and owning of Trade Marks, Copy Rights, and Patents.
4. Develops conceptual exposure on legal aspects related to IPR
5. Knowledge on different types of competition and ethical and unethical practices of advertising.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 2 | | | | | | | | 3 | |
| CO2 | | | | | | 2 | | | 3 | | | |
| CO3 | | | | 3 | | | | | 2 | 1 | | |
| CO4 | | 2 | | | | | | | | | | 3 |
| CO5 | | | 2 | | | | | 3 | | | | |

## (A404314) DIGITAL SIGNAL PROCESSING

**B. Tech. (ECE) VI-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

**Introduction: Introduction to Digital Signal Processing**: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems
**Multirate Digital Signal Processing**: Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion.

**UNIT - II**
**Discrete Fourier series**: Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation, DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z Transform. Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

**UNIT – III**
**IIR Digital Filters**: Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

**UNIT - IV**
**FIR Digital Filters**: Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

**UNIT - V**
**Realization of Digital Filters**: Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.
**Finite Word Length Effects**: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

**TEXT BOOKS**:

1. V. Oppenheim and R.W. Schaffer - Discrete Time Signal Processing, PHI, 2009
2. John G. Proakis, Dimitris G. Manolakis - Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education / PHI, 2007.

**REFERENCE BOOKS:**

1. Li Tan - Digital Signal Processing – Fundamentals and Applications, Elsevier, 2008
2. Robert J. Schilling, Sandra L. Harris - Fundamentals of Digital Signal Processing using MATLAB, Thomson, 2007
3. S. Salivahanan, A. Vallavaraj and C. Gnanapriya - Digital Signal Processing, TMH, 2009
4. Emmanuel C. Ifeachor and Barrie W. Jervis - Digital Signal Processing - A Practical approach, 2 nd Edition, Pearson Education, 2009.

**COURSE OUTCOMES**

Upon completing this course, the student will be able to

1. Differentiate time, frequency and Z- transform analysis on signals and systems and explain multi rate DSP techniques.
2. Analyze the fast computation of DFT and compute FFT processing.
3. Design various analog filter approximation techniques.
4. Design and compare IIR digital filters for the given specifications.
5. Illustrate the significance of various structures of filters and describe finite length word effects.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **1** | **1** | **1** | | | | **1** | | | **1** |
| **CO2** | **3** | **3** | **2** | **1** | **1** | | | | **2** | | | **1** |
| **CO3** | **2** | **2** | **3** | **2** | **1** | | | | **2** | | | **1** |
| **CO4** | **2** | **2** | **3** | **2** | **1** | | | | **2** | | | **1** |
| **CO5** | **3** | **3** | **2** | **1** | **1** | | | | **2** | | | **1** |

## (A404316) CONTROL SYSTEMS

**B. Tech. (ECE) VI-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**UNIT - I**

Introduction to Control Problem: Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

**UNIT – II**

Time Response Analysis of Standard Test Signals: Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

**UNIT - III**

Frequency-Response Analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

**UNIT – IV**

Introduction to Controller Design: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

**UNIT - V**

State Variable Analysis and Concepts of State Variables: State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

**TEXT BOOKS**:

1. M. Gopal, -Control Systems: Principles and Design, McGraw Hill Education, 1997.
2. B. C. Kuo, -Automatic Control System, Prentice Hall, 1995.

**REFERENCE BOOKS**:

1. K. Ogata=Modern Control Engineering, Prentice Hall, 1991.
2. I. J. Nagrath and M. Gopal-Control Systems Engineering, New Age International, 2009.

**COURSE OUTCOMES:**

After successful completion of this course, the students can be able to

1. Choose a suitable controller and/or a compensator for a specific application to improve the system performance.
2. Apply various time domain and frequency domain techniques to assess the system performance.
3. Apply various control strategies to different applications (example: Power systems, electrical drives etc…)
4. Determine the stability of a linear control system. Design classical controllers for given system response.
5. Test system Controllability and Observability using state space representation and applications of state space representation to various systems.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | - | 1 | 1 | - | - | - | - | 2 |
| CO2 | 3 | 3 | 3 | 3 | - | 1 | 1 | - | - | - | - | 2 |
| CO3 | 3 | 3 | 3 | 3 | - | 1 | 1 | - | - | - | - | 2 |
| CO4 | 3 | 3 | 2 | 3 | - | 1 | 1 | - | - | - | - | 2 |
| CO5 | 3 | 3 | 3 | 3 | - | 1 | 1 | - | - | - | - | 2 |

## (A404315) MICROWAVE AND OPTICAL COMMUNICATIONS

**B. Tech. (ECE) VI-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

Microwave Tubes: Limitations and Losses of conventional Tubes at Microwave Frequencies, Microwave Tubes – O Type and M Type Classifications, O-type Tubes: 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for O/P Power and Efficiency. Reflex Klystrons – Structure, Velocity Modulation and Applegate Diagram, Mathematical Theory of Bunching, Power Output, Efficiency, Oscillating Modes and O/P Characteristics. Helix TWTs: Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations.

**UNIT - II**

M-Type Tubes: Introduction, Cross-field Effects, Magnetrons – Different Types, Cylindrical Traveling Wave Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PIMode, o/p characteristics, Microwave Solid State Devices: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Principle of operation of IMPATT and TRAPATT Devices.

**UNIT - III**

Waveguide Components: Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide Windows, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Different Types, Resistive Card and Rotary Vane Attenuators; Waveguide Phase Shifters – Types, Dielectric and Rotary Vane Phase Shifters, Waveguide Multiport Junctions - E plane and H plane Tees. Ferrites– Composition and Characteristics, Faraday Rotation, Ferrite Components – Gyrator, Isolator,

**UNIT – IV**

Scattering matrix: Scattering Matrix Properties, Directional Couplers – 2 Hole, Bethe Hole, [s] matrix of Magic Tee and Circulator. Microwave Measurements: Description of Microwave Bench – Different Blocks and their Features, Errors and Precautions, Measurement of Attenuation, Frequency. Standing Wave Measurements, measurement of Low and High VSWR, Cavity Q, Impedance Measurements.

**UNIT - V** Optical Fiber Transmission Media: Optical Fiber types, Light Propagation, Optical fiber Configurations, Optical fiber classifications, Losses in Optical Fiber cables, Light Sources, Optical Sources, Light Detectors, LASERS, WDM Concepts, Optical Fiber System link budget.

**TEXT BOOKS:**

1. Samuel Y. Liao -Microwave Devices and Circuits, 3rd Edition, Pearson, 2003.
2. Wayne Tomasi- Electronic Communications Systems, 5th Edition, Pearson,

**REFERENCE BOOKS:**

1. Gerd Keiser - Optical Fiber Communication, 4th Edition, TMH, 2008.
2. David M. Pozar - Microwave Engineering – 3rd edition, John Wiley & Sons (Asia) Pvt Ltd., 2011 Reprint.
3. G.S. Raghuvanshi - Microwave Engineering, Cengage Learning India Pvt. Ltd., 2012.
4. George Kennedy - Electronic Communication System, 6th Edition, McGraw Hill.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Analyze the operation of two cavity Klystron, reflex klystron and the Helix TWT.
2. Explain the functioning of magnetron and principles of various microwave solid state devices.
3. Distinguish between the different types of waveguide and ferrite components, and select proper components for engineering applications.
4. Explain the operation of various types of waveguide components and calculate their S- Parameters.
5. Analyze the mechanism of light propagation through the optical fibers.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | | | | 1 | 1 |
| CO2 | 3 | 1 | 2 | 2 | 1 | 1 | 1 | | | | 1 | 1 |
| CO3 | 3 | 1 | 2 | 2 | 3 | 1 | 1 | | | | 1 | 1 |
| CO4 | 3 | | 1 | 2 | 3 | 1 | 1 | | | | 1 | 1 |
| CO5 | 3 | 1 | 2 | 2 | 1 | 1 | 1 | - | - | - | 1 | 1 |

## (A404317) PROFESSIONAL PRACTICE, LAW & ETHICS

**B. Tech. (ECE) VI-Semester**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**UNIT- I**

Professional Practice and Ethics: Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders

**UNIT - II**

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

**UNIT- III**

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

**UNIT- IV**

Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other - Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

**UNIT- V**

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970.

**TEXT BOOKS:**

1. R. Subramanian - Professional Ethics, Oxford University Press, 2015.
2. Ravinder Kaur - Legal Aspects of Business, 4th edition, Cengage Learning, 2016.

**REFERENCE BOOKS:**

1. RERA Act, 2017.
2. Wadhera - Intellectual Property Rights, Universal Law Publishing Co., 2004.
3. T. Ramappa - Intellectual Property Rights Law in India, Asia Law House, 2010.
4. O.P. Malhotra - Law of Industrial Disputes, N.M. Tripathi Publishers.

**COURSE OUTCOMES:**

1. Understand Professional Ethics & Personal Ethics, code of Ethics, Conflict of Interest. Will able to learn the concept of professionalism, Whistle blowing and the brief introduction of GST.
2. Recognize the element of contract, unlawful and illegal agreement. Will analyze the remedies for breach of contract, sale of goods act 1930and performance of contract of sales
3. Illustrate Arbitration, Conciliation and ADR different forms of laws and the dispute resolution board. Distinction between conciliation, negotiation, mediation and arbitration, confidentiality
4. Enumerate the concept of labour laws and other construction related laws and other different types of ACT (1946, 1947, 1923) and also); RERA Act 2017, NBC 2017

5. Understand IPR Copyright, Trademarks, Patents and Designs, Secrets, Piracy in Internet Remedies and procedures in India.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **2** | **3** | **2** | | | | | | **2** | | **3** | |
| **CO2** | **2** | **2** | | | | | | | | | **2** | |
| **CO3** | | **2** | **2** | | | | | | | | | |
| **CO4** | **2** | **2** | | | | | | | **2** | | **3** | |
| **CO5** | **2** | **2** | **2** | | | | | | **3** | | **2** | |

## (A404404) DIGITAL IMAGE PROCESSING
## (Professional Elective-II)

**B. Tech. (ECE) VI-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels. Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

**UNIT – II**

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering. Image Enhancement (Frequency Domain): Filtering in 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, 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. Rafael C. Gonzalez, Richard E. Woods -Digital Image Processing, 3rd Edition, Pearson, 2008
2. S Jayaraman, S Esakkirajan, T Veerakumar - Digital Image Processing- - TMH, 2010.

**REFERENCE BOOKS:**

1. Scotte Umbaugh- Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools, 2nd Ed, CRC Press, 2011
2. Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings - Digital Image Processing using MATLAB, 2nd Edition, TMH, 2010.
3. Somka, Hlavac, Boyle-Digital Image Processing and Computer Vision –Cengage Learning (Indian edition) 2008.
4. Adrian low- Introductory Computer Vision Imaging Techniques and Solutions-,2nd Edition, BS Publication, 2008.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Understand the fundamental concepts of digital image processing systems
2. Analyze various transformation techniques and evaluate different kinds of techniques for image enhancement
3. Compare various restoration filtering techniques
4. Interpret image segmentation techniques and morphological models
5. Categorize various lossy and loseless image compression techniques

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | 2 | | 3 | | | | |
| CO2 | 2 | 2 | 3 | | | | 2 | | 1 | | | 1 |
| CO3 | 2 | 3 | 2 | | 2 | | | | | | 2 | 3 |
| CO4 | 1 | 3 | 3 | | 2 | 2 | 2 | | | 1 | | |
| CO5 | | 1 | | 2 | 2 | 3 | 2 | | | | | 2 |

## (A404405) MOBILE COMMUNICATIONS AND NETWORKS

**(Professional Elective-II)**

**B. Tech. (ECE) VI-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

Introduction to Cellular Mobile Radio Systems: Limitations of Conventional Mobile Telephone Systems. Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems. Uniqueness of Mobile Radio Environment-Fading-Tie Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time. Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I from a Normal Case in a Omni Directional Antenna System, System Capacity Improving Coverage and Capacity in Cellular Systems Cell Splitting, Sectoring, Microcell Zone Concept.

**UNIT – II**

Co-Channel Interference: Measurement of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and their effects, diversity techniques-space diversity, polarization diversity, frequency diversity, time diversity. Non Co-Channel Interference: Adjacent Channel Interference, Near end far end interference, cross talk, effects on coverage and interference by power decrease, antenna height decrease, effects of cell site components.

**UNIT – III**

Cell Coverage for Signal and Traffic: Signal Reflections in flat and Hilly Terrain, effects of Human Made Structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation, path loss from a point to point prediction model in different conditions, merits of lee model. Frequency Management and Channel Assignment: Numbering and Grouping, Setup Access and Paging Channels, Channel Assignments to Cell Sites and Mobile Units.

**UNIT – IV**

Handoffs and Dropped Calls: Handoff Initiation, types of Handoff, Delaying Handoff, advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, Intersystem handoff, Introduction to Dropped Call Rates and their Evaluation.

**UNIT - V**

Ad Hoc Wireless Networks: Introduction, Cellular and Ad Hoc wireless Networks, Applications and Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet, MAC Protocols for Ad Hoc Wireless, Introduction, issues in designing AMAC Protocol for Ad Hoc wireless Networks, Design Goals of AMAC protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols.

**TEXT BOOKS**:

1. W.C.Y. Lee - Mobile Cellular Telecommunications, 2nd edition, Mc Graw Hill, 1989.
2. Theodore. S. Rapport - Wireless Communications, 2nd edition, Pearson Education, 2002.

**REFERENCE BOOKS**:

1. Siva ram Murthy and B.S. Manoj - Ad Hoc Wireless Networks: Architectures and Protocols, PHI, 2004.
2. Simon Haykin, Michael Moher - Modern Wireless Communications, Pearson Education, 2005.
3. Vijay Garg - Wireless Communications and Networking, Elsevier Publications, 2007.
4. Andrea Goldsmith -Wireless Communications-, Cambridge University Press, 2005.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Know the evolution of cellular and mobile communication system.
2. Describe the co-channel and non-co-channel interferences
3. Demonstrate the cell coverage for signal, traffic and frequency management and channel assignment.
4. Understand the concept of various types of Handoff's.
5. Demonstrate the Ad-Hoc networks and design goals of MAC layer protocol.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | | | | 1 | |
| CO2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | | | | 1 | |
| CO3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | | | | 1 | |
| CO4 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | | | | 1 | |
| CO5 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | | | | 1 | |

**(A404406) EMBEDDED SYSTEM DESIGN**
**(Professional Elective-II)**

**B. Tech. (ECE) VI-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**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: 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**

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

**UNIT - V**

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS.

**TEXT BOOK**

1. Shibu K.V - Introduction to Embedded Systems, Mc Graw Hill.

**REFERENCE BOOKS:**

1. Raj Kamal - Embedded Systems, TMH.
2. Frank Vahid, Tony Givargis - Embedded System Design, John Wiley.
3. Lyla - Embedded Systems, Pearson, 2013
4. David E. Simon - An Embedded Software Primer, Pearson Education.

**COURSE OUTOMES:**

Upon completing this course, the student will be able to

1. Discuss the concept of embedded systems and its applications
2. Apply the knowledge of interfacing various types of memories, sensors and Input / Output devices to processor.
3. Explain the embedded firmware for design approaches.
4. Classify various types of Real time operating Systems and multi tasking & Scheduling
5. Distinguish the task communication and task synchronization techniques.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | 2 | | | | | | 1 | 1 | 2 |
| CO2 | 2 | 2 | 1 | 2 | | | | | | 1 | 1 | 2 |
| CO3 | 2 | 2 | 1 | 1 | 2 | | | | 1 | | 1 | 2 |
| CO4 | 1 | 2 | 2 | 2 | | | | | | 1 | 1 | 2 |
| CO5 | 1 | 1 | 3 | 3 | 1 | | | | | 1 | 2 | 2 |

## (A404514) DIGITAL SIGNAL PROCESSING LABORATORY

**B. Tech. (ECE) VI-Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

- The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors).

**Note:** - Minimum of 12 experiments has to be conducted.

**LIST OF EXPERIMENTS:**

1. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
2. Histogram of White Gaussian Noise and Uniformly Distributed Noise.
3. To find DFT / IDFT of given DT Signal
4. To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
5. Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.
6. Implementation of FFT of given Sequence
7. Determination of Power Spectrum of a given Signal(s).
8. Implementation of LP FIR Filter for a given Sequence/Signal.
9. Implementation of HP IIR Filter for a given Sequence/Signal
10. Generation of Narrow Band Signal through Filtering
11. Generation of DTMF Signals
12. Implementation of Decimation Process
13. Implementation of Interpolation Process
14. Implementation of I/D Sampling Rate Converters
15. Impulse Response of First order and Second Order Systems.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Examine Time, Frequency and Z- transform analysis on signals and systems.
2. Apply z-transform, DTFT, DFT and FFT to analyze and design DSP systems.
3. Analyze and Observe Magnitude and phase characteristics (Frequency response Characteristics) of digital filters.
4. Evaluate the impulse response of first order and second order systems
5. Predict the Multi-rate filters for various applications of DSP.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 2 | 1 | | | 1 | | | |
| CO2 | 3 | 2 | 2 | 1 | 2 | 1 | | | 2 | | | |
| CO3 | 3 | 2 | 1 | 1 | 2 | 1 | | | 2 | | | |
| CO4 | 3 | 2 | 2 | 1 | 3 | 1 | | | 2 | | | |
| CO5 | 3 | 2 | 1 | 1 | 3 | 1 | | | 2 | | | |

## (A404515) CMOS VLSI DESIGN LABORATORY

**B. Tech. (ECE) VI-Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Note**: Note: Any SIX of the following experiments from each part are to be conducted (Total 12)

**Part - I**

All the following experiments have to be implemented using HDL

1. Realize all the logic gates
2. Design of 8-to-3 encoder (without and with priority) and 2-to-4 decoder
3. Design of 8-to-1 multiplexer and 1-to-8 demultiplexer
4. Design of 4 bit binary to gray code converter
5. Design of 4 bit comparator
6. Design of Full adder using 3 modeling styles
7. Design of flip flops: SR, D, JK, T
8. Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset) or any sequence counter
9. Finite State Machine Design

**Part - II**

Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis for the following:

1. Basic logic gates
2. CMOS inverter
3. CMOS NOR/ NAND gates
4. CMOS XOR and MUX gates
5. Static / Dynamic logic circuit (register cell)
6. Latch
7. Pass transistor
8. Layout of any combinational circuit (complex CMOS logic gate).

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Apply the concepts of basic combinational logic circuits, sequential circuit elements, and programmable logic in the laboratory setting.
2. Verify the various digital functions, combinational and sequential functions using Verilog HDL.
3. Analyze and Simulate circuits within a CAD tool and compare to design specification
4. Develop familiarity and confidence with designing, building and testing digital circuits, including the use of CAD tools. Behavioral, register- transfer, logic, and physical-level structured VLSI design using CAD tools and hardware description languages
5. Provide a general framework that should allow students to understand the working methodology of CAD tool.

**CO-PO MAPPING:**

| | **PO 1** | **PO 2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO 8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | **3** | 1 | 1 | **1** | | | | | | 1 | **3** |
| **CO2** | 2 | **2** | **3** | **3** | **3** | | | | | | **3** | **2** |
| **CO3** | 2 | **3** | **2** | **2** | **2** | | | | | | **2** | **3** |
| **CO4** | 1 | **3** | **3** | **1** | **2** | | | | | | **1** | **3** |
| **CO5** | 1 | **1** | **2** | **2** | **2** | | | | | | | **2** |

## (A404516) MICROWAVE AND OPTICAL COMMUNICATIONS LABORATORY

**B. Tech. (ECE) VI-Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Note:** Any twelve of the following experiments

**LIST OF EXPERIMENTS:**

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation measurement
4. Directional coupler Characteristics.
5. Scattering parameters of wave guide components
6. Frequency measurement.
7. Impedance measurement
8. VSWR measurement
9. Characterization of LED.
10. Characterization of Laser Diode.
11. Intensity modulation of Laser output through an optical fiber.
12. Measurement of Data rate for Digital Optical link.
13. Measurement of Numerical Aperture of fiber cable.
14. Measurement of losses for Optical link

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Study the characteristics of various microwave Tubes.
2. Analyze the various parameters of microwave devices.
3. Distinguish between H plane, E plane and Magic Tee.
4. Examine Isolation, Coupling factor and Directivity of directional couplers.
5. Study the characteristics of Digital Optic Fiber & Laser.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | | 2 | | | 1 |
| CO2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | | 2 | | | 1 |
| CO3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | | 2 | | | 1 |
| CO4 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | | 2 | | | 1 |
| CO5 | 3 | 2 | 1 | 1 | | 1 | 1 | | | | | 1 |

## (A400102) BUSINESS ECONOMICS & FINANCIAL ANALYSIS

**B. Tech. (ECE) VII-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT – I**

Introduction to Business and Economics: Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance. Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

**UNIT - II**

Demand and Supply Analysis: Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting. Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

**UNIT - III**

Production, Cost, Market Structures & Pricing: Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions. Cost analysis: Types of Costs, Short run and Long run Cost Functions. Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition. Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

**UNIT - IV**

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

**UNIT - V**

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems). Introduction to Fund Flow and Cash Flow Analysis (simple problems).

**TEXT BOOKS**:

1. D.D. Chaturvedi, S.L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.

**REFERENCE BOOKS:**

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. The students will understand the various Principles and functions of Management and apply in real scenarios
2. The students can have the systematic knowledge of the synchronization of various departments of organization
3. Forecast demand, production, cost, capital, price under different market situations for various products of business enterprise in general.
4. Employ various factors of production to gain the maximum out of them and learn the cost concepts
5. Understand the financial aspects and sources of accumulation of funds and maintenance.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | | | | | | | | 3 |
| CO2 | | | | | | | | | | 2 | 3 | |
| CO3 | | | | | 2 | | | | 3 | | | |
| CO4 | | | | 2 | | | 3 | | | | | |
| CO5 | | 2 | | | | | | | | | 3 | |

## (A404407) RADAR SYSTEMS
## (Professional Elective-III)

**B. Tech. (ECE) VII-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

Basics of Radar: Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation. Radar Equation: SNR, Envelope Detector – False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment).

**UNIT - II**

CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar. FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter.

**UNIT - III**

MTI and Pulse Doppler Radar: Principle, MTI Radar - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

**UNIT - IV**

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

**UNIT - V**

Detection of Radar Signals in Noise Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise. Radar Receivers – Noise Figure and Noise Temperature, Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.

**TEXT BOOKS:**

1. Merrill I. Skolnik- Introduction to Radar Systems, 2nd Edition, TMH Special Indian Edition, 2007.

**REFERENCE BOOKS:**

1. Byron Edde - Radar: Principles, Technology, Applications, Pearson Education, 2004.
2. Peebles, Jr., P.Z., Wiley - Radar Principles, New York, 1998.
3. Mark A. Richards, James A. Scheer, William A. Holm, Yesdee - Principles of Modern Radar: Basic Principles, 2013
4. Merrill I. Skolnik -Radar Handbook, 3rd Edition., McGraw-Hill Education, 2008.

**COURSE OUTCOMES:**

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

1. Explain basics of Radar Systems, Radar Range and various terminologies.
2. Describe Continuous wave Radar and its applications.
3. Analyse operation of MTI Radar and applications.
4. Explain principle operation of tracking radar and different error determination methods.
5. Distinguish various sub systems used in Radars and describe filter Techniques.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | | | | | | | | 1 | 2 |
| CO2 | 2 | 2 | 1 | 1 | | 1 | 2 | 1 | | | 1 | 2 |
| CO3 | 2 | 2 | 1 | 2 | | 1 | 2 | 1 | | | | 2 |
| CO4 | 2 | 2 | 1 | 2 | | 1 | 1 | 1 | | | | 2 |
| CO5 | 2 | 2 | 1 | 2 | | 1 | 2 | 1 | | | 2 | 2 |

**(A404408) CMOS ANALOG IC DESIGN**
**(Professional Elective-III)**

**B. Tech. (ECE) VII-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT – I**

MOS Devices and Modeling The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

**UNIT - II**

Analog CMOS Sub-Circuits MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Bandgap Reference.

**UNIT- III**

CMOS Amplifiers Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

**UNIT-IV**

CMOS Operational Amplifiers Design of CMOS Op-Amps, Compensation of Op-Amps, Design of Two-Stage Op-Amps, PowerSupply, Rejection Ratio of Two-Stage Op-Amps, Cascode Op-Amps, Measurement Techniques of OPAmp.

**UNIT - V**

Comparators Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

**TEXT BOOKS:**

1. Philip E. Allenand Douglas, R. Holberg – CMOS Analog Circuit Design, Oxford University Press, International Second Edition/Indian Edition, 2010.
2. Paul R. Gray, Paul J. Hurst, S. Lewis and R.G. Meyer -Analysis and Design of Analog Integrated Circuits, 5th edition, Wiley India, 2010.

**REFERENCE BOOKS:**

1. David A. Johns, Ken Martin- Analog Integrated Circuit Design, Wiley Student Edn, 2013.
2. Behzad Razavi – Design of Analog CMOS Integrated Circuits, TMH.
3. Baker, Liand Boyce - CMOS: Circuit Design, Layout and Simulation, PHI.

**COURSE OUTCOMES**

Upon completing this course, the student will be able to

1. Analyse the Large signal model, small Signal Models and Sub-Threshold Models of MOS Transistor.
2. Apply various current mirror circuit models to Design Analog circuits for improving the circuitperformance.
3. Design and analyse different CMOS Amplifier circuits.
4. Design various CMOS Operational Amplifier circuits.
5. Categorize and correlate various Comparator circuits in the circuit design.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | | | | | | 2 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | | | | | | 3 | 2 |
| CO3 | 3 | 3 | 2 | 3 | 3 | | | | | | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 2 | | | | | | 3 | 2 |

## (A404409) ARTIFICIAL NEURAL NETWORKS
## (Professional Elective-III)

**B. Tech. (ECE) VII-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

**UNIT - II**

Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

**UNIT - III**

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

**UNIT - IV**

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

**UNIT - V**

Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models, restricted boltzmen machine.

**TEXT BOOKS:**


1. Simon S Haykin - Neural Networks a Comprehensive Foundations, PHI
2. Jacek M. Zurada - Introduction to Artificial Neural Systems, JAICO Publishing House, 2006.


**REFERENCE BOOKS:**


1. Li Min Fu - Neural Networks in Computer Intelligence, TMH 2003
2. James A Freeman David M S Kapura - Neural Networks, Pearson, 2004.
3. B. Vegnanarayana -Artificial Neural Networks, Prentice Hall of India P Ltd, 2005


**COURSE OUTCOMES**

Upon completing this course, the student will be able to

1. Create the mathematical foundations of neural network models.
2. Design and implement neural network systems to solve real world problems
3. Apply the knowledge of radial basis functions in neural networks using various learning rules.
4. Develop various algorithms and mapping models for associate memory networks and SOM.
5. Distinguish various systems for neuro dynamics and Hopfield models.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | 1 | | 2 | | | | 2 |
| CO2 | 2 | 2 | | 2 | | | 1 | | | | 2 | |
| CO3 | 2 | 2 | | | 3 | | | 2 | | | | 2 |
| CO4 | 3 | 3 | 2 | | | 2 | | | | | 2 | |
| CO5 | 3 | 2 | 2 | | 3 | | 2 | | | | 3 | 3 |

## (A404410) NETWORK SECURITY AND CRYPTOGRAPHY

**(Professional Elective-IV)**

**B. Tech. (ECE) VII-Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

Security Services, Mechanisms and Attacks, A Model for Internetwork security, Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques. Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Block Cipher Design Principles.

**UNIT - II**

Encryption: Triple DES, International Data Encryption algorithm, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers. Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

**UNIT - III**

Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography. Number Theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

**UNIT - IV**

Message Authentication and Hash Functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs. Hash and Mac Algorithms: MD-5, Message digest Algorithm, Secure Hash Algorithm. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications: Kerberos, Electronic Mail Security: Pretty Good Privacy, SIME/MIME.

**UNIT - V**

IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms: Intruders, Viruses and Related threats. Fire Walls: Fire wall Design Principles, Trusted systems.

**TEXT BOOKS:**

1. William Stallings-Cryptography and Network Security: Principles and Practice, Pearson Education.
2. Robert Bragg, Mark Rhodes -Network Security: The complete reference, TMH, 2004.

**REFERENCE BOOKS:**

1. William Stallings - Network Security Essentials (Applications and Standards), Pearson Education.
2. Eric Maiwald - Fundamentals of Network Security, Dreamtech press
3. Whitman - Principles of Information Security, Thomson. 4. Buchmann - Introduction to Cryptography, Springer.

**COURSE OUTCOMES**

Upon completing this course, the student will be able to

1. Analyse and design classical encryption techniques, block cipher and data encryption standard.
2. Analyse public-key cryptography, RSA and other public-key cryptosystems
3. Vulnerability assessments and the weakness of using passwords for authentication
4. Perform simple vulnerability assessments and password audits
5. Configure simple firewall architectures for networks

**CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | | | | | 2 | | 2 |
| CO2 | 3 | 2 | | | | | 1 | | | 2 | 2 | |
| CO3 | 3 | 2 | | | | 2 | | 1 | | | | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | | | 3 | 3 | 3 | 3 | 3 |
| CO5 | 2 | 2 | 3 | 3 | 2 | | 1 | | 3 | 3 | 3 | 3 |

## (A404411) SATELLITE COMMUNICATIONS
## (Professional Elective-IV)

**B. Tech. (ECE) VII-Semester**

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| 3 | 0 | 0 | 3 |

**UNIT - I**

Introduction: Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications, Future Trends of Satellite Communications. Orbital Mechanics and Launchers: Orbital Mechanics, Look Angle determination, Orbital Perturbations, Orbit determination, Launches and Launch vehicles, Orbital Effects in Communication Systems Performance.

**UNIT - II**

Satellite Subsystems: Attitude and Orbit Control System, Telemetry, Tracking, Command And Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability and Space Qualification.

**UNIT - III**

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Up Link Design, Design Of Satellite Links For Specified C/N, System Design Examples. Multiple Access: Frequency Division Multiple Access (FDMA), Inter modulation, Calculation of C/N, Time Division Multiple Access (TDMA), Frame Structure, Examples, Satellite Switched TDMA Onboard Processing, DAMA, Code Division Multiple Access (CDMA), Spread Spectrum Transmission and Reception.

**UNIT - IV**

Earth Station Technology: Introduction, Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power Test Methods.

**UNIT - V**

Low Earth Orbit and Geo-Stationary Satellite Systems: Orbit Considerations, Coverage and Frequency Consideration, Delay & Throughput Considerations, System Considerations, Operational NGSO Constellation Designs. Satellite Navigation & Global Positioning System: Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, GPS Receiver Operation, GPS C/A Code Accuracy, Differential GPS.

**TEXT BOOKS**:

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt - Satellite Communications, WSE, Wiley Publications, 2nd Edition, 2003.
2. Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud - Satellite Communications Engineering, 2nd Edition, Pearson Publications, 2003.

**REFERENCE BOOKS**:

1. M. Richharia - Satellite Communications : Design Principles, 2nd Edition, BS Publications, 2003.
2. D.C Agarwal - Satellite Communication, 5th Edition, Khanna Publications,
3. K.N. Raja Rao - Fundamentals of Satellite Communications, PHI, 2004
4. Dennis Roddy - Satellite Communications, 4th Edition, McGraw Hill, 2009.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Understand frequency allocation of satellite communication, orbital mechanics, and satellite launching vehicles.
2. Describe satellite subsystems like telemetry, tracking & command and monitoring system etc.
3. Demonstrate the design of satellite links for specified C/N, Recognize various multiple access techniques for satellite communication systems.
4. Understand different transmitters, receivers and tracking systems.
5. Understand LEO, GEO Satellite systems, Constellation design, Navigation and GPS Principles, GPS Codes.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | | 1 | 1 | | 2 | | | 2 |
| CO2 | 3 | 2 | 2 | 2 | | 1 | 1 | | 2 | | | 2 |
| CO3 | 3 | 2 | 2 | 2 | | 1 | 1 | | 2 | | | 2 |
| CO4 | 3 | 2 | 2 | 2 | | 1 | 1 | | 2 | | | 2 |
| CO5 | 3 | 2 | 2 | 2 | | 1 | 1 | | 2 | | | 2 |

## (A404412) BIOMEDICAL INSTRUMENTATION
## (Professional Elective-IV)

**B. Tech. (ECE) VII-Semester**

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| 3 | 0 | 0 | 3 |

**UNIT - I**

Bio-Potential Signals and Electrodes: Bio-signals and their characteristics, Organization of cell, Nernst equation of membrane, Resting and Action potentials. Bio-amplifiers, characteristics of medical instruments, problems encountered with measurements from living systems. Bio-potential electrodes – Body surface recording electrodes, Internal electrodes, micro electrodes. Bio-chemical transducers – reference electrode, the pH electrodes, Blood gas electrodes.

**UNIT - II**

Cardiovascular Instrumentation: Heart and cardiovascular system Heart electrical activity, blood pressure and heart sounds. Cardiovascular measurements electro cardiography – electrocardiogram, ECG Amplifier, Electrodes and leads, ECG recorder principles. Types of ECG recorders. Principles of blood pressure and blood flow measurement.

**UNIT - III**

Neurological Instrumentation: Neuronal communication, electro encephalogram (EEG), EEG Measurements EEG electrode-placement system, interpretation of EEG, EEG system Block diagram, preamplifiers and amplifiers. EMG block diagram and Stimulators

**UNIT - IV**

Equipment for Critical Care: Therapeutic equipment - Pacemaker, Defibrillator, Shortwave diathermy, Hemodialysis machine. Respiratory Instrumentation - Mechanism of respiration, Spirometry, Pneumotachograph, Ventilators.

**UNIT - V**

Principles of Medical Imaging: Radiography, computed Radiography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear Medicine, Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), Ultrasonography, Introduction to Telemedicine.

**TEXT BOOKS**:

1. R.S. Khandpur - Hand-book of Biomedical Instrumentation, McGraw-Hill, 2003.
2. John G. Webster = Medical Instrumentation, Application and Design, John Wiley.

**REFERENCE BOOKS:**

1. Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer - Biomedical Instrumentation and Measurements, PHI.
2. L.A. Geoddes and L.E. Baker - Principles of Applied Biomedical Instrumentation, John Wiley and Sons.
3. Joseph Carr and Brown - Introduction to Biomedical equipment technology.

**COURSE OUTCOMES**

Upon completing this course, the student will be able to

1. Understanding the fundamental concept of various electrodes in biomedical instrumentation.
2. Demonstrate the Heart and Cardiovascular system and principle of ECG recorders.
3. Understanding the Neurological communication system and interpretation of EEG system and stimulator.
4. Understanding the concept of Therapeutic equipment and Respiratory instrumentation used in critical care.
5. Demonstrate various imaging demonstrate used in Radiology.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | | 2 | | 3 | 2 | | 2 | | 1 | 2 |
| CO2 | 1 | 2 | | 2 | | 3 | 2 | | 2 | | 1 | 2 |
| CO3 | 1 | 2 | | 2 | | 3 | 2 | | 2 | | 1 | 2 |
| CO4 | 1 | 2 | | 2 | | 3 | 2 | | 2 | | 1 | 2 |
| CO5 | 1 | 2 | | 2 | | 3 | 2 | | 2 | | 1 | 2 |

## (A404413) ARTIFICIAL INTELLIGENCE

**(Professional Elective-V)**

**B. Tech. (ECE) VII-Semester**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**UNIT- I:**

Introduction Introduction–Definition – foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

**UNIT- II:**

Problem Solving Methods Problem solving Methods – Search Strategies- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A*, AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

**UNIT- III:**

Knowledge Representation First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information.

**UNIT- IV:**

Knowledge Acquisition Introduction to Learning, Rule Induction, learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning. Learning Using Neural Networks, Probabilistic Learning Natural Language Processing.

**UNIT- V:**

Expert systems Introduction, basic concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty.

**TEXT BOOKS:**


1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel,” Computational Intelligence: a logical approach”, Oxford University Press.


**REFERENCE BOOKS**:


1. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, Pearson Education.
2. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers


**COURSE OUTCOMES**

Upon completing this course, the student will be able to

1. Formulate an efficient problem space for a problem expressed in natural language.
2. Analyze and Select a search algorithm for a problem and estimate its time and space complexities.
3. Learn different knowledge representation techniques for a given problem.
4. Apply AI techniques to solve problems and machine learning.
5. Apply AI techniques to solve problems of game playing and machine learning.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | 2 | | | | | | 2 |
| CO2 | 2 | 3 | 2 | | | | | | | | | |
| CO3 | 2 | 1 | 2 | 3 | | | 1 | | | | | 2 |
| CO4 | | 3 | 2 | | 2 | | | 2 | | | | 1 |
| CO5 | 1 | 2 | | | 3 | | 2 | | | | 2 | 2 |

**(A404414) 5G AND BEYOND COMMUNICATIONS**
**(Professional Elective-V)**

**B. Tech. (ECE) VII-Semester**

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**UNIT - I**
Multiple Input Multiple Output (MIMO) Communications: Spatial Multiplexing, Spatial Diversity, Beamforming in MIMO systems, Hybrid Precoding, 5G Communication Landscape, Related work on 5G.

**UNIT - II**
Introduction to Mobile Wireless Technology Generations: 5G, WISDOM, GIMVC, Requirements of 5G, standardization of WISDOM, Vision of 5G, WISDOM Concept and Challenges, Cellular D2D Communication, D2D Using Physical Layer Network Coding, Using FFR and Using Cognitive Radio. SMNAT: Introduction, Network Architecture and the Process, Implementation of SMNAT for In-BandD2D and Interoperability with WISDOM, Description of Network elements of SMNAT and Call Flow for Session Establishment.

**UNIT - III**
Radio Wave Propagation for Mm Wave: Introduction, Large-scale Propagation Channel Effects, Small-Scale Channel Effects, Spatial Characterization of Multipath and Beam Combing, Outdoor Channel Models, Indoor Channel Models.

**UNIT - IV**
Higher layer Design Considerations for Mm Wave: Challenges when Networking Mm Wave Devices, Beam Adaptation Protocols, Relaying for Coverage Extension, Support for Multimedia Transmission, Multiband considerations, Performance of Cellular networks, Mm Wave Standardization: ECMA-387, IEEE 802.11ad.

**UNIT - V**
BEYOND 2020 Major Challenges Surrounding Future Cyber Security, Users Awareness, Spectrum Related Security Issues in CRNs. Challenges for 2020 and beyond, Future Mobile Technologies, High Altitude Stratospheric Platform Station Systems, Human Bond Communications, CONASENSE.

**TEXT BOOKS:**
1. Ramjee Prasad, 5G: 2020 and Beyond, River Publishers
2. T. S. Rappaport, R. W. Heath Jr., R. C. Daniels, and J. M. Murdock, Millimetre Wave Wireless Communication, Pearson Education, 2015.

**REFERENCE BOOKS**:
1. M. Manish, G. Devendra, P. Pattanayak, and N. Ha, 5G and Beyond Wireless Systems PHY Layer Perspective, Springer Series in Wireless Technology
2. M. Vaezi, Z. Ding, and H. V. Poor, Multiple Access techniques for 5G Wireless Networks and Beyond, Springer Nature, Switzerland, 2019.

**COURSE OUTCOMES**

Upon completing this course, the student will be able to
1. Understand the Fundamental of MIMO Communications.
2. Describe various Mobile Wireless Technology Generations.
3. Understand Radio Wave Propagation for Mm Wave.
4. Describe various Higher Layer Design Considerations for Mm Wave
5. Demonstrate Challenges for 2020 and beyond, Future Mobile Technologies

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | | | | | | | 2 | 2 |
| CO2 | 3 | 3 | 2 | 2 | | | | | | | 2 | 2 |
| CO3 | 1 | 3 | 2 | 2 | | | 2 | | | | 2 | 2 |
| CO4 | 1 | 3 | 2 | 2 | | | | | | | 2 | 2 |
| CO5 | 1 | 2 | 2 | 2 | | | | | | | 2 | 2 |

**(A404415) MACHINE LEARNING**
**(Professional Elective-V)**

**B. Tech. (ECE) VII-Semester**

| L | T | P | C |
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**UNIT - I**
Artificial Neural Networks Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

**UNIT - II**
Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks.

**UNIT - III**
Linear Models: Linear Basis Function Models -Maximum likelihood and least squares, Geometry of least squares , Sequential learning, Regularized least squares, Multiple outputs , The Bias-Variance Decomposition, Bayesian Linear Regression -Parameter distribution, Predictive, Equivalent, Bayesian Model Comparison, Probabilistic Generative Models-Continuous inputs, Maximum likelihood solution, Discrete features, Exponential family, Probabilistic Discriminative Models -Fixed basis functions, Logistic regression, Iterative reweighted least squares, Multiclass logistic regression, Probit regression, Canonical link functions

**UNIT - IV**
Kernel Methods: Constructing Kernels, Radial Basis Function Networks - Nadaraya-Watson model, Gaussian Processes -Linear regression revisited, Gaussian processes for regression, Learning the hyper parameters, Automatic relevance determination, Gaussian processes for classification, Laplace approximation, Connection to neural networks, Sparse Kernel Machines- Maximum Margin Classifiers, Overlapping class distributions, Relation to logistic regression, Multiclass SVMs, SVMs for regression, Computational learning theory, Relevance Vector Machines- RVM for regression, Analysis of sparsity, RVM for classification

**UNIT-V**
Graphical Models: Bayesian Networks, Example: Polynomial regression, Generative models, Discrete variables, Linear-Gaussian models, Conditional Independence- Three example graphs, D-separation, Markov Random Fields -Conditional independence properties, Factorization properties, Illustration: Image de-noising, Relation to directed graphs, Inference in Graphical Models- Inference on a chain, Trees, Factor graphs, The sum-product algorithm, The max-sum algorithm, Exact inference in general graphs, Loopy belief propagation, Learning the graph structure.

**TEXT BOOKS:**
1. C. Bishop -Pattern Recognition and Machine Learning- -Springer, 2006.
2. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall.

**REFERENCE BOOKS:**
1. Nils J. Nilsson -Introduction to machine learning, Stanford University Stanford.
2. William J. Deuschle – Undergraduate Fundamentals of Machine Learning, thesis Harvard College, Cambridge.
3. Shai Shalev-Shwartz, Shai Ben-David- Understanding Machine Learning, From theory to Algorithms, Cambridge University press, 2014

**COURSE OUTCOMES**
Upon completing this course, the student will be able to
1. Understand the fundamentals of ANNs, including architectures and learning algorithms
2. Apply various ANN models for pattern recognition and supervised learning.
3. Analyze the strengths and weaknesses of different ANN approaches for classification and clustering
4. Implement ANN algorithms and evaluate their performance using tools and libraries
5. Critically evaluate the suitability of different ANN architectures for specific machine learning tasks

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | |
| CO2 | | | 3 | | 2 | | | | | | | |
| CO3 | | 3 | | 1 | | | | | | | | |
| CO4 | | | | | 3 | | 1 | | | | | |
| CO5 | | | | | | 2 | | 2 | | 3 | | |

## (A404518) ADVANCED COMMUNICATIONS LABORATORY

**B. Tech. (ECE) VII-Semester**

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**Note:** Minimum Eight experiments should be conducted:

1. Study the features of Network and spectrum analyzer
2. Simulate the Radiation pattern for different antennas using HFSS/ ADS/Matlab and compare the measurement using Network analyzer.
   i. Dipole Antenna
   ii. Horn antenna
   iii. Microstrip Antenna etc

. 3. Simulate the Radiation resistance for different antennas using HFSS/ ADS/ MATLAB and compare the measurement using Network analyzer.
   i. Dipole Antenna
   ii. Horn antenna
   ii. Microstrip Antenna etc.
   iii.

4. Plotting eye diagram for baseband signal using MATLAB and verifying using Network analyzer.
5. Plotting Constellation Diagram of QAM using MATLAB and verify using kit.
6. OFDM generation and detection using Simulink and verify using kit.
7. Generation of different types of signals using Vector Signal Generator
8. Modulation analysis on digital modulated single carrier signals using MATLAB.
9. Reading analog and digital sensors data using UART Using ICONT setup.
10. Collecting sensor values of remote nodes using RIME broadcasting Using ICONT setup.

**COURSE OUTCOMES**

Upon completing this course, the student will be able to

1. Understand the principles of network and spectrum analysers and their applications in signal analysis.
2. Gain knowledge in simulating and analyzing the radiation pattern and radiation resistance of antennas and compare them with real-world measurements.
3. Acquire proficiency in generating and analyzing constellation diagrams of signals and verifying them practically.
4. Evaluate the performance of OFDM systems by simulating different channel conditions and noise levels.
5. Examine the network topology and communication patterns to optimize data collection efficiency.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | 1 | |
| CO2 | 3 | 1 | 1 | 1 | 1 | | | | 1 | | 1 | |
| CO3 | 3 | | 1 | | | | | | | | 1 | |
| CO4 | 3 | 1 | 1 | | | | | | | 1 | 1 | |
| CO5 | 3 | | 1 | | | | | | | | 1 | |

## (A404416) MULTIMEDIA DATABASE MANAGEMENT SYSTEMS
## (Professional Elective-VI)

**B. Tech. (ECE) VIII-Semester**

| L | T | P | C |
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**UNIT - I**

Database System Applications: A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model

**UNIT - II**

Introduction to the Relational Model: Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical data base design, introduction to views, destroying/altering tables and views. Relational Algebra, Tuple relational Calculus, Domain relational calculus.

**UNIT - III**

SQL: Queries, Constraints, Triggers: form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active data bases. Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multi-valued dependencies, FOURTH normal form, FIFTH normal form.

**UNIT - IV**

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols, Multiple Granularity, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions.

**UNIT - V**

Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree base Indexing, Comparison of File Organizations, Indexes and Performance Tuning, Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure.

**TEXT BOOKS:**

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill 3rd Edition
2. Database System Concepts, Silberschatz, Korth, Mc Graw hill, V edition.

**REFERENCE BOOKS:**

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate, Pearson Education
3. Introduction to Database Systems, C. J. Date, Pearson Education
4. Oracle for Professionals, The X Team, S.Shah and V. Shah, SPD.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.
6. Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Comprehend The Fundamentals of Multimedia Data &Management Systems
2. Grasp The Design Principles of Multimedia Databases
3. Employ Query Languages for Multimedia Data
4. Implement Techniques for Efficient Storage Retrieval And Indexing Of Multimedia Data.
5. Evaluate Select Appropriate Multimedia Database Management Systems

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 1 | | | | | | | | 2 |
| CO2 | | | 3 | 2 | | | | | | | | 2 |
| CO3 | | | | | | | | | | | | 2 |
| CO4 | | | | 2 | | | | | 1 | 2 | 1 | |
| CO5 | | 1 | | | | | | | 1 | | | 2 |

## (A404417) SYSTEM ON CHIP ARCHITECTURE
## (Professional Elective-VI)

**B. Tech. (ECE) VIII-Semester**

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| 3 | 0 | 0 | 3 |

**UNIT - I**

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

**UNIT - II:**

Processors: Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

**UNIT - III:**

Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

**UNIT - IV:**

Interconnect Customization: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization:

**UNIT - V:**

Configuration: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

**TEXT BOOKS:**

1. Computer System Design System-on-Chip by Michael J. Flynn and Wayne Luk, Wiely India Pvt. Ltd.
2. ARM System on Chip Architecture – Steve Furber –2nd Ed., 2000, Addison Wesley Professional.

**REFERENCE BOOKS:**

1. Design of System on a Chip: Devices and Components – Ricardo Reis, 1st Ed., 2004, Springer
2. Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newnes, BK and CDROM
3. System on Chip Verification – Methodologies and Techniques –Prakash Rashinkar, Peter Paterson and Leena Singh L, 2001, Kluwer Academic Publishers.

**COURSE OUTCOMES:**

After the completion of course students are able to

1. Identify the approach for SoC Design, System Architecture and Complexity.
2. Analyze various Processor architectures and Buffer of the SoC.
3. Examine the SOC Memory System and Cache Organization, Distinguish different types of Memory Elements of SoC.
4. Understand the interconnection strategies and their customization on SOC.
5. Analyze the Reconfiguration Technologies, Customizable Instruction Processor and Soft Processor designs involved in SOC.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | | | | | | | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 2 | | | | | | | 2 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | | | | | | | 2 |
| **CO4** | 3 | 2 | 3 | 3 | 3 | | | | | | | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 | | | | | | | 2 |

## (A404418) WIRELESS SENSOR NETWORKS
## (Professional Elective-VI)

**B. Tech. (ECE) VIII-Semester**

| L | T | P | C |
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**UNIT - I:**
Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

**UNIT - II:**
Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

**UNIT - III:**
Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee

**UNIT - IV:**
Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

**UNIT - V:**
Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

**TEXT BOOKS:**

1. Ad-Hoc Wireless Sensor Networks- C. Siva Ram Murthy, B. S. Manoj, Pearson
2. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE

**REFERENCE BOOKS:**

1. Wireless Digital Communications – Kamilo Feher, 1999, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.
4. Wireless Communication and Networking – William Stallings, 2003, PHI.

**COURSE OUTCOMES:**

Upon completing this course, the student will be able to

1. Describe the overview of wireless sensor networks and applications of sensor networks.
2. Understand issues, challenges and enabling technologies for WSN.
3. Apply various concepts for assignment of MAC layer protocol.
4. Analyse and compare various data gathering and dissemination methods.
5. Apply the design principles of WSN architectures and operating systems for simulating environment situations**.**

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | | | | 1 | |
| CO2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | | | | 1 | |
| CO3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | | | | 1 | |
| CO4 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | | | | 1 | |
| CO5 | 3 | | 3 | | | 3 | 3 | | | | 1 | |

## (A404601) FUNDAMENTALS OF INTERNET OF THINGS
## (Open Elective-I)

**B. Tech. (ECE)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT – I**

**Introduction to Arduino:** Introduction to Arduino Uno, Features, Pin functionality, Basic Arduino Programming: Interfacing LEDs, Switches using Digital I/O Read/Write, Acquiring and generating signals using Analog I/O Read/Write, Serial functions.

**UNIT – II**

**Introduction to Raspberry Pi:** Introduction to Raspberry Pi, Pin functionality, Revision of Python Programming; Raspberry Pi commands, GPIO programming.

**Other Open Source Devices:** Features and pin functions of NodeMCU, ESP8266, ESP32.

**UNIT - III**

**Introduction to IOT**: Terms and definitions, Logical design of IoT, IOT Reference Model;

**IOT and M2M:** Introduction to M2M, Difference between IoT and M2M and other types;

**IOT Servers and Cloud Offerings:** IoT enabling technologies – Cloud Computing; Introduction to Cloud Storage/Services – Google, Microsoft Azure, IBM, Amazon Web services for IOT, setting up to read and write using Thingspeak;

**UNIT – IV**

**IOT & Communication Protocols:** Serial –RS 485, IEEE1394 Firewire, I2C, SPI, USB, CAN; Wireless sensor networks and its technologies, IOT Protocols.

**UNIT – V**

**Domain Specific IOT Applications & Case Studies:**

IOT Application & case studies for Agriculture, Smart Cities & Transport, Home Automation, Environment, Retail, Logistics, Health, Life style, Industry – Energy;

**TEXT BOOKS:**

1. Srinivasa K G, Siddesh G M, Hanumantha Raju R, Internet of Things, Cengage, 2019.

**REFERENCE BOOKS:**

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-on-Approach”, VPT, 1st Edition, 2014
2. Jeremy Blum, Exploring Arduino: Tools and Techniques for Engineering Wizardry, Wiley, 2013.
3. Simon Monk, Raspberry Pi Cookbook, O'Reilly 3rd Edition, 2019
4. Michael Margolis, Arduino Cookbook, 2nd Edition, December 2011, O'Reilly Media, Inc.
5. Rahul Dubey, An Introduction to Internet of Things – Connecting Devices, Edge Gateway, and Cloud with Applications, Cengage, 2019.

**COURSE OUTCOMES:**

Students will be able to

1. Have knowledge of programming open source Edge devices like Arduino, Raspberry Pi.
2. Apply the knowledge of arduino and raspberry pi with clouds for IOT applications.
3. Analyze the different communication and IOT protocols.
4. Aware of various cloud services and providers.
5. Understand various IOT implementations in different domains.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | 2 | 1 | | | | | | | 1 |
| CO2 | | 2 | | | | | | | | | | 1 |
| CO3 | | | | 3 | 1 | 1 | | | | | | 1 |
| CO4 | | 3 | | | | | | | | | | 1 |
| CO5 | | | 2 | 3 | 1 | | | | | | | 1 |

**(A404602) PRINCIPLES OF DIGITAL SIGNAL PROCESSING**
**(Open Elective-I)**

| | L | T | P | C |
|---|---|---|---|---|
| **B. Tech. (ECE)** | **3** | **0** | **0** | **3** |

**UNIT-I**
**Introduction to Signal and Systems**
Basic Signals and Systems – properties and basic operations-1-D Signals and Filters - Random Signals - Multi-Dimensional Signals – Analog and Digital signals and their conversion techniques Convolution process, Filtering process, Z-transform concepts.

**UNIT-II**
**Time domain analysis and Characteristics**
Correlation and Discrete sequences: notation, signal characteristics, and operations Discrete linear time invariant systems -Properties and analysis of discrete linear time invariant systems Periodic sampling: aliasing and low pass filtering.

**UNIT-III**
**Frequency domain Analysis**
Discrete Fourier transforms (DFT) DFT properties: symmetry, linearity, magnitudes, frequency axis, and shifting Inverse DFT - Fast Fourier transform (FFT): relationship to DFT, implementation considerations, radix-2 algorithm, and input/output indexing FFT: butterfly algorithm structures.

**UNIT-IV**
**FIR filter design**
FIR filters – Introduction-Basic Properties-Design using Hamming, Hanning Windows - Realization of FIR filters.

**UNIT-V**

**IIR filter design**
Review of design of analogue Butterworth Filters, - Design of IIR digital filters using impulse invariance technique - Realization using direct, cascade and parallel forms.

**TEXT BOOKS:**
1. Richard G. Lyons, Understanding Digital Signal Processing, Third edition, Prentice-Hall, 2011.
2. Introduction to Digital Signal Processing, J.Proakis & E. Manolakis, MacMillan, 2007 (4th Edition)

**REFERENCES:**
1. S.Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, TMH/McGraw Hill International, 2007
2. E.C. Ifeachor and B.W. Jervis, " Digital signal processing - A practical approach", Second edition, Pearson, 2002.

**COURSE OUTCOMES:**
Students will be able to
1. Characterize discrete time signals and LTI signal processing systems mathematically.
2. Analyze the functions performed by simple discrete-time systems.
3. Develop the discrete Fourier transform (DFT) over time domain signals, its applications and its implementation by FFT techniques.
4. Apply the design techniques for FIR type digital filters known as the ―windowing method.
5. Design IIR type digital filters over the given specifications

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | | | | | | | | | | **1** |
| **CO2** | **3** | **3** | | | | | | | | | | **1** |
| **CO3** | **3** | **3** | **2** | | | | | | | | | **1** |
| **CO4** | **3** | **3** | **2** | **2** | | | | | | | | **1** |
| **CO5** | **3** | **3** | **2** | **2** | | | | | | | | **1** |

## (A405602) FUNDAMENTALS OF OPERATING SYSTEMS
## (Open Elective-I)

| | L | T | P | C |
|---|---|---|---|---|
| **B. Tech (ECE)** | **3** | **0** | **0** | **3** |

**UNIT - I**

Operating System - Introduction, Structures - Simple Batch, Multi programmed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls
Process - Process concepts and scheduling, Operations on processes, Cooperating Processes, Threads

**UNIT - II**

CPU Scheduling - Scheduling Criteria, Scheduling Algorithms, Multiple -Processor Scheduling. System call interface for process management-fork, exit, wait, waitpid, exec
Deadlocks - System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock

**UNIT - III**

Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors

**UNIT – IV**

Interprocess Communication Mechanisms: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

**UNIT – V**

Memory Management and Virtual Memory - Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms.

**TEXTBOOKS:**

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.
2. Advanced programming in the UNIX environment, W.R. Stevens, Pearson education.

**REFERENCE BOOKS:**

1. Operating Systems- Internals and Design Principles, William Stallings, Fifth Edition–2005, Pearson Education/PHI
2. Operating System A Design Approach- Crowley, TMH.
3. Modern Operating Systems, Andrew S. Tanenbaum 2nd edition, Pearson/PHI
4. UNIX programming environment, Kernighan and Pike, PHI/ Pearson Education
5. UNIX Internals -The New Frontiers, U. Vahalia, Pearson Education.

**COURSE OUTCOMES:**

Students will be able to

1. Demonstrate the knowledge of the components of computers and their respective role in computing.
2. Explain CPU Scheduling Algorithms and Explain the methods for handling Deadlocks.
3. Explain Process Management and Synchronization and Demonstrate inter process Communication.
4. Analyze Various Memory Management an Allocation Methods.
5. Discuss File System Interface and Operations.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **1** | | | | | | | | | | | |
| **CO2** | **1** | **2** | **2** | **2** | | | | | | | | |
| **CO3** | **1** | **2** | **2** | **2** | | | | | | | | |
| **CO4** | **1** | **2** | **2** | **2** | | | | | | | | |
| **CO5** | **1** | **2** | **2** | **2** | | | | | | | | |

## (A405604) JAVA PROGRAMMING
## (Open Elective-I)

**B. Tech (ECE)**

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**UNIT-I**

**Introduction:** Java Essentials, JVM, Java Features, Creation and Execution of Programs, Data Types, Type Conversion, Casting, Conditional Statements, Loops, Branching Mechanism, Classes, Objects, Class Declaration, Creating Objects, Method Declaration and Invocation, Method Overloading, Constructors– Parameterized Constructors, Constructor Overloading, Cleaning-up unused Objects, Class Variables & Methods-static Keyword, this Keyword.

**UNIT–II**

**Arrays:** One-Dimensional Arrays, Two-Dimensional Arrays, Command-Line Arguments, Inner Class. **Inheritance**: Introduction, Types of Inheritance, extends Keyword, Examples, Method Overriding, super, final Keywords, Abstract classes, Interfaces, Abstract Classes Verses Interfaces.

**UNIT–III**

**Packages**–Creating and Using Packages, Access Protection, Wrapper Classes, String Class, String Buffer Class. **Exception**: Introduction, Types, Exception Handling Techniques, User-Defined Exception.

**UNIT-IV**

**Multithreading:** Introduction, Main Thread, Creation of New Threads – By Inheriting the Thread Class or Implementing the Runnable Interface, Thread Lifecycle, Thread Priority, Synchronization.

**UNIT–V**

**java.io Package**, File Class, File Input Stream Class, File Output Stream Class, Scanner Class, Buffered Input Stream Class, Buffered Output Stream Class, Random Access File Class.

**TEXT BOOKS:**

**1.**Sachin Malhotra, Saurabh Choudhary, Programming in Java (2e), Oxford publications.

**REFERENCE BOOKS:**

1.Herbert Schildt, Java: The Complete Reference (9e), McGraw Hill Education;
2. C. Thomas Wu, An introduction to object-oriented programming with Java (5e), McGraw-Hill Education;

**COURSE OUTCOMES**

The student shall be able to:

1. Explain the OOPs concepts.
2. Describe various types of Inheritance in Java.
3. Develop robust Java applications using Packages, Exceptions.
4. Implement Java applications using Java Threads.
5. Design Java applications with various modes of Input and output

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | | 2 | | | | | | | 1 |
| CO2 | 1 | 2 | 2 | | 2 | | | | | | | 1 |
| CO3 | 1 | 2 | 2 | 2 | 2 | | | | | | | 2 |
| CO4 | 1 | 2 | 2 | 2 | 2 | | | | | 2 | | 2 |
| CO5 | 1 | 2 | 2 | 2 | 2 | | | | | 2 | | 2 |

## (A402601) RENEWABLE ENERGY SOURCES
## (Open Elective-I)

**B. Tech (ECE)**

| L | T | P | C |
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**UNIT I: GLOBAL AND NATIONAL ENERGY SCENARIO**

Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO2 reduction potential of renewable energy- concept of Hybrid systems.

**UNIT II: SOLAR ENERGY**

Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

**UNIT III: WIND ENERGY**

Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

**UNIT IV: BIO GAS**

Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermochemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

**UNIT V: OCEAN ENERGY**

Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy. Small hydro Power Plant: Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power. Geothermal Energy: Geothermal power plants, various types, hot springs and steam ejection.

**TEXT BOOKS**

1. Renewable Energy Sources / Twidell, J.W. and Weir, A./ EFN Spon Ltd., 1986.
2. Non-Conventional Energy Sources / G.D Rai/ Khanna Publishers

**COURSE OUTCOME:**

After successful completion of this course, the students can be able to:

1. Understand the importance of renewable energy sources
2. Explain the operation of solar energy system
3. Illustrate various wind energy conversion systems
4. Explain the operation Bio gas conversion
5. Explain the principle and operation of Ocean wave energy conversion.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | 1 | | | 1 | | | 2 | | |
| CO2 | 2 | 1 | 1 | 1 | | | 1 | | | 2 | | |
| CO3 | 2 | 1 | 1 | 1 | | | 1 | | | 2 | | |
| CO4 | 2 | 1 | 1 | 1 | | | 1 | | | 2 | | |
| CO5 | 2 | 1 | 1 | 1 | | | 1 | | | 2 | | |

**(A402602) BASICS OF POWER ELECTRONICS & DRIVES**
**(Open Elective-1)**

**B. Tech (ECE)**

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**UNIT I: POWER SEMICONDUCTOR DEVICES**
Power Semiconductor Devices Construction and Characteristics of Power diodes, Power Transistors, Power MOSFET, Insulated Gate Bipolar transistors (IGBTs) Introduction to Thyristor family: SCR, DIACs, TRIACs.

**UNIT II: PHASE CONTROLLED (AC TO DC) CONVERTERS**
**Principle of phase-controlled converter operation**; Operation of 1-phase half wave converter with R, RL and RLE load; 1- phase full wave converter, Bridge Configuration; Operation with R, RL, RLE load; Operation of 1-phase Semi-converter/ Half controlled converter:

**UNIT III: THREE -PHASE CONVERTERS**
**Operation of half wave converter**: Full wave fully controlled converters: Semi-controlled converter; Dual Converter: Principle and operation; Applications of AC-DC converters

**UNIT IV: DC TO DC CONVERTERS**
The chopper, Basic principle of DC chopper, Classification of DC choppers, Control strategies Basic DC-DC converter (switch regulator) topologies: Principle, operation Step-down (Buck), Step-up (Boost), Step up/down (Buck-Boost), Continuous conduction and Discontinuous conduction operation, Two zone operation, Four quadrant operation (Operating modes),

**UNIT V: POWER CONVERTERS FED DRIVES**
**Single phase separately excited drives**: Half Wave converter, Semiconverter and Fully Controlled converter based drives; Braking operation of separately excited drive Semi-converter and Fully Controlled converter based drives 3-phase separately excited drives: Half Wave converter, Semi-converter and Fully Controlled converter based drives; Principle of power control (motoring control) of separately excited and series motor with DC-DC Converter.

**TEXT BOOKS:**

1. M D Singh and K B Khanchandani, “Power electronics”, TMH, New Delhi, 2nd ed., 2007.
2. P.S. Bimbhra, “Power Electronics”, Khanna Publishers, New Delhi, 2012..
3. Muhammad H. Rashid, “Power Electronics - Circuits, Devices and Applications”, Prentice Hall of India, 3rd ed., 2003.


**REFERENCE BOOKS:**

1. VedamSubramanyam, “Power Electronics – Devices, Converters and Applications”, New Age International Publishers Pvt. Ltd., Bangalore, 2nd ed. 2006.
2. Ned Mohan, Undeland and Robbins, “Power Electronics – Converters, Applications and Design”, John Willey & sons, Inc., 3rd ed., 2003.
3. V.R.Moorthi, “Power Electronics”, Oxford University press, 2005.
4. G..K. Dubey, S.R. Doradla, A. Joshi, and R.M.K. Sinha, “Thyristorised Power Controllers”, New Age International Ltd. Publishers, 1986 (Reprint 2008).
5. P.T. Krein, “Elements of Power Electronics”, Oxford University Press, 1998.
6. G..K. Dubey, “ Fundamentals of Electrical Drives”, Narosa Publishing House, New Delhi, 2nd ed. 2001


**COURSE OUTCOMES:**
After successful completion of this course, the students can be able to:
1. Explain the construction and characteristics of Power semiconductor devices
2. Analyze the operation of single phase and three phase ac-to-dc converters.
3. Analyze various three phase converters
4. Compare the various types of dc-to-dc converters.
5. Apply the knowledge of power electronic converter for various applications.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **1** | | | | | | | **2** | | |
| **CO2** | **3** | **3** | **3** | **1** | | | | | | **2** | | |
| **CO3** | **3** | **3** | **3** | **1** | | | | | | **2** | | |
| **CO4** | **3** | **3** | **1** | **1** | | | | | | **2** | | |
| **CO5** | **3** | **3** | **1** | **2** | | | | | | **2** | | |

**(A403601) FUNDAMENTALS OF ENGINEERING MATERIALS**
**(Open Elective: 1)**

| **B. Tech (ECE)** | **L** | **T** | **P** | **C** |
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| | **3** | **0** | **0** | **3** |

**UNIT – I**
**Structure of Metals:** Crystallography, Miller's indices, Packing Efficiency, Density calculations. Grains and Grain Boundaries. Effect of grain size on the properties. Determination of grain size by different methods. Constitution of Alloys: Necessity of alloying, Types of solid solutions, Hume - Rothery rules, Intermediate alloy phases.

**UNIT –II**
**Phase Diagrams:** Construction and interpretation of phase diagrams, Phase rule. Lever rule. Binary phase Diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

**UNIT – III**
**Steels:** Iron-Carbon Phase Diagram and Heat Treatment: Study of Fe-Fe3C phase diagram. Construction of TTT diagrams. Annealing, Normalizing, Hardening and Tempering of steels, Hardenability. Alloy steels.

**UNIT – IV**
**Cast Irons:** Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron. Engineering Materials-III: Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Al-Cu phase diagram, Titanium and its alloys.

**UNIT – V**
**Ceramics, Polymers and Composites:** Crystalline ceramics, glasses, cermets: structure, properties and applications. Classification, properties and applications of composites. Classification, Properties and applications of Polymers.

**TEXT BOOKS:**
1. Material Science and Metallurgy/ Kodgire
2. Essentials of Materials Science and engineering / Donald R. Askeland / Thomson.

**REFERENCE BOOKS:**
1. Introduction to Physical Metallurgy / Sidney H. Avner.
2. Materials Science and engineering / William and callister.
3. Elements of Material science / V. Rahghavan

**COURSE OUTCOMES:**
At the end of the course the students are able to:
1. Identify the crystalline structure of steel.
2. Understand the theory of time temperature and transformation
2. Determine of different uses of heat treatment in steel.
3. Distinguish between the various forms of steel.
4. Understand the properties of non-ferrous alloys and uses of composite materials.

**CO-PO MAPPING:**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | | | | **1** | | | | | | **1** |
| **CO2** | **3** | **2** | | | | **1** | | | | | | **1** |
| **CO3** | **3** | **2** | | | | **1** | | | | | | **1** |
| **CO4** | **3** | **2** | | | | **1** | | | | | | **1** |
| **CO5** | **3** | **2** | | | | **1** | | | | | | **1** |

## (A403602) BASICS OF THERMODYNAMICS
## (Open Elective: 1)

**B. Tech (ECE)**

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**UNIT – I**

**Introduction: Basic Concepts:** System, Control Volume, Surrounding, Boundaries, universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle, Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility.

**UNIT - II**

Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale.

**UNIT – III**

**First and Second Laws of Thermodynamics**: First Law: Cycle and Process, Specific Heats (cpand cv), Heat interactions in a Closed System for various processes, Limitations of First Law,Concept of Heat Engine (H.E.) and Reversed H.E. (Heat Pump and Refrigerator), Efficiency/COP, Second Law: Kelvin-Planck and Clausius Statements, Carnot Cycle, Carnot Efficiency, Statement of Clausius Inequality, Property of Entropy, T-S and P-V Diagrams

**UNIT - IV**

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const.

Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet BulbTemperature, Dew point Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation, Psychrometric chart

**UNIT - V**

**Power Cycles:** Otto, Diesel cycles - Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis

**Refrigeration Cycles:** Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

**TEXT BOOKS:**

1. Basic Engineering Thermodynamics / PK Nag / Mc Graw Hill
2. Engineering Thermodynamics / chattopadhyay/ Oxford

**REFERENCE BOOKS:**

1. Thermodynamics for Engineers / Kenneth A. Kroos, Merle C. Potter/ Cengage
2. Thermodynamics /G.C. Gupta /Pearson

**COURSE OUTCOMES:**

After completing this course, the students will be able to

1. Apply energy balance to systems and control volumes, in situations involving heat and work interactions.
2. Evaluate changes in thermometric properties of substances.
2. Apply the laws of thermodynamics to different systems.
3. Understand the psychrometric properties of air
4. Compare differ**e**nt air standard cycles.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | - | 2 | - | - | 2 |
| CO2 | 3 | 3 | 2 | 3 | 3 | 1 | 2 | - | 2 | - | - | 2 |
| CO3 | 3 | 3 | 1 | 3 | 1 | 1 | 2 | - | 2 | - | - | 2 |
| CO4 | 3 | 3 | 1 | 3 | 1 | 1 | 2 | - | 2 | - | - | 2 |
| CO5 | 3 | 3 | 1 | 3 | 2 | 1 | 2 | - | 1 | - | - | 2 |

## (A401601) DISASTER PREPAREDNESS & PLANNING MANAGEMENT
## (Open Elective – I)

**B.Tech (ECE)**

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**UNIT - I**

Introduction: - Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation.

**UNIT - II**

Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

**UNIT - III**

Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

**UNIT - IV**

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

**UNIT - V**

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

**TEXT BOOKS:**


1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
3. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation


**REFERENCE:**


1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003


**COURSE OUTCOMES:**

On completion of the course students will be able to

1. The application of Disaster Concepts to Management
2. Analyzing Relationship between Development and Disasters.
3. Ability to understand Categories of Disasters
4. Realization of the responsibilities to society
5. Understand Impacts of Disasters Key Skills Understand

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| **CO2** | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| **CO3** | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| **CO4** | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| **CO5** | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |

## (A401602) ENVIRONMENTAL IMPACT ASSESSMENT
**(Open Elective – I)**

**B.Tech (ECE)**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**UNIT - I:**
Introduction: The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

**UNIT- II**
EIA Methodologies: Environmental attributes -Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. EIA review- Baseline Conditions - Construction Stage Impacts, post project impacts.

**UNIT- III**
Environmental Management Plan: EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal and Appraisal.

**UNIT- IV**
Environmental Legislation and Life cycle Assessment: Environmental laws and protection acts, Constitutional provisions-powers and functions of Central and State government, The Environment (Protection) Act 1986, The Water Act 1974, The Air act 1981, Wild Life act 1972, Guidelines for control of noise, loss of biodiversity, solid and Hazardous waste management rules. Life cycle assessment: Life cycle analysis, Methodology, Management, Flow of materials-cost criteria case studies.

**UNIT- V**

Case Studies: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air ports.

**TEXT BOOKS:**

1. Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007
2. Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002

**REFERENCE BOOKS:**

1. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
2. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996

**COURSE OUTCOMES:** On completion of the course students will be able to
1. Identify the attributes to be considered for EIA
2. Assess impact of deforestation
3. Interpret impact prediction, significance of soil quality and mitigation
4. Conduct environmental audit and prepare reports
5. Illustrate environmental policies and provisions

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO2 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO3 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO4 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO5 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |

## (A400601) BASICS OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT
## (Open Elective – I)

**B. Tech (ECE)**

| L | T | P | C |
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**Unit – I: Understanding Supply Chain:** Objectives of a Supply Chain, Importance, Stages of Supply Chain, Value Chain Process, Cycle View of Supply Chain Process, Key Issues in SCM, Logistics & SCM, Supply Chain Drivers and Obstacles, Supply Chain Strategies, Strategic Fit, Best Practices in SCM, Obstacles of Streamlined SCM, Green Supply Chain Management, Supply Chain Sustainability.

**Unit – II: Logistics:** Evolution, Objectives, Components and Functions of Logistics Management, Difference between Logistics and Supply Chain, Distribution related Issues and Challenges. Gaining Competitive Advantage through Logistics Management, Transportation: Functions, Costs, and Mode of Transportation Network and Decision, Models, Containerization, Cross Docking, Reverse Logistics. Outsourcing: Nature and Concept, Strategic Decision to Outsourcing, Third-party Logistics (3PL), Fourth-party Logistics (4PL).

**Unit – III: Designing the Supply Chain Network:** Designing the Distribution Network, Role of Distribution, Factors Influencing Distribution, Design Options, e-Business and its Impact, Distribution Networks in Practice, Network Design in the Supply Chain, Role of Network, Factors Affecting the Network Design Decisions, Modeling for Supply Chain.

**Unit – IV: Supply Chain Performance**: Bullwhip Effect and Reduction, Performance Measurement: Dimension, Tools of Performance Measurement, SCOR Model. Demand Chain Management, Global Supply Chain, Challenges in Establishing Global Supply Chain, Factors that influence Designing Global Supply Chain Network.

**Unit – V: Coordination in a Supply Chain:** Importance of Coordination, Lack of Supply Chain Coordination and the Bullwhip Effect, Obstacles to Coordination, Managerial Levels, Building Partnerships and Trust, Continuous Replenishment and Vendor Managed Inventories, Collaborative Planning, Forecasting and Replenishment. Role of Information Technology in Supply Chain, Supply Chain 4.0.

**REFERENCE BOOKS:**


1. IMT Ghaziabad, Advanced Supply Chain Management, Sage Publications, 2021.
2. Rajat K. Basiya, Integrated Supply Chain Management, Sage Publications, 2020.
3. K Sridhara Bhat, Logistics & Supply Chain Management, HPH,1e,2017.
4. Chopra, Sunil, Meindl, Peter and Kalra, D. V., Supply Chain Management: Strategy, Planningand Operation; Pearson Education, 6e, 2016.
5. Altekar, Rahul V, Supply Chain Management: Concepts and Cases; PHI Learning ,1e,2005.
6. Donald J. Bowersox and David J. Closs, Logistical Management" The Integrated Supply Chain Process, TMH, 2017
7. Edward J Bradi, John J Coyle, A Logistics Approach to Supply Chain Management, Cengage Learning, New Delhi, 2012
8. Sunil Chopra and Peter Meindl, Supply chain Management: Strategy, Planning and Operation, Pearson Education, New Delhi 2013


**COURSE OUTCOMES:**

Students will be able to

1. Understand the cyclical perspective of logistics and supply chain process.
2. Learn about the distribution, transportation, warehousing related issues and challenges in supply chain.
3. Appreciate the significance of network design in the supply chain.
4. Gain knowledge of various models / tools of measuring the Supply Chain Performance.
5. Appreciate the role of coordination and technology in supply chain management.

**CO-PO MAPPING**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | - | - | - | 2 | 2 | 2 | 2 | - | - | - |
| **CO2** | 3 | 2 | 3 | - | - | 2 | 2 | - | - | 3 | - | 2 |
| **CO3** | - | 3 | 3 | 2 | 3 | 3 | 2 | - | 3 | - | - | - |
| **CO4** | - | - | - | 2 | 3 | 3 | - | - | - | - | 3 | - |
| **CO5** | - | - | - | - | 3 | - | 2 | 2 | 3 | - | 3 | 2 |

**(A400602) INDUSTRIAL RELATIONS**
**(Open Elective – I)**

**B. Tech (ECE)**

| L | T | P | C |
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**UNIT-I**

**Overview of Industrial Relations**: Meaning & Objectives, Scope, Importance, Approaches to Industrial Relations – Role of Three Actors to Industrial Relations – State, Employer & Employees, causes for poor IR, Developing sound IR. Ethical approach to IR: Idea of trusteeship – Principles & features, Code of conduct. The industrial policy resolution 1991.ILO in IR. Collective Bargaining (Perspective, Bargaining Structure, Procedure and Machinery for Collective Bargaining) – The Bargaining Process – Strengths and Skills

**UNIT-II**

**Laws on Industrial Relations:** The Trade Union Act 1926: Role & function of Trade union, Registration, Rights and privileges, Duties, Dissolution of Trade Unions.

Industrial Disputes Act 1947: Strike, Lockout, Layoff, Retrenchment, Grievance and disciplinary procedures, Penalties, Causes, Tripartite & Bipartite Bodies, Grievance Procedure.

Industrial Employment Act, 1946: Information in standing orders, Procedure for submission

**UNIT-III**

**Laws on Wages, Welfare and Social Security:** Minimum Wages Act, 1948, Payment of Wages Act, 1936, Payment of Bonus Act, 1965 Laws on Labour Welfare: The Workmen's Compensation Act, 1923, The Employees' State Insurance Act,1948, The Maternity Benefit Act, 1961.Laws on Social Security: The Employee's Provident Fund Act, 1952, The Payment of Gratuity Act, 1972.

**UNIT-IV**

**Laws on Working Conditions:** Factories Act, 1948: Health, Welfare, Safety, Working Hours, Annual Leave with wages, Registers and Records. Contract Labour (Regulation and Abolition) Act, 1986 – Child Labour (Prohibition and Regulation Act, 1986)

**UNIT-V**

**Quality of Work Life and Quality Circles:** Meaning of quality of work life – Quality Circles- Objectives- Process, Structure and problems- workers participation in management and quality circles – Concept of empowerment.

**SUGGESTED READING:**


1. ArunMonappa (2020). Industrial Relations. New Delhi: Tata McGraw- Hill Publishing companyLtd.
2. Mamoria C.B, Mamoria, G. (2021). Dynamics of Industrial Relations. New Delhi: HimalayanPublications,
3. Padhi,P.K.(2012).Labour&IndustrialLaws.NewDelhi:PHILearningP.Ltd.
4. Kapoor, N.D. (2014). Elements of Mercantile Law. New Delhi: S.Chand&Co.
5. Subramani, P N. &Rajendran, G. (2001). Human Resources Management and Industrial Relations. New Delhi: Himalaya PublishingHouse.
6. Pylee, P V. & A Simon George. (2007). Industrial relations and personnel Management. New Delhi: Vikas Publishing House Pvt. Ltd., NewDelhi.
7. Verma, P. (1991). Management of Industrial Relations Reading and cases. Oxford and IBHpublications


**COURSE OUTCOMES:**

Students will be able to

1. Access the concept and Scope of Industrial Relations and its resolution.
2. Outline the knowledge towards Trade unions, Industrial disputes and Grievance Procedure.
3. Identify various Laws on Wages, Welfare and Social Security.
4. Illustrate rules and regulations of working conditions.
5. Enlighten on quality standards in industry.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | - | 2 | 2 | 3 | | - | - | - |
| CO2 | - | - | - | - | - | 2 | 2 | 3 | 2 | 2 | - | - |
| CO3 | 1 | - | - | - | - | - | - | - | 2 | 2 | - | 3 |
| CO4 | - | - | - | - | - | 2 | 2 | 2 | 2 | - | - | - |
| CO5 | - | - | - | - | - | 2 | - | - | 3 | - | - | - |

**(A404603) SENSORS & TRANSDUCERS**
**(Open Elective-II)**

**B.Tech(ECE)**

| L | T | P | C |
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**Unit – I: Introduction:** Definition, principle of sensing & transduction, classification. **Mechanical and Electromechanical sensor:** Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity. Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesive, rosettes. Inductive sensor: common types- Reluctance change type, Mutual inductance change type, Magnetostrictive type, material, construction and input output variable, Ferromagnetic plunger type, short analysis.

**Unit – II: Capacitive sensors:** variable distance-parallel plate type, variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type, calculation of sensitivity, Proximity sensor. Stretched diaphragm type: microphone, response characteristics. Piezoelectric element: piezoelectric effect, charge and voltage co-efficient, crystal model, materials, natural & synthetic type, their comparison, force & stress sensing, ultrasonic sensors.

**Unit – III: Thermal sensors:** Resistance change type: RTD materials, tip sensitive & stem sensitive type, Thermistor material, shape, ranges and accuracy specification. Thermo emf sensor: types, thermoelectric power, general consideration, Junction semiconductor type IC and PTAT type. Radiation sensors: types, characteristics and comparison, Pyro electric type.

**Unit – IV: Magnetic sensors:** Sensor based on Villari effect for assessment of force, torque, proximity, Wiedemann effect for yoke coil sensors, Thomson effect, Hall effect, and Hall drive, performance characteristics. Radiation sensors: LDR, Photovoltaic cells, photodiodes, photo emissive cell types, materials, construction, response. Geiger counters, Scintillation detectors.

**Unit – V: Film Sensors:** Thick film and thin film types, Electroanalytic sensors – Electrochemical cell, Polarization types, and membrane electrode types. Biosensors, Smart/Intelligent sensors, Nano-sensors, Nano-tube sensors, molecular and quantum sensors.

**TEXT BOOKS:**

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI
2. Instrument transducers, H.K.P. Neubert, Oxford University press.
3. Measurement systems: application & design, E.A.Doebelin, McGraw Hill.

**REFERENCE BOOKS:**

1. Sensor and Transducers, Third Edition, Ian Sinclair, Newnes.
2. Sensor Technology, Hand Book, JON S. Wilson, Newnes.ELSEVIER.
3. Sensor and Transducers, Characteristics, Applications, Instrumentation, Interfacing, Second Edition, M.J.Usher and D.A.Keating, MACMILLAN Press Ltd.

**COURSE OUTCOMES:**

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

1. Explain the basic concepts of mechanical and electromechanical sensors, their electrical characteristics.
2. Analyze various capacitor sensors, ultrasonic sensors their electrical characteristics.
3. Compare and elaborate various thermal sensors, principle of operation.
4. Distinguish various magnetic sensors based on their operations, radiation sensors and their operation.
5. Analyze various film sensors and operation of different nano sensors and their applications.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | 1 |
| CO2 | 3 | 2 | | | | | | | | | | 1 |
| CO3 | 3 | 2 | | | | | | | | | | 1 |
| CO4 | 3 | 2 | | | | | | | | | | 1 |
| CO5 | 3 | 2 | | | | | | | | | | 1 |

## (A404604) IMAGE PROCESSING
## (Open Elective-II)

**B.Tech (ECE)**

| L | T | P | C |
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**Unit- I: Digital Image Fundamentals**
Digital Image fundamentals, Components of Digital Image Processing, Sampling and Quantization, Relationship between pixels.
**Image Transforms:** 2-D FFT, Properties, Walsh transform, Hadamard Transform, Discrete Cosine Transform, Haar 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, image Smoothing & Sharpening
**Image Enhancement (Frequency Domain)**
Filtering in Frequency domain, obtaining frequency domain filters from spatial filters, generating filters directly in the frequency domain, image Smoothing & Sharpening.

**Unit- III: Image Restoration**
Degradation model, Algebraic approach to restoration, Inverse filtering, least mean square filters, Constrained Least Squares Restoration.

**Unit- IV: Image Segmentation**
Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation.
**Morphological Image Processing:** Dilation and Erosion, Structuring Element Decomposition, 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, Rechard E. Woods, 3rd edition. Pearson, 2008
2. Digital Image Processing – S. Jayaraman, S Esakkirajan, T Veerakumar- TMH, 2010

**REFERENCE BOOKS:**
1. Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E woods and Steven L. Eddings, 2nd Edition, TMH, 2010.
2. Fundamentals of Digital Image Processing – A. K. Jain, PHI, 1989.
3. Digital Image processing and Computer vision – Somka, Hlavac, Boyle Cengage learning (Indian edition) 2008.
4. Introductory Computer Vision Imaging Techniques and Solutions – Adrian low, 2008, 2nd Edition.
5. Introduction to Image Processing & Analysis – John C. Russ, J. Christian Russ, CRC press, 2010.

**COURSE OUTCOMES:**
At the end of the course the student will be able to:
1. Describe the fundamentals of digital image processing.
2. Distinguish between spatial domain enhancement and frequency domain enhancement.
3. Explain various image degradation models for image restoration.
4. Analyze the image restoration and segmentation methods.
5. Discriminate between lossless and lossy compression techniques.

**CO- PO MAPPING***:*

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | | | | | | | 1 |
| CO2 | 3 | 3 | | | | | | | | | | 1 |
| CO3 | 3 | 3 | 2 | | | | | | | | | 1 |
| CO4 | 3 | 3 | 2 | | | | | | | | | 1 |
| CO5 | 3 | 3 | 2 | | | | | | | | | 1 |

## (A405601) FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS
## (Open Elective-II)

| | L | T | P | C |
|---|---|---|---|---|
| **B. Tech (ECE)** | **3** | **0** | **0** | **3** |

**UNIT-I**

Introduction to Databases: Introduction, Traditional File-Based Systems, Database Approach, Roles in the Database Environment, Advantages and Disadvantages of DBMS, The Three-Level ANSI-SPARC Architecture, Database Languages, Data Models, Functions of a DBMS, Components of DBMS. Relational Model: Introduction, Terminology, Integrity Constraints, Views. The Relational Algebra: Unary Operations, Set Operations, Join Operations, Division Operation, Aggregation and Grouping Operations.

**UNIT–II**

SQL: The ISO SQL Data Types, Integrity Enhancement Feature–Domain Constraints, Entity Integrity, Referential Integrity, General Constraints, Data Definition–Creating a Database, creating a Table, changing a Table Definition, removing a Table, Creating an Index, Removing an Index, Views–Creating a View, Removing a View, View Resolution, Restrictions on Views, View Updatability 'WITH CHECK OPTION', Advantages and Disadvantages of Views, View Materialization.

**UNIT–III**

SQL: Introduction, Data Manipulation–Simple Queries, Sorting Results, Using the SQL Aggregate Functions, Grouping Results, Sub-queries, ANY and ALL, Multi-table Queries, EXISTS and NOT EXIST, Combining Result Tables, Database Updates.

**UNIT-IV**

Advanced SQL: The SQL Programming Language–Declarations, Assignments, Control Statements, Exceptions, Cursors, Subprograms, Stored Procedures, Functions, and Packages, Triggers, Recursion.

**UNIT–V**

Normalization: The Purpose of Normalization, How Normalization Supports Database Design, Data Redundancy and Update Anomalies, Functional Dependencies in brief, The Process of Normalization,1NF, 2NF, 3NF, BCNF.

**TEXTBOOKS:**

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill Education, 2003
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, McGraw-Hill Education

**REFERENCE BOOKS:**

1. Thomas M. Connolly, Carolyn E. Begg, Database Systems–A Practical Approach to Design, Implementation, and Management (6e), Pearson publisher
2. RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Pearson publisher

**COURSE OUTCOMES:**

Students shall be able to

1. Describe Database Management System Architecture.
2. Create, update, modify Relational Database Objects.
3. Manipulate data in Relational Database
4. Develop PL/SQL programs using Cursors, Subprograms, Stored Procedures, Functions, and Packages, Triggers.
5. Explain the purpose of normalization and types Normal forms.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | | | | | | | | | | |
| **CO2** | 2 | 2 | 2 | 2 | 2 | | | | | | | |
| **CO3** | 2 | 2 | 2 | 2 | 2 | | | | | | | |
| **CO4** | 2 | 2 | 2 | 2 | 2 | | | | | | | |
| **CO5** | 2 | 2 | 2 | 2 | 2 | | | | | | | |

**(A405605) WEB PROGRAMMING**
**(Open Elective-II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B. Tech (ECE)** | **3** | **0** | **0** | **3** |

**Unit-I**

Structuring Documents for the Web: Introducing HTML and XHTML, Basic Text Formatting, Presentational Elements, Phrase Elements, Lists, Editing Text, Core Elements and Attributes, Attribute Groups Links and Navigation: Basic Links, Creating Links with the **< a>** Element, Advanced E- mail Links. Images, Audio, and Video: Adding Images Using the **<img>** Element, Using Images as Links Image Maps, Choosing the Right Image Format, Adding Flash, Video and Audio to your web pages. Tables: Introducing Tables, Grouping Section of a Table, Nested Tables, Accessing Tables Forms: Introducing Forms, Form Controls, Sending Form Data to the Server Frames: Introducing Frameset, <frame>Element, Creating Links Between Frames, Setting a Default Target Frame Using **<base>**Element, Nested Framesets, Inline or Floating Frames with **<iframe>**. Changing font size, color of text using <font> Element, scrolling text/image using <marquee> Element

**Unit-II**

**Cascading Style Sheets:** Introducing CSS, where you can Add CSS Rules. **CSS Properties**: Controlling Text, Text Formatting, Text Pseudo Classes, Selectors, Lengths, Introducing the Box Model. **More Cascading Style Sheets:** Links, Lists, Tables, Outlines, the: focus and: activate Pseudo classes Generated Content, Miscellaneous Properties, Additional Rules, Positioning and Layout with CSS, **Page Layout**: Understating the Site's Audience, Page Size, Designing Pages, Coding your Design, Developing for Mobile Devices. **Design Issues:** Typography, Navigation, Tables, Forms.

**Unit-III**

**Learning JavaScript:** How to Add Script to Your Pages, the Document Object Model, Variables, Operators, Functions, Control Statements, Looping, Events, Built- In Objects, Working with JavaScript: Practical Tips for Writing Scripts, Form Validation, Form Enhancements, JavaScript Libraries. Putting Your site on the web: Meta tags, testing your site, Taking the Leap to Live, Telling the World about your site, Understanding your visitors.

**Unit-IV**

**XML** - Introduction, XML Basics, Structuring Data, XML Namespaces, Document Type Definitions (DTDs), W3C XML Schema Documents, XML Vocabularies, Extensible Style sheet Language and XSL Transformations, Document Object Model (DOM).

**Unit-V**

Ajax-Enabled Rich Internet Applications: introduction, history of Ajax, traditional web applications Vs Ajax Applications, RIAs with Ajax, Ajax example using XML HttpRequest object, XML and DOM, creating full scale Ajax-enabled application, Dojo Toolkit.

**TEXTBOOK:**

1. Jon Duckett, Beginning HTML, XTML, CSS and JavaScript
2. Dietel and Dietel : "Internet and World Wide Web - How to Program", 5th Edition, PHI/Pearson Education, 2011.

**REFERENCE BOOKS:**

1. Chris Bates, Web Programming
2. M. Srinivasan, Web Technology: Theory and Practice
3. Achyut S. Godbole, AtulKahate, Web Technologies
4. Kogent Learning Solutions Inc, Web Technologies Black Book
5. Ralph Moseley and M. T. Savaliya, Developing Web Applications

**COURSE OUTCOMES**

Students shall be able to

1. write well-structured, easily maintained, standards-compliant, accessible HTML code.
2. write well-structured, easily maintained, standards-compliant CSS code to present HTML pages in different way
3. use JavaScript to add dynamic content to pages.
4. effectively debug JavaScript code, making use of good practice and debugging tools.
5. use JavaScript to access and use web services for dynamic content (AJAX, JSON, etc.)

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | **2** | **2** | **2** | **2** | | | | | | | **2** |
| **CO2** | | **2** | **2** | **2** | **2** | | | | | | | **2** |
| **CO3** | | **2** | **2** | **2** | **2** | | | | **2** | | | **2** |
| **CO4** | | **2** | **3** | **3** | **3** | | | | **2** | **2** | | **3** |
| **CO5** | | **2** | **3** | **3** | **3** | | | | **2** | **2** | | **3** |

## (A402603) ELECTRIC VEHICLE TECHNOLOGY
## (Open Elective-II)

| | L | T | P | C |
|---|---|---|---|---|
| **B. Tech (ECE)** | **3** | **0** | **0** | **3** |

**Unit-I – Introduction to Hybrid Electric Vehicle:**
Review of Conventional Vehicle: Introduction to Hybrid Electric Vehicles: Types of EVs, Hybrid Electric Drive-train, Tractive effort in normal driving

**Unit-II – Electric Drives:**
Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains, Electric Propulsion unit, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, switched reluctance motor.

**Unit- III– 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, Hybridization of different energy storage devices. Sizing the drive system, Design of Hybrid Electric Vehicle and Plug-in Electric Vehicle.

**Unit-IV- Energy Management System:**
Energy Management Strategies, Automotive networking and communication, EV charging standards, V2G, G2V, V2B, V2H. Business: E-mobility business, electrification challenges, Business- E-mobility business, electrification challenges.

**Unit- V – Mobility and Connectors:**
Connected Mobility and Autonomous Mobility- case study Emobility Indian Roadmap Perspective. Policy: EVs in infrastructure system, integration of Evs in smart grid, social dimensions of Evs. Connectors- Types of EV charging connector, North American EV Plug Standards, DC Fast Charge EV Plug Standards in North America, CCS (Combined Charging System), CHAdeMO, Tesla, European EV Plug Standards,

**TEXT BOOKS**

1. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003
2. Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press, 2010.

**REFERENCE BOOKS:**

1. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wiley and Sons, 2012
2. Tariq Muneer and Irene IllescasGarcía, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2017
3. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles", Springer, 2013

**COURSE OUTCOMES:**

On completion of the course, students will be able to

1. Explain Hybrid Electric Vehicle technology
2. Understand the operation of various Electric Drives used in Hybrid Electric Vehicle
3. Illustrate various energy storage techniques in Hybrid Electric Vehicle
4. Gain Knowledge on Energy Management Strategies in Hybrid Electric Vehicle
5. Understand the different types of Mobility and Connectors in Hybrid Electric Vehicle

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | | | | | | | | **2** | | |
| **CO2** | **3** | **3** | | | | | | | | **2** | | |
| **CO3** | **3** | **3** | | | | | | | | **2** | | |
| **CO4** | **3** | **3** | | | | | | | | **2** | | |
| **CO5** | **3** | **3** | | | | | | | | **2** | | |

**(A402604) BASICS OF POWER PLANT ENGINEERING**
**(Open Elective –II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B. Tech (ECE)** | **3** | **0** | **0** | **3** |

**UNIT - I Coal Based Thermal Power Plants:** Basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems.

**UNIT - II Gas Turbine and Combined Cycle Power Plants**: Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

**UNIT - III Basics of Nuclear Energy Conversion:** Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

**UNIT - IV Hydroelectric Power Plants:** Classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems

**UNIT - V Energy, Economic and Environmental Issues:** Power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

**TEXT BOOKS:**

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.

**REFERENCE BOOK**:

1. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

**COURSE OUTCOMES**

On completion of the course, students will be able to

1. Understand the layout of and various components of Coal Based Thermal Power Plants
2. Understand the operation of Gas Turbine and Combined Cycle Power Plants
3. Illustrate the Nuclear Energy Conversion system
4. Explain the operation and Classification, typical layout and components of Hydroelectric Power Plants
5. Understand the different parameters associated with Energy, Economic and Environmental Issues

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 1 | | | | | 2 | | | |
| **CO2** | 2 | 2 | 2 | 1 | | | | | 2 | | | |
| **CO3** | 3 | 3 | 3 | 1 | | | | | 2 | | | |
| **CO4** | 3 | 3 | 3 | 1 | | | | | 2 | | | |
| **CO5** | 2 | 2 | 2 | 1 | | | | | 2 | | | |

**(A403603) FUNDAMENTALS OF MANUFACTURING PROCESSES**
**(Open Elective: II)**

**B. Tech (ECE)**

| L | T | P | C |
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**UNIT – I**

**Casting:** Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands. Methods of Melting - Crucible melting and cupola operation – Defects in castings; Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design.

**UNIT – II**

**Welding:** Classification – Types of welds and welded joints; Gas welding - Types, oxy-fuel gas cutting. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding. Inert Gas Welding - TIG Welding, MIG welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

**UNIT – III**

Hot working, cold working, strain hardening, recovery, recrystallisation, and grain growth. Stamping, forming, and other cold working processes. Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning. Types of presses and press tools. Forces and power requirement in the above operations.

**UNIT – IV**

**Extrusion of Metals:** Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion

**UNIT – V**

**Forging Processes:** Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects –cold forging, swaging, Forces in forging operations.

**TEXT BOOKS:**

1. Manufacturing Technology / P.N. Rao / Mc Graw Hill
2. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson.

**REFERENCE BOOKS:**

1. Metal Casting / T.V Ramana Rao / New Age
2. Métal Fabrication Technology/ Mukherjee/PHI

**COURSE OUTCOMES:**

On completion of the course, students will be able to

1. Understand the idea for selecting materials for patterns.
2. Learn different types and allowances of patterns used in casting and analyze the components of moulds.
3. Design core, core print and gating system in metal casting processes Understand arc, gas, solid state and resistance welding processes.
4. Develop process-maps for metal forming processes using plasticity principles.
5. Identify the effect of process variables to manufacture defect free products.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 1 | 1 | | - | - | - | 1 | 1 |
| CO2 | 2 | 2 | 2 | 2 | | | 1 | - | - | - | 1 | 1 |
| CO3 | 2 | 2 | 2 | 2 | | | 1 | - | - | - | 1 | 1 |
| CO4 | 2 | 2 | 2 | 2 | | | 1 | - | - | - | 1 | 1 |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 | | - | - | - | 1 | 1 |

**(A403604) FUNDAMENTALS OF AUTOMOBILE ENGINEERING**
**(Open Elective: II)**

**B. Tech (ECE)**

| L | T | P | C |
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**Unit – I**

**Introduction:** Components of four-wheeler automobile – chassis and body – power unit – power transmission rear wheel drive, front wheel drive, 4-wheel drive – types of automobile engines, engine construction – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, re boring, decarburization

**Unit – II**

**Fuel System:** S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pumps – Carburetor – types – air filters – petrol injection.
**C.I. Engines:** Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, Alternative fuels for Automobiles-injection, Classification, Properties, Hybrid vehicles injection timing, testing of fuel, pumps.
**Cooling System:** Cooling Requirements, Air Cooling, Liquid Cooling and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporating cooling – pressure sealed cooling – antifreeze solutions.

**Unit – III**

**Electrical System:** Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.
**Ignition System:** Function of an ignition system, battery ignition system, constructional features of storage battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

**Unit – IV**

**Transmission System:** Clutches, principle, types- cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – Gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter.
Propeller shaft – Hoatch – Kiss drive, Torque tube drive universal joint, differential rear axles – types – wheels and tyres.
**Steering System:** Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism

**Unit-V**

**Suspension System:** Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.
**Braking System:** Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

**TEXT BOOKS**

1. Automobile Engineering, Vol. 1 & Vol. 2/ Kripal Singh
2. Automobile Engineering, Vol. 1 & Vol. 2,by K.M Gupta,Umesh publication

**REFERENCE BOOKS**

1. A System approach to Automotive Technology by Jack Erjavec YesDee publishing Pvt Ltd.
2. Automobile Engineering / William Crouse
3. Automotive Mechanics / Heitner
4. Alternative fuels of Automobiles by P. Rami Reddy, Frontline publications.

**COURSE OUTCOMES:**

By undergoing this course, a student shall be able to

1. Identify power generation, transmission and control mechanisms in an automobile
2. Manipulate the chemical, thermal, mechanical and electrical energies in an automobile
3. Infer the interaction between subsystems
4. Analyze how transmission system works
5. Learn different components of suspension systems.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | 1 | 1 | 1 | 3 | 3 | - | - | - | - | 3 |
| CO2 | 3 | - | 1 | 1 | 1 | 3 | 3 | - | - | - | - | 3 |
| CO3 | 3 | - | 3 | 2 | 1 | 3 | 3 | - | - | - | - | 3 |
| CO4 | 3 | - | 3 | 2 | 1 | 3 | 3 | - | - | - | - | 3 |
| CO5 | 3 | - | 1 | 1 | 1 | 3 | 3 | - | - | - | - | 3 |

**(A401603) REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEMS**
**(Open Elective: II)**

**B.Tech (ECE)**

| L | T | P | C |
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**UNIT - I:**

Introduction: The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

**UNIT- II**

EIA Methodologies: Environmental attributes -Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. EIA review- Baseline Conditions - Construction Stage Impacts, post project impacts.

**UNIT- III**

Environmental Management Plan: EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal and Appraisal.

**UNIT- IV**

Environmental Legislation and Life cycle Assessment: Environmental laws and protection acts, Constitutional provisions-powers and functions of Central and State government, The Environment (Protection) Act 1986, The Water Act 1974, The Air act 1981, Wild Life act 1972, Guidelines for control of noise, loss of biodiversity, solid and Hazardous waste management rules. Life cycle assessment: Life cycle analysis, Methodology, Management, Flow of materials-cost criteria case studies.

**UNIT- V**

Case Studies: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air ports.

**TEXT BOOKS:**

1. Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007
2. Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002

**REFERENCE BOOKS:**

1. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
2. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996

**COURSE OUTCOMES:**

On completion of the course students will be able to

1. Illustrate the principles of photogrammetry
2. Make use of remote sensing process
3. Utilize GIS principles in real life
4. Explain the concepts of topology, OBVDM and tomography
5. Develop the geospatial data model with various file formats

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO2 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO3 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO4 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO5 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |

**(A401604) SOLID WASTE MANAGEMENT**
**(Open Elective-II)**

**B.Tech (ECE)**

| L | T | P | C |
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**UNIT - I**

Solid Waste: Definitions, Types of solid wastes, sources of solid wastes, Characteristics, and perspectives; properties of solid wastes, Sampling of Solid wastes, Elements of solid waste management - Integrated solid waste management, Solid Waste Management Rules 2016.

**UNIT - II**

Engineering Systems for Solid Waste Management: Solid waste generation; on-site handling, storage and processing; collection of solid wastes; Stationary container system and Hauled container systems – Route planning - transfer and transport; processing techniques;

**UNIT- III**

Engineering Systems for Resource and Energy Recovery: Processing techniques; materials recovery systems; recovery of biological conversion products – Composting, pre and post processing, types of composting, Critical parameters, Problems with composing - recovery of thermal conversion products; Pyrolisis, Gasification, RDF - recovery of energy from conversion products; materials and energy recovery systems.

**UNIT- IV**

Landfills: Evolution of landfills – Types and Construction of landfills – Design considerations – Life of landfills- Landfill Problems – Lining of landfills – Types of liners – Leachate pollution and control – Monitoring landfills – Landfills reclamation.

**UNIT- V**

Hazardous waste Management: – Sources and characteristics, Effects on environment, Risk assessment – Disposal of hazardous wastes – Secured landfills, incineration - Monitoring – Biomedical waste disposal, E-waste management, Nuclear Wastes, Industrial waste Management

**TEXT BOOKS:**

1. Tchobanoglous G, Theisen H and Vigil SA 'Integrated Solid Waste Management, Engineering Principles and Management Issues' McGraw-Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, 'Solid Waste Engineering' Brooks/Cole Thomson Learning Inc., 2002.

**REFERENCE BOOKS:**

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, 'Environmental Engineering', McGraw Hill Inc., New York, 1985.
2. Qian X, Koerner RM and Gray DH, 'Geotechnical Aspects of Landfill Design and Construction' Prentice Hall, 2002.

**COURSE OUTCOMES:** On completion of the course students will be able to

1. Explain the sources of solid waste and its impact
2. Describe the process of solid waste and its management
3. Illustrate the process of handling hazardous wastes
4. Classify various biomedical waste management systems
5. Apply e-waste management techniques

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO2 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO3 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO4 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO5 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |

**(A400603) ENTREPRENEURSHIP**
**(Open Elective-II)**

| | L | T | P | C |
|---|---|---|---|---|
| **B. Tech (ECE)** | **3** | **0** | **0** | **3** |

**Unit I:**
**Understanding Entrepreneurial Mindset-** The revolution impact of entrepreneurship- The evolution of entrepreneurship- Approaches to entrepreneurship- Process approach- Twenty first centaury trends in entrepreneurship.

**Unit II:**
**The individual entrepreneurial mind-set and Personality**- The entrepreneurial journey- Stress and the entrepreneur- the entrepreneurial ego- Entrepreneurial motivations. Corporate Entrepreneurial Mindset- the nature of corporate entrepreneur- conceptualization of corporate entrepreneurship Strategy-sustaining corporate entrepreneurship.

**Unit III:**
**Launching Entrepreneurial Ventures-** opportunities identification- entrepreneurial Imagination and Creativity- the nature of the creativity process-Innovation and entrepreneurship. Methods to initiate Ventures- Creating new ventures-Acquiring an Established entrepreneurial venture- Franchising-hybrid- disadvantage of Franchising.

**Unit IV:**
**Legal challenges of Entrepreneurship-**Intellectual property protection-Patents, Copyrights-Trade marks and Trade secrets-Avoiding trademark pitfalls. Formulation of the entrepreneurial Plan- The challenges of new venture start-ups, Poor financial Understanding-Critical factors for new venture development-The Evaluation process-Feasibility criteria approach.

**Unit V:**
**Strategic perspectives in entrepreneurship-** Strategic Planning-Strategic actions- strategic Positioning-Business stabilization- Building the adaptive Firms-Understanding the growth Stage-Unique managerial concern of growing ventures.

**TEXT BOOKS:**

1. D F Kuratko and T V Rao "Entrepreneurship- A South-Asian Perspective "Cengage Learning, 1st edition, 2012. **(For PPT, Case Solutions Faculty may visit: login.cengage.com)**
2. Vasant Desai "Small Scale industries and entrepreneurship" Himalaya publishing, 9th Edition, 2017.
3. Rajeev Roy "Entrepreneurship" 3e, Oxford, 2020.
4. B.Janakiram and M.Rizwana" Entrepreneurship Development :Text & Cases, Excel Books, 1st Edition, 2011.
5. Stuart Read, Effectual Entrepreneurship, Routledge, 2nd Edition, 2016.
6. Robert Hisrich et al "Entrepreneurship" 6th e, TMH, 2012.


**COURSE OUTCOMES**
On completion of the course students will be able to

1. Identify the evolution and approaches of Entrepreneurship.
2. Analyze and develop the conceptualization of corporate Entrepreneurship Personality.
3. Explore different possibilities to start an Enterprise for young Entrepreneurs.
4. Outline challenging benchmarks for formulation of Entrepreneurship.
5. Evaluate the application of Strategic action for growing ventures.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** |
| **CO2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **-** | **2** |
| **CO3** | **3** | **2** | **3** | **-** | **-** | **2** | **2** | **-** | **-** | **-** | **-** | **-** |
| **CO4** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **3** |
| **CO5** | **-** | **-** | **3** | **-** | **3** | **-** | **-** | **-** | **-** | **3** | **2** | **-** |

## (A400604) ETHICS IN BUSINESS & CORPORATE GOVERNANCE
## (Open Elective-II)

**B. Tech (ECE)**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**Unit – I: Business Ethics in the Changing Environment**: Business Ethics, Levels of Business Ethics, Myths about Business Ethics, Stages of Moral Development Kohlberg's Study, Carol Gilligan's Theory, Principles of Ethics.

**Unit – II: Professional Ethics**: Introduction to Professional Ethics, Ethics in Production and Product Management, Ethics of Marketing Professionals, Ethics in HRM, Ethics of Finance and Accounting Professionals, Ethics of Advertisement, Ethics of Media Reporting, Ethics of Healthcare Services. Ethical Dilemma, Mounting Scandals, Ethical Issues, Preparatory Ethics: Proactive Steps, Cyber Ethics.

**Unit – III: Corporate Governance**: Introduction to Corporate Governance, Major Corporate Governance Failures, Need for Corporate Governance, Corporate Governance in India, Theories of Corporate Governance: Agency Theory, Stewardship Theory and Stakeholder Theory, Problems of Governance in Companies, Role of Capital Markets, Regulator, Government in Corporate Governance.
**Corporate Governance Codes and Committees:** Global Reporting Initiative, OECD Principles, Cadbury Committee Report, Kumara Mangalam Birla Committee Report, Naresh Chandra Committee Report, Narayana Murthy Committee Report, SEBI Clause 49 Guidelines, Corporate Governance Committees.

**Unit – IV: Role of Board:** Types of Directors Functions of the Board, Structure of the Board, Role of the Board in Subcommittees, Audit, Compensation Committee, Role, Duties and Responsibilities of Directors, Conflicts of Interest, Remedial Actions. Governance Ratings, Merits and Demerits of Governance Ratings.

**Unit – V: Corporate Social Responsibility (CSR):** Models for Implementation of CSR, Scope of CSR, Steps to attain CSR, Business Council for Sustainable Development (BCSD) India, Ethics and Social Responsibility of Business, Social Responsibility and Indian Corporations, CSR as a Business Strategy for Sustainable Development, CSR Committee, Recent Amendments in Companies Act (Sec: 135)

**REFERENCE BOOKS**


1. Jyotsna G B, R C Joshi, Business Ethics and Corporate Governance, TMH, 1e, 2019.
2. Martin J. Ossewaarde, Introduction to Sustainable Development, sage,1e,2018.
3. T.N. Sateesh Kumar, Corporate Governance, Oxford University Press, 2015.
4. SK Mandal, Ethics in Business and Corporate Governance, TMH, 2/e,2017.
5. Archie. B Carroll, Business Ethics-Brief Readings on Vital Topics, Routledge, 2013.
6. A.C. Fernando, Corporate Governance: Principles, Policies and Practices, 2nd Edition, Pearson,2018.
7. C.S.V. Murthy, Business Ethics, 1st Edition, Himalaya Publishing House,2019.
8. N. Balasubramanian, Corporate Governance and Stewardship,TMH,2012.
9. Nina Godbole &SunitBelapure, Cyber Security, wileyindia, 2012.
10. Joseph W.Weiss, Business Ethics, Thomson,2006.
11. Geethika, RK Mishra, Corporate Governance Theory andPractice,Excel,2013.
12. Dr.S.S. Khanka, Business Ethics and Corporate Governance, S.Chand,2013.
13. K. Praveen Parboteeach, Business Ethics, Routledge,2019.
14. Praveen B Malla, Corporate Governance, Routledge2016.


**COURSE OUTCOMES:** Students will be able to

1. Understand the Need for Business Ethics and Corporate Governance in India.
2. Apply Knowledge of Established Methodologies of Solving Professional Ethical Issues.
3. Learn Codes and Committees in Corporate Governance.
4. Understand the Role of Board in Corporate Governance.
5. Assess the Stakeholder perspective of Corporate Governance.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | - | 3 | 3 | 2 | 3 | - | 3 |
| CO2 | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - | 3 |
| CO3 | 3 | - | - | - | 3 | - | - | - | - | - | 3 | - |
| CO4 | - | - | - | - | - | 3 | 3 | 3 | - | - | - | - |
| CO5 | - | - | - | - | 3 | 2 | 3 | - | - | - | 2 | 3 |

**(A404605) FUNDAMENTALS OF EMBEDDED SYSTEMS**
**(Open Elective-III)**

**B.Tech-ECE**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**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

**Unit- II: Typical Embedded System**
Core of the Embedded System: General Purpose and Domain Specific Processors, Memory, ROM, RAM, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: On-board 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: RTOS Based Embedded System Design**
Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

**Unit – V: Task Communication**
Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization issues, Task Synchronization Techniques, Device Drivers

**TEXT BOOK:**
1. Introduction to Embedded Systems – Shibu K.V. McGraw Hill
2. Embedded Systems – Raj Kamal, TMH

**REFERENCE BOOKS:**
1. Embedded System Design – Frank Vahid, Tony Givargis, John Wiley.
2. Embedded Systems – Lyla, Pearson, 2013
3. An Embedded Software Primer- David E Simon, Pearson Education

**COURSE OUTCOMES:**
At the end of the course the student will be able to:
1. Explain the basics of embedded systems and classify its applications
2. Compare various types of memories, sensors and Input / Output devices.
3. Summarize the embedded firmware for various applications.
4. Interpret the characteristics of Real time operating Systems
5. Illustrate the concepts of shared memory and task communications

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | | |
| CO2 | 3 | 1 | 1 | | | | | | | | | |
| CO3 | 2 | | | | | | | | | | | 1 |
| CO4 | 2 | 1 | 1 | 1 | | | | | | | | |
| CO5 | 3 | | | | 1 | | | | | | | |

## (A404606) DATA COMMUNICATIONS
## (Open Elective-III)

**B.Tech (ECE)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Unit I:** Introduction to data communications, networking, signals, noise, modulation and demodulation. Data communication network architecture, layered network architecture, open systems interconnection, data communications circuits, serial and parallel data transmission, data communications circuit arrangements, data communication networks, alternate protocol suites. Information capacity, bits, bit rate, baud, and M-ARY encoding.

**Unit II:** Metallic cable transmission media & optical fiber transmission media: metallic transmission lines, transverse electromagnetic waves, characteristics of electromagnetic waves, transmission line classifications, metallic transmission line types, metallic transmission line equivalent circuit, wave propagation on metallic transmission lines, metallic transmission line losses, block diagram of an optical fiber communications system, optical fiber versus metallic cable facilities.

**Unit III**: Digital transmission & multiplexing and t-carriers digital transmission: pulse modulation, pulse code modulation, dynamic range, signal–to-quantization noise voltage Ratio, linear versus nonlinear PCM codes
Multiplexing: Time- division multiplexing, t1 digital carrier system, north American digital multiplexing hierarchy, digital line encoding, t carrier systems, European digital carrier system, statistical time – division multiplexing, frame synchronization, frequency- division multiplexing, wavelength- division multiplexing, synchronous optical network

**Unit IV:** Telephone instruments and signals: The subscriber loop, standard telephone set, basic telephone call procedures, call progress tones and signals, cordless telephones, caller id, electronic telephones, paging systems.
The telephone circuit: The local subscriber loop, telephone message- channel noise and noise weighting, units of powers measurement, transmission parameters and private-line circuits, voice-frequency circuit arrangements, crosstalk.

**Unit V:** Data communication codes, bar codes, error control, error detection, error correction, data formats, data communications hardware, character synchronization.

**TEXT BOOKS:**

1. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education.

**REFERENCE BOOKS:**

1. Data Communications and Networking, Behrouz A Forouzan, Fourth Edition. Tmh.
2. Computer Communications and Networking Technologies, Gallow, Second edition Thomson
3. Computer Networking and Internet, Fred Halsll, Lingana Gouda Kulkarni, Fifth Edition, Pearson Education.

**COURSE OUTCOMES:**

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

1. Explain the basic concepts of data communication systems.
2. Distinguish various types of transmission medias for data communications.
3. Compare different multiplexing techniques for digital transmission
4. Analyze different telephone instruments, signal and circuits
5. Identify different error detecting and correcting codes.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | | | | | | | | | 2 |
| CO2 | 3 | 3 | 2 | | | | | | | | | 2 |
| CO3 | 3 | 3 | 2 | | | | | | | | | 2 |
| CO4 | 3 | 3 | 2 | | | | | | | | | 2 |
| CO5 | 3 | 3 | 2 | | | | | | | | | 2 |

## (A405603) FUNDAMENTALS OF COMPUTER NETWORKS
## (Open Elective-III)

| | L | T | P | C |
|---|---|---|---|---|
| **B. Tech (ECE)** | **3** | **0** | **0** | **3** |

**UNIT-I**

**Fundamental of Data Communication and Computer Network:** Components, Data Representation, Data Flow, Data and Signal, Classification Network: LAN, WAN, MAN, **Network Architecture:** Peer to Peer, Client Server Network, History of Internet.

**UNIT-II**

**Network Model:** OSI Reference Model and TCP/IP Protocol Suit
**Network Connecting Devices**: Hub, Switch, Router, Repeater, Bridge, Gateway, Modem
**Network Topologies:** Types of Topology-Bus, Ring, Star, Mesh, Tree, Hybrid, and IEEE Standards.

**UNIT-III**

**Physical Layer:** Guided Transmission Media and Unguided Transmission Media
**Data Link Layer:** Design Issues, Error Detection and Correction, Simplex Stop and wait protocol.

**UNIT-IV**

**Network Layer:** Design Issues, Routing Algorithm: Shortest Path Routing algorithm, Congestion Control, IPv4, IPv6, DHCP
**Transport Layer:** Process to process Delivery, Addressing, UDP and TCP, Error control and flow control.

**UNIT-V**

**Application Layer:** Domain Name System, E-Mail, FTP, WWW and Http.
**Network Security:** Cryptography, Symmetric Key and Public Key, Firewall, VPN, Web Security

**TEXTBOOKS:**

1. Computer Networks, Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI
2. Data Communications and Networking – Behrouz A. Forouzan. 3rd Edition, TMH.

**REFERENCE BOOKS:**

1. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.
2. Computer Networking A Top-Down Approach – Kurose James F, Keith W, 6th Edition, Pearson
3. Data communication and Networks - Bhusan Trivedi, Oxford university press, 2016.

**COURSE OUTCOMES:** At the end of the course, the student will be able to:

1. Explain the Data in communication and two types of networks architecture.
2. Compare OSI Reference model and TCP/IP Protocol Suit and able to Sketch the different topologies and network connecting devices.
3. Describe about Transmission media in Physical layer and Analyze the Error detection and correction methods in Data link layer.
4. Apply knowledge in developing routing algorithm and Explain transport layer protocols.
5. Examine the Application Layer Protocols and Analyze various network security approaches.

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **2** | **2** | | **2** | | | | | | | | |
| **CO2** | **2** | **2** | | **2** | | | | | | | | |
| **CO3** | **2** | **2** | | **2** | | | | | | | | |
| **CO4** | **2** | **2** | **2** | **2** | | | | | | | | |
| **CO5** | **2** | **2** | **2** | **2** | | | | | | | | |

**(A405606) FUNDAMENTALS OF DEVOPS**
**(Open Elective-III)**

| | L | T | P | C |
|---|---|---|---|---|
| **B. Tech (ECE)** | **3** | **0** | **0** | **3** |

**UNIT - I**
Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

**UNIT - II**
Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing.
DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

**UNIT - III**
Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

**UNIT - IV**
Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.
**UNIT - V**
Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client,
Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

**TEXTBOOKS:**
1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN-10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

**REFERENCE BOOK:**

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10

**COURSE OUTCOMES:**
On successful completion of this course, students will be able to:
1. Identify components of Devops environment
2. Describe Software development models and architectures of DevOps
3. Apply different project management, integration, testing and code deployment tool
2. Investigate different DevOps Software development models
3. Assess various Devops practices

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | **2** | | | | | | | **2** |
| **CO2** | | **3** | | | | | | | | | | **2** |
| **CO3** | | | **3** | **3** | | | | | | | **2** | **2** |
| **CO4** | | | **3** | **3** | | | | | **1** | **1** | **2** | **2** |
| **CO5** | | | | **3** | | | | | **2** | **1** | **2** | **2** |

**(A405602) CLOUD COMPUTING**
**(Open Elective-III)**

**B.Tech.(ECE)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

**Computing Paradigms:** High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.

**UNIT - II**

**Cloud Computing Fundamentals**: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models.

**UNIT - III**

**Cloud Computing Architecture and Management:** Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud, Managingthe Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

**UNIT - IV**

**Cloud Service Models:** Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.

**UNIT V**

**Cloud Service Providers:** EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue, service, Microsoft, Windows Azure

**TEXT BOOK:**

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014

**REFERENCE BOOKS:**

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp 2011.

**COURSE OUTCOMES**: On successful completion of this course, students will be able to:

1. Explain Distributed System Modeling, Clustering and Virtualization
2. Discuss basic concepts of cloud computing.
3. Distinguish Infrastructure as a Service(IAAS) & Platform and Software as a Service(PAAS/SAAS).
4. Design & implement cloud computing applications.
5. Explore some important cloud computing driven commercial systems.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | 2 | | | | | | |
| CO2 | 3 | | | | | 2 | | 2 | | | | |
| CO3 | 3 | | | | | | 2 | | | | | |
| CO4 | 3 | 1 | 1 | | 1 | | | | | | | |
| CO5 | 3 | 2 | | | | | | | | | | |

**(A402605) NANO TECHNOLOGY**
**(Open Elective-III)**

**B. Tech (ECE)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT I: INTRODUCTION**
History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges, and Future Prospects.

**UNIT II: UNIQUE PROPERTIES OF NANOMATERIALS**
Microstructure and Defects in Nanocrystalline Materials: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple and declinations, Effect of Nano-dimensions on Materials Behavior: Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility. Magnetic Properties: Soft magnetic nano crystalline alloy, Permanent magnetic nano-crystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties, and Mechanical Properties.

**UNIT III: SYNTHESIS ROUTES**
Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Solgel method, Self-assembly, Top down approaches: Mechanical alloying, Nano-lithography, Consolidation of Nanopowders: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing, Spark plasma sintering.

**UNIT IV: TOOLS TO CHARACTERIZE NANO MATERIALS**
X-Ray Diffraction (XRD), Small Angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nanoindentation.

**UNIT V: APPLICATIONS OF NANOMATERIALS**
Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Défense and Space Applications, Concerns and challenges of Nanotechnology.

**TEXT BOOKS:**
1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM.
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

**REFERENCES BOOKS:**
1. Nano: The Essentials by T. Pradeep, McGraw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L. Schodek.
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact – Ed. Challa S., S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press

**COURSE OUTCOMES:**
On completion of the course, students will be able to
1. Classify nanostructured materials
2. Illustrate the characteristics and properties of nano-materials.
3. Identify the synthesis routes of nano-materials
4. Make use of the tools to characterize the nano-materials.
5. Utilize the nano-materials for various applications

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | | | | | | 2 | | |
| **CO2** | 3 | 3 | 3 | | | | | | | 2 | | |
| **CO3** | 3 | 3 | | | | | | | | 2 | | |
| **CO4** | 3 | 3 | | | 2 | | | | | 2 | | |
| **CO5** | 3 | 3 | | | | | | | | 2 | | |

## (A402604) EV BATTERIES & CHARGING SYSTEM
## (Open Elective-III)

**B. Tech (ECE)**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**UNIT I - Battery parameters:**
Cell and battery voltages, Charge (or Amphour) capacity, Energy stored, Energy density, Specific power, Amphour (or charge) efficiency, Energy efficiency, Self-discharge rates, Battery geometry, Battery temperature, heating and cooling needs, Battery life and number of deep cycles

**UNIT II – EV Batteries**:
Lead Acid Batteries Lead acid battery basics, Special characteristics of lead acid batteries, Battery life and maintenance, Battery charging, Summary Nickel-based Batteries Introduction, Nickel cadmium, Nickel metal hydride batteries

**UNIT III– Sodium, Lithium and Metal air batteries:**
Sodium-based Batteries Introduction, Sodium sulphur batteries, Sodium metal chloride (Zebra) batteries Lithium Batteries Introduction, The lithium polymer battery, The lithium ion battery Metal Air Batteries Introduction, The aluminium air battery, The zinc air battery

**UNIT IV– Charging Infrastructure:**
Domestic Charging Infrastructure, Public Charging Infrastructure, Normal Charging Station, Occasional Charging Station, Fast Charging Station, Battery Swapping Station, Move-and-charge zone.

**UNIT V– EV Charging Battery Chargers:**
Charge equalisation, Conductive (Basic charger circuits, Microprocessor based charger circuit. Arrangement of an off-board conductive charger, Standard power levels of conductive chargers, Inductive (Principle of inductive charging, Soft-switching power converter for inductive charging), Battery indication methods

**TEXT BOOKS**

1. James Larminie Oxford Brookes University, Oxford, UK John Lowry Acenti Designs Ltd., UK, Electric Vehicle Technology Explained
2. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001.

**REFERENCE BOOKS:**

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

**COURSE OUTCOMES**

On completion of the course, students will be able to

1. Gain knowledge on various battery parameters
2. Classify different types of EV batteries
3. Illustrate Sodium, Lithium and Metal air batteries
4. Understand the different types of Charging Infrastructure.
5. Understand the operation of EV Charging Battery Chargers

**CO-PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | | | | | 2 | | |
| CO2 | 3 | 3 | | | | | | | | 2 | | |
| CO3 | 3 | 3 | | | | | | | | 2 | | |
| CO4 | 3 | 3 | | | | | | | | 2 | | |
| CO5 | 3 | 3 | | | | | | | | 2 | | |

**(A403605) INDUSTRIAL SAFETY ENGINEERING**
**(Open Elective: III)**

**B. Tech (ECE)**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**UNIT-I:**
**Industrial safety**: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

**UNIT-II:**
**Fundamentals of maintenance engineering**: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

**UNIT-III:**
**Wear and Corrosion and their prevention**: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

**UNIT-IV:**
**Fault tracing**: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

**UNIT-V:**
**Periodic and preventive maintenance**: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

**TEXT BOOKS**

1. Mobley, R. Keith, Lindley R. Higgins, and Darrin J. Wikoff. *Maintenance Engineering Handbook*. New York, NY: Mcgraw-Hill, 2008.
2. Garg, H. P. *Industrial Maintenance*. S Chand, 1976.

**REFERENCE BOOKS:**

1. Graham, F. D. "Audels Pumps, Hydraulics and Air Compressors. Theo." (1998).
2. Winterkorn, Hans F., and Hsai-Yang Fang. *Foundation engineering handbook*. Springer, Boston, MA, 1991.

**COURSE OUTCOMES:**
At the end of the course, the student should be able to

1. Understand various hazards and their prevention.
2. Apply maintenance techniques to various equipments.
3. Understand types of wear and corrosions and their prevention.
4. Explain fault tracing and its applications.
5. Apply periodic and preventive maintenance techniques to various equipment.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 1 | - | - | - | 1 | - | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 1 | - | - | - | 1 | - | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 1 | - | - | - | 1 | - | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 1 | - | - | - | 1 | - | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 1 | - | - | - | 1 | - | 3 | 3 |

**(A403606) WASTE TO ENERGY**
**(Open Elective: III)**

**B. Tech (ECE)**

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**Unit-I:**
**Introduction to Energy from Waste:** Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

**Unit-II:**
**Biomass Pyrolysis:** Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

**Unit-III:**
**Biomass Gasification:** Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

**Unit-IV:**
**Biomass Combustion:** Biomass stoves – Improved chullahs, types, some exotic designs, fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

**Unit-V:**
**Biogas:** Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion – Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

**TEXT BOOKS:**

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

**REFERENCE BOOKS:**

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons,1996.

**COURSE OUTCOMES:**

By undergoing this course, a student shall be able to

1. Understand different Conversion Devices.
2. Explain Biomass Pyrolysis.
3. Understand the working Principle of biomass gasification
4. Explain Biomass Combustion.
5. Know the application of Bio Gas.

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | 3 | 2 | 1 | 2 | - | 2 | - | - | 2 |
| CO2 | 3 | 2 | 2 | 3 | 3 | 1 | 2 | - | 2 | - | - | 2 |
| CO3 | 3 | 3 | 1 | 3 | 1 | 1 | 2 | - | 2 | - | - | 2 |
| CO4 | 3 | 3 | 1 | 3 | 1 | 1 | 2 | - | 2 | - | - | 2 |
| CO5 | 3 | 2 | 1 | 3 | 2 | 1 | 2 | - | 1 | - | - | 2 |

## (A401605) ENERGY EFFICIENT BUILDINGS
## (Open Elective-III)

**B.Tech (ECE)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Unit I**

Climates and buildings, Thermal properties and energy content of building materials, Psychrometry, thermal comfort: Criteria and various parameters, Air conditioning systems, Energy conservation techniques in Air conditioning systems. Climate and comfort zones, Introduction to the design of shading devices, Overhangs. Factors that effects energy use in buildings: ventilation and its significance.

**Unit II**

Passive and active methods of heating and cooling, Passive heating concepts: direct heat gain, indirect heat gain, isolated gain and sunspaces. Passive cooling concepts: evaporative cooling, radiative cooling; application of wind, water and earth for cooling; shading, paints and cavity walls for cooling; roof radiation traps; earth air-tunnel.

**Unit III**

Heat transmission in buildings: surface co-efficient: air cavity, Internal and external surfaces Overall thermal transmittance, Wall and windows; Heat transfer due to ventilation/infiltration, Internal heat transfer; Decrement factor; Phase lag; Lighting (Daylighting and Electric lighting), Design of day-lighting, Concept of sol-air temperature and its significance.

**Unit IV**

Estimation of building loads, Steady state method, Network method, Numerical method, Correlations.
Energy conservation through site selection, Planning and design; Siting and orientation Green buildings, Zero emission buildings. Energy Efficient Landscape Design: Modification of microclimatic through landscape element for energy conservation.

**Unit V**

Bioclimatic classification of India; Passive concepts appropriate for the various climatic zones in India; Typical design of selected buildings in various climatic zones; Thumb rules for design of buildings and building codes Energy Efficient Landscape Design: Modification of microclimatic through landscape element for energy conservation

**TEXT BOOKS:**


1. Tiwari G N, Goyal R K, Greenhouse Technology: Fundamentals, Design Modeling and Application, Narosa Publishing House.
2. Krieder J, Rabi A, Heating and Cooling of Buildings: Design for Efficiency, McGrawHill.


**REFERENCE BOOKS:**


1. Archie, Culp W, Principles of Energy Conservation, McGraw Hill.
2. Callaghan P O, Energy Management, McGraw - Hill Book Company.
3. Majumder Milli, Energy Efficient Buildings, TERI, New Delhi


**COURSE OUTCOMES:** On completion of the course students will be able to

1. Identify different Energy conservation techniques in Air conditioning systems
2. Demonstrate a good ability to calculate the energy balance of buildings
3. Assess whether there is a potential conflict between energy conservation and indoor climate for different energy saving measures
4. Evaluate different opportunities to save energy with measures regarding both building technology and building services engineering
5. Design different buildings in various climatic zones

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO2 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO3 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO4 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO5 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |

**(A401606) ENVIRONMENTAL POLLUTION**
**(Open Elective-III)**

**B.Tech (ECE)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**UNIT - I**

**Air Pollution:** Air pollution Control Methods – Particulate control devices – Methods of Controlling Gaseous Emissions –Air quality standards. Noise Pollution: Noise standards, Measurement and control methods –Reducing residential and industrial noise –ISO: 14000.

**UNIT - II**

**Industrial waste water Management:** Strategies for pollution control –Volume and Strength reduction – Neutralization –Equalization –Proportioning –Common Effluent Treatment Plants –Recirculation of industrial wastes –Effluent standards.

**UNIT - III**

**Solid Waste Management**: Solid Waste Management: solid waste characteristics –basics of on-site handling and collection –separation and processing –Incineration-Composting-Solid waste disposal methods –fundamentals of Land filling. Hazardous Waste: Characterization –Nuclear waste –Biomedical wastes –Electronic wastes – Chemical wastes –Treatment and management of hazardous waste-Disposal and Control methods.

**UNIT - IV**

**Environmental Sanitation**: Environmental Sanitation: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

**UNIT - V**

**Sustainable Development**: Sustainable Development: Definition-elements of sustainable Developments-Indicators of sustainable Development-Sustainability Strategies-Barriers to Sustainability–Industrialization and sustainable development –Cleaner production in achieving sustainability-sustainable development.

## TEXT BOOKS


1. Peavy, H. S., Rowe, D.R, Tchobanoglous, "Environmental Engineering", G. Mc - Graw Hill International Editions, New York 1985. .
2. J. G. Henry and G.W. Heinke, "Environmental Science and Engineering", Pearson Education.


**REFERENCE BOOKS**


1. G. L. Karia and R.A. Christian, "Waste water treatment-concepts and design approach", Prentice Hall of India
2. M. N. Rao and H. V. N. Rao, "Air pollution", Tata Mc.Graw Hill Company. Ruth F. "Weiner andRobin Matthews Environmental Engineering", 4thEdition Elesevier, 2003.
3. K. V. S. G. Murali Krishna, "Air Pollution and Control"by, Kousal & Co. Publications, New Delhi.


**COURSE OUTCOMES:** On completion of the course students will be able to

1. Define the air pollution control methods
2. Able to evaluate Volume and Strength reduction
3. Identify the different ways to dispose Solid waste
4. Identify the sanitation methods.
5. Products that accelerate more sustainable lifestyles

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO2 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO3 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO4 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |
| CO5 | 3 | 3 | - | - | - | - | - | - | 3 | 2 | - | 3 |

**(A400605) BASICS OF MARKETING**
**(Open Elective-III)**

**B.Tech (ECE)**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**Unit I**
**Understanding Marketing Management:** Concepts of Marketing, Marketing Strategies & Plans, Creating long term Loyalty relationships, Marketing mix, Product Life Cycle.

**Unit II**
**Connecting with Customers & Building Strong Brands**: Analyzing Competitors, Conducting Marketing Research, Consumer Behaviour, identifying market segments and targets, crafting Brand Positioning.

**Unit III**
**New Product and Promotions**: Introducing New Market Offering, Developing Pricing Strategies & Programmes, Designing & Managing Integrated Marketing Communications, Advertising & Sales Promotions, Managing Digital Communication – Online, Social Media & Mobile, Personal Selling.

**Unit IV**
**Delivering Value:** Managing Retailing, Wholesaling and logistics, Designing and Managing Integrated Marketing Channels.

**Unit V**
**Sales Management**: Nature and Importance of Sales Management, Skills of Sales Manager, Sales objectives, Concepts of Sales organization, Type of Sales organization.

**TEXT BOOKS:**

1. Marketing Management, Philip Kotler, Kevin Lane Keller, Pearson

**REFERENCES:**


1. Rosalind Masterson, Nichola Philips, David Pickton, Marketing : An Introduction, 5e, Sage Publications, 2021.
2. G. Shainesh Philip Kotler, Kevin Lane Keller, Alexander Cherneb, Jagdish N Sheth, Marketing Management, 16e, Pearson, 2022.
3. Lamb, Hair, Sharma, Mc Daniel: MKTG, A South Asian Perspective, Cengage Learning, 2016. (For PPT, Case Solutions, video cases, Faculty may visit : login.cengage.com )
4. Philip Kotler, Gray Armstrong, Principles of Marketing, Pearson Education, 18e,2020.
5. Ramaswamy, Namakumari, Marketing Management, Sage Publications, 6e, 2018.
6. Lamb, Hair, Sharma, Mc Daniel, Principles of Marketing:A South Asian Perspective, Cengage Learning, 2016.
7. Paul Baines, Chris Fill, Kelly Page, Piyush Sinha, Marketing, Asian Edition, Oxford University Press, 2015.
8. Arun Kumar & N. Meenakshi, Marketing Management , Vikas, 3e, 2016
9. RajanSaxena, Marketing Management, Tata Mc Graw Hill,3e, 2012.
10. Kenneth E Clow, Donald Baack, Cases in Marketing Management, Sage South Asia edition,2015.
11. Rajendra P Maheshwari, marketing management text and cases, an Indian perspective, International Book House2012/


**COURSE OUTCOMES:**
On completion of the course students will be able to:

1. Analyze the scope, concepts of Marketing and forecasting techniques in present Global Market Environment.
2. Outline marketing research, consumer behaviour, segmentation and targeting.
3. Develop conceptual knowledge on new product development, marketing mix and promotional mix
4. Illustrate marketing channels of distribution and logistics
5. Identify the skills and importance of sales management

**CO- PO MAPPING:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | 3 | 3 | - | 2 | 3 | - | - | - | 3 | - | - |
| CO2 | - | - | - | - | 3 | 3 | - | 3 | - | - | 2 | - |
| CO3 | - | - | - | - | - | 3 | 2 | - | 3 | - | 3 | - |
| CO4 | - | - | 3 | - | - | - | - | - | 3 | - | 2 | - |
| CO5 | 3 | - | - | - | - | - | 3 | - | - | 3 | - | - |