GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY (Autonomous)
(**Approved by AICTE, Permanently Affiliated to JNTUH, Accredited by NAAC with 'A+')**
Cheeryal (V), Keesara (M), Medchal Dist., Telangana - 501 301

AR22
ACADEMIC REGULATIONS
AND
DETAILED SYLLABUS

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

For CBCS BASED B. TECH – FOUR YEAR PROGRAM
(Applicable for the batches admitted from AY 2023-24)

GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY (Autonomous)
Cheeryal (V), Keesara (M), Medchal Dist., Telangana State, Pin Code: 501 301

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20MA11001	Basic Engineering Mathematics	46
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***Activity oriented non laboratory courses.**

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***Activity oriented non laboratory courses.**

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20CS41075	Knowledge Management (OE-II)	194
20MB41076	Supply Chain Management (OE-II)	196
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20EC41L02	EDA Tools and Simulation Lab	199
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Course Code	**Name of the Course**	**Page No.**
20MB42005	Project Management and Finance	202
20EC42001	Radar Systems (PE-V)	203
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ACADEMIC REGULATIONS 2022

For CBCS Based B.Tech PROGRAMMES

(Effective for the students admitted into FIRST year from the Academic Year **2023-2024)**

1. Under-Graduate Degree Programme (B.Tech) in Engineering

Geethanjali College of Engineering and Technology (GCET) offers **four (**4) Year (**eight** (8) Semesters) **Bachelor of Technology** (B.Tech) Degree Programme, under Choice Based Credit System (CBCS) with effect from the Academic Year 2023-2024, in the following Branches of Engineering

S. No.	***Branch***
1.	Civil Engineering
2.	Computer Science and Engineering
3.	Computer Science and Engineering (Artificial Intelligence and Machine Learning)
4.	Computer Science and Engineering (Cyber Security)
5.	Computer Science and Engineering (Data Science)
6.	Electrical and Electronics Engineering
7.	Electronics and Communication Engineering
8.	Mechanical Engineering

2. Eligibility for Admission

2.1 Admission to the B.Tech Programme shall be made either on the basis of the merit rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (EAMCET), or on the basis of any other order of merit approved by the Government of Telangana, subject to reservations as prescribed from time to time.

2.2 The medium of instruction for all the B.Tech programmes shall be ENGLISH only.

3. B.Tech Programme Structure

3.1 A student after securing admission shall complete the B. Tech programme in a minimum period of **four (4)** academic years (**eight** (8) semesters), and a maximum period of **eight (8)** academic years (**sixteen (**16) semesters) starting from the date of commencement of first year first semester, failing which the student shall forfeit his seat in B. Tech program. The 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 various terms and abbreviations used in these Academic Regulations / Norms, which are as listed below.

3.2.1 **Semester Scheme:**

Each B. Tech program is of **four** (4) academic years (**eight** (8) semesters**)**, with each academic year being divided into two semesters of **20 weeks (minimum of 90 working days)** each. Each semester has - '**Continuous Internal Evaluation (CIE)**' and '**Semester End Examination (SEE)**'. **Choice Based Credit System (CBCS)** as indicated by UGC and curriculum / programme structure as suggested by AICTE are followed.

3.2.2 **Credit Courses:**

All courses are to be registered by a student in a semester to earn credits. Credits shall be assigned to each course in a L: T: P/D: C (Lecture periods: Tutorial periods: Practicals / Drawing periods: Credits) Structure, based on the following general pattern...

- One credit - for one hour / week / semester for Theory / Lecture (L) / Tutorial(T) courses;
- One-half (½) of a credit – for one hour / week / semester for Laboratory / Practical (P) or Drawing (D) courses.
- No Credits for mandatory courses.

3.2.3 **Course Classification:**

The College follows almost all the guidelines issued by AICTE/ UGC. All subjects/ courses offered for the B.Tech. Degree programmes are broadly classified as follows.

S. No	Broad Course Classification	Course Group/Category	Course Description
1	Foundation Courses (FnC)	BSC-Basic Science Courses	Includes Mathematics, Physics and Chemistry courses
2		ESC-Engineering Science Courses	Includes Fundamental Engineering Courses
3		HSMC-Humanities and Social sciences including Management Courses	Includes courses related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PCC-Professional Core Courses	Includes core courses related to parent discipline/department/ branch of Engineering
5	Elective Courses (EℓC)	PEC-Professional Elective Courses	Includes elective courses related to parent discipline / related department / branch of Engineering
6		OEC-Open Elective Courses	Elective Courses which include interdisciplinary courses or courses in an area outside the parent discipline/department /branch of engineering
7	Core Courses	PROJ –Project	Project Seminar/ Project
8			Design Thinking/ Internship/ Industry Oriented Mini-Project/ Mini-Project
9			Technical Seminar based on core contents related to parent discipline/ department/ branch of Engineering.
10	Mandatory Courses (MC)		Mandatory courses (Non Credit)

4. Course Registration

4.1 A 'Faculty Advisor or Counselor' shall be assigned to a group of around 20 students, who shall advise the students about the B.Tech programme, its structure along with curriculum, choice / option for course(s), based on their competence, progress, pre-requisites and interest.

4.2 The Academic Departments of the college invite 'Registration Forms' from students before the beginning of the semester. 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 may be permitted to register for all the courses in a semester as specified in the course structure with maximum additional course(s) (elective course(s)) limited to 6 credits, duly approved by faculty advisor, based on progress and SGPA/ CGPA, and completion of the 'pre- requisites' as indicated for various courses, in the department course structure and syllabus content.

4.4 A student can apply for registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his faculty advisor, which should be submitted to the College Academic Committee through Head of the Department concerned (a copy of the same being retained with Head of the Department, Faculty Advisor and the student).

4.5 If the student submits ambiguous choices or multiple options or erroneous entries - during registration for the course(s) under a given / specified course(s) Group/ Category, as listed in the programme structure, Faculty Advisor shall rectify such errors and advise the student accordingly.

4.6 Course(s) options exercised by the student and approved by Faculty Advisor are final and CANNOT be changed, or inter-changed. Further, alternate choices shall also not be considered. However, if the course(s) that has (have) already been listed for registration (by the department) in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice: either for new course(s) (subject to offering of such course(s)), or for another existing course(s) offered, which may be considered. Such alternate arrangements shall be made by the department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of class-work for that semester.

4.7 Dropping of course(s) may be permitted, only after obtaining prior approval from the faculty advisor / counselor 'within a period of 15 days' from the beginning of the current semester.

4.8 **Open electives**: The student has to choose open electives from the list of open electives given. However, the student cannot opt for an open elective course(s) offered by his own (parent) department.

4.9 **Professional electives**: The student has to choose the required professional electives from the list given.

5. Courses to be offered

5.1 A Course may be offered to the students, ONLY IF a Minimum of 15 students opt for it.

5.2 More than one Instructor may offer the same course(s) (laboratory / practical may be included with the corresponding theory course(s) in the same semester) in any semester. However, selection of choice for students shall be based on - 'first come first serve basis and CGPA criterion'. (i.e. the first focus shall be on early registration 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 course come into picture then the Head of the Department concerned shall decide whether or not to offer such a course for two or more sections.

5.4 In case of options coming from students of other departments / branches / disciplines (not considering OPEN ELECTIVES), PRIORITY shall be given to the student of the 'Parent Department'.

6 Attendance Requirements

6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% attendance in aggregate of all the courses (including attendance in mandatory course like Environmental Science, Indian Constitution for that semester.

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 towards 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 Semester End Examinations. They get detained and their registration for that semester shall stand cancelled. They shall not be promoted to the next semester.** They may seek re-registration for all those course(s) registered in the semester in which they were detained, by seeking re-admission into that semester as and when offered. In the case of elective course(s), namely, professional elective(s) and / or open elective(s), the same may also be re-registered, if offered. However, if those elective(s) are not offered in later semesters, then alternate elective(s) may be chosen from the SAME set of elective course(s) offered under that specific category.

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

7 Academic Requirements

The following academic requirements have to be satisfied, in addition to the attendance requirement mentioned in section 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 including minimum 35% of average Mid-Term examinations for 25 marks) in the internal examinations, not less than 35% (21 marks out of 60 marks) in the semester end examination, 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 Academic requirements in respect of Internship, Mini-Project, Technical Seminar, Project Seminar, Project, Activity Oriented (Non-Laboratory) courses such as Design Thinking, Logical reasoning and English Language courses (English for effective communication, English for career development, English for professional success) are as follows:

Name of the Course	Academic Requirements
Internship	A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Internship if the student: i. Submits a report on his Internship. ii. Makes a presentation of the Internship carried out before the Departmental Evaluation Committee as per schedule iii. Secures not less than 40% of the total marks allocated for the course in the evaluation by Departmental Evaluation Committee.
Mini-Project	A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Mini-Project if the student: i. Submits a report on his Mini-Project. ii. Makes a presentation of the Mini-Project carried out before the Departmental Evaluation Committee as per schedule. iii. Secures not less than 40% of the total marks allocated for the course in the evaluation by Departmental Evaluation Committee.
Project Seminar	A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Project Seminar if the student: i. Submits a report on his Project Seminar. ii. Makes a presentation of the Project Seminar carried out before the Departmental Evaluation Committee as per schedule. iii. Secures not less than 40% of the total marks allocated for the course in the evaluation by Departmental Evaluation Committee.
Technical Seminar	A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Technical Seminar if the student: i. Submits a report on his Technical Seminar. ii. Makes a presentation of the Technical Seminar carried out before the Departmental Evaluation Committee as per schedule. iii. Secures not less than 40% of the total marks allocated for the course in the evaluation by Departmental Evaluation Committee.
*Project	A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Project if the student: i. Submits a report on his Project. ii. Makes a presentation of the Project carried out before the Internal Project Review Committee as per schedule. iii. Secures not less than 40% of the total marks allocated for the course, in the project evaluation.
Activity Oriented (Non –Laboratory) courses (CIE) a. Design Thinking b. Logical reasoning c. English for effective communication d. English for career development e. English for professional success.	A student shall be deemed to have satisfied the academic requirements and earned the credits allotted if the student: i. Submits all assignments in time. ii. Secures not less than 40% of the total marks allocated for the course in continuous Internal Evaluation.

*Note: A student who has not satisfied the above requirements in any of the courses mentioned in the above table, is deemed to have failed; he may reappear once for each of the evaluations in the failed courses when they are 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.

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. ii. Must have secured at least 50% of the credits specified in the program structure of first year (up to and including 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. ii. Must have secured at least 60% of the credits specified in the program structure of second year (up to and including 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. ii. Must have secured at least 60% of the credits specified in the program structure of third year (up to and including 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 program structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing SGPA $\geq$5.0 (in each semester), and CGPA $\geq$ 5 (at the end of 8 semesters), (iv) **passes 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 grade card / marks memo of IV-year II semester

7.5 If a student registers for '**extra Courses'** (in the parent department or other departments/branches of Engg.) other than those listed Courses totaling to 160 credits as specified in the course structure of his department, the performances in those '**extra Courses**' (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 Courses'** 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 Items 6 and 7.1 – 7.4 above.

7.6 A student eligible to appear in the semester end examination for any 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 course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that Course.

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

8 Evaluation - Distribution and Weightage of Marks

8.1 The performance of a student in each semester shall be evaluated course-wise (irrespective of credits assigned) with a maximum of 100 marks for all types of course(s), namely, theory, drawing, practicals, Internship, Mini-Project, Project Seminar, Project, Technical seminar, Activity Oriented (Non-Laboratory) courses etc., and their evaluation is as follows:

Theory, practical, drawing and Project course(s) shall be evaluated based on **40** marks CIE (Continuous Internal Evaluation) and **60** marks SEE (Semester End Examination)

Internship/ Mini-project/ Project Seminar / Technical seminar/ Activity Oriented (Non-Laboratory) courses shall be evaluated internally by the Department Evaluation Committee.

Note: A letter grade corresponding to the % marks obtained shall be given for all course(s) as mentioned in section 9.2.

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 paper for 10 marks.
   b. Part - B: Descriptive paper for 20 marks.

- The objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks.
  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 on a topic in the concerned 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 shall be 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 overall 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 makeup test in theory/laboratory internal examination for AR22 regulations

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 units carrying 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.

8.2 For laboratory course(s), there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks, and Semester End Examination (SEE) for 60 marks.

A detailed break up of 40 marks for CIE is given below:

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 shall be 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 other reputed colleges which will be decided/approved by the examination branch/Chief Controller of Examinations of the Institution.

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 Overall 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.

8.3 **Internship, Mini-Project, Technical Seminar, Project seminar, Project and Activity Oriented courses.**

8.3.1 There shall be an internship, which the student shall carryout immediately after Second year second semester examinations and pursue it during summer vacation for a duration of about four weeks. The Work carried out during Internship shall be submitted in the form of a report, and a presentation of the same shall be made before a committee, which evaluates

it for 100 marks. The committee shall consist of Head of the Department or his nominee, the supervisor allocated for the internship, one senior faculty of the department. There shall be only CIE for 100 marks for internship and shall be evaluated during third year first semester.

8.3.2 There shall be a Mini Project, which the student shall carryout immediately after Third year second semester examinations and pursue it during summer vacation. Mini Project shall be submitted in the form of a report, duly approved by the departmental internal evaluation committee, and presented before the examination committee in Fourth year first semester. It shall be evaluated for 100 marks as SEE. The examination committee consists of Head of the Department or his nominee, supervisor of the mini project, a senior faculty member of the department. **There shall be no internal marks (CIE) for Mini Project.**

8.3.3 There shall be a technical seminar presentation in Fourth year second semester, for which, the student shall collect the information on a specialized topic, prepare a technical report, submit it and present the same before a departmental committee. It shall be evaluated by the departmental committee, consisting of Head of the Department or his nominee, seminar supervisor and a senior faculty member. The technical seminar report shall be evaluated for 100 marks as CIE.

8.3.4 There shall be a Project seminar presentation in Fourth year First semester, for which, the student shall collect the information on the Project topic, prepare a report, submit it and present the same before a departmental committee. It shall be evaluated internally (CIE) for 100 marks by the departmental committee, consisting of Head of the Department or his nominee, seminar supervisor and a senior faculty member.

8.3.5 The student shall carryout the Project in final year second semester. There shall be three reviews, one at the end of the fourth week, another at the end of the ninth week and third at the end of the fourteenth week. The reviews shall be conducted and evaluated by an internal project review committee. The committee shall consist of Head of the Department or his nominee, the supervisor allocated for the Project, and two Professors /Assoc-Professors of the department. Each review shall be evaluated for forty (40) marks and average of all three reviews shall constitute CIE of forty (40) marks. Project carried out shall be submitted in a dissertation form, and a presentation of the same shall be made before a final examination committee consisting of Head of the Department or his nominee, the supervisor and an external examiner, appointed by the chief controller of examinations, selected from a panel of examiners suggested by the chairperson, BoS, which evaluates it for sixty (60) marks.

8.3.6 Activity Oriented (Non-laboratory) courses shall be evaluated internally (CIE) for 100 marks; there shall be no SEE.

8.3.7 For mandatory / non-credit course(s), a student has to secure 40 marks out of 100 marks (i.e. 40% of the marks allotted) in the continuous internal evaluation for securing satisfactory grade.

8.3.8 No marks / letter grades shall be allotted for mandatory/non-credit course(s). Only Satisfactory (S) / Unsatisfactory (US) shall be indicated in Grade Card.

8.4. A student shall be given only one time chance to re-register for a maximum of two 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 Vivavoce/ PPT/ Poster presentation/ Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.

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.

In the event of the student taking this chance, his Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

9 Grading procedure

9.1 Grades shall be awarded to indicate the performance of students in each theory course, laboratory / practicals / Engineering Graphics / Drawing, Technical Seminar, Internship, Mini-Project, Project, Activity Oriented courses based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in section 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 using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a 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 course(s) shall be deemed to have '**failed'** and is required to reappear as a 'supplementary candidate' in the semester end examination, as and when conducted. However, the internal marks in those course(s) shall remain the same as obtained earlier.

9.4 A student, who has not appeared for an examination in any course(s), shall be awarded '**Ab'** grade in that course(s), and shall be deemed to have '**failed'** in that course(s). Such a student shall be required to reappear as a 'supplementary candidate' in the semester end examination, as and when conducted. However, the internal marks in those course(s) shall remain the same as 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 a grade point (GP) in each course, on the basis of the letter grade secured in that course. The corresponding 'Credit Points (CP)' for a course are computed by multiplying the grade point with credits for that particular course.

Credit points (CP) = grade point (GP) x credits …. For a course

9.7 A student passes a course, only when the student secures a **GP ≥ 5 ('C' grade or above)** in that course.

9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from all course(s) registered for in a semester, by the total number of credits registered for in that semester. SGPA is rounded off to **two decimal places**. SGPA is thus computed as

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

where 'i' is the course indicator index (takes into account all course(s) in a semester), 'N' is the number of courses '**registered'** for in that semester (as specifically required and listed under the program structure of the parent department), C is the number of credits allotted to the i^{th} course, and G represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} course.

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

$$CGPA = \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \} \text{ ... for all S Semesters registered}$$
$$\text{(ie., upto and inclusive of S Semesters, } S \geq 2 \text{)},$$

where '**M'** is the **total** number of courses (as specifically required and listed under the program structure of the parent department) the student has '**registered'** for i.e. from the first semester onwards up to and inclusive of the eighth semester, 'j' is the course indicator index (takes into account, all course(s) from first semester to eighth semester), C is the number of credits allotted to the j^{th} course, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} course. After registration and completion of First year first 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	Credits	Letter Grade	Grade Point	Credit Points
Course1	4	A	8	4 x 8=32
Course 2	4	O	10	4 x 10=40
Course 3	4	C	5	4 x 5=20
Course 4	3	B	6	3 x 6=18
Course 5	3	A+	9	3 x 9=27
Course 6	3	C	5	3 x 5=15
Total	**21**	**Total Credit Points**		**152**

SGPA = 152/21 = 7.24

Illustration of calculation of CGPA up to 3rd semester:

Semester	Course Title	Credits Allotted	Letter Grade Secured	Corresponding Grade Point	Credit Points(CP)
I	Course 1	3	A	8	24
I	Course 2	3	O	10	30
I	Course 3	3	B	6	18
I	Course 4	4	A	8	32
I	Course 5	3	A+	9	27
I	Course 6	4	C	5	20
II	Course 7	4	B	6	24
II	Course 8	4	A	8	32
II	Course 9	3	C	5	15
II	Course 10	3	O	10	30
II	Course 11	3	B+	7	21
II	Course 12	4	B	6	24
II	Course 13	4	A	8	32
II	Course 14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
Total Credits		**69**	**Total Credit Points**		518

CGPA = 518/69 = 7.51

The above illustrated calculation process of CGPA shall be followed for each subsequent semester until eighth semester. The CGPA obtained at the end of eighth 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 shall be used.

9.11 SGPA and CGPA of a semester shall be mentioned in the semester Memorandum of Grades if all courses of that semester are passed in the first attempt. Otherwise, the SGPA and CGPA shall be mentioned only on the Memorandum of Grades generated after the student has passed his last examination in that semester. However, mandatory course(s) will not be taken into consideration.

10. Passing Standards

10.1 A student shall be declared **'SUCCESSFUL'** or **'PASSED'** in a semester, only when he gets an SGPA ≥ 5.00 (at the end of that particular Semester); and a student shall be declared **'SUCCESSFUL'** or **'PASSED'** in the entire B.Tech programme, only when he gets a CGPA ≥ 5.00, subject to the condition that he secures a GP ≥ 5 (C Grade or above)

in every registered course(s) in each semester (during the entire B.Tech Programme) for award of the degree.

10.2 After the completion of each semester, a Grade Card or Grade Sheet (Memorandum of Grades) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It shall show the details of the course(s) registered (course(s) code, title, number of credits, grade earned etc.), credits earned, SGPA and CGPA.

10.3 **There shall be no exemption of credits under any circumstances.**

11. Declaration of Results

11.1 Computation of SGPA and CGPA are done using the procedure listed in sections 9.5 through 9.8.

11.2 For final % of marks equivalent to the computed final CGPA, the following formula shall be used:

% of Marks = (final CGPA – 0.5) x 10

12. Award of Degree

12.1 A student who registers for all the specified course(s) as listed in the programme structure, satisfies all the programme requirements, and passes all the examinations prescribed in the entire B.Tech programme, and secures the required number of 160 credits (with CGPA ≥ 5.0), within eight (8) academic years from the date of commencement of the first academic year, shall be declared to have **'QUALIFIED'** for the award of the B.Tech degree in the branch of Engineering studied.

12.2 A student who qualifies for the award of the degree as listed in section 12.1, shall be placed in the following classes based on evaluation as per section 7.4:

12.2.1 Students with final CGPA (at the end of the B. Tech Programme) ≥ 8.00 and fulfilling the following conditions shall be placed in 'FIRST CLASS with DISTINCTION' -

i. Should have passed all the courses in 'FIRST APPEARANCE' within the first four (4) academic years (or eight (8) sequential semesters) from the date of commencement of his first academic year,
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.

12.2.2 Students having final CGPA (at the end of B.Tech Programme) ≥ 8.00, but not fulfilling the above conditions shall be placed in 'FIRST CLASS'.

12.2.3 Students with final CGPA (at the end of the B.TECH Programme) ≥ 7.00 but < 8.00, shall be placed in 'FIRST CLASS'.

12.2.4 Students with final CGPA (at the end of the B.TECH Programme) ≥ 6.00 but < 7.00, shall be placed in 'SECOND CLASS'.

12.2.5 All other Students who qualify for the award of the degree (as per Section 12.1), with final CGPA (at the end of the B.Tech Programme) ≥ 5.00 but < 6.00, shall be placed in 'PASS CLASS'.

12.3 A student with final CGPA (at the end of the B. Tech Programme) < 5.00 shall not be eligible for the award of the degree.

12.4 Students fulfilling the conditions listed under of 12.2.1 alone shall be eligible for the award of 'college rank' and / or 'gold / silver / bronze medal'.

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

12.5.1 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(with in 4 years from the date of admission) up to B. Tech. – II Year – II Semester, if the student want to exit the 4-Year B. Tech. program. The student once opted and awarded for 2-Year UG Diploma Certificate, the student will not 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.

12.5.2 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 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. Withholding of Results

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

14. Transitory Regulations

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of AR18/AR20 Regulations due to lack of attendance, shall be permitted to join I year I Semester of AR22 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, III and IV years of AR18/AR20 regulations for want of attendance, shall be permitted to join the corresponding semester of AR22 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 AR22 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 AR18/AR20 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of AR22 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including AR18, AR20 and AR22 regulations. 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 AR22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in AR22 Regulations:

4. A student who has failed in any Course under any regulation has to pass those Courses 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 AR22 Regulations. There is NO exemption of credits in any case.
6. If a student is readmitted to AR22 Regulations and has any Course with 80% of syllabus common with his/her previous regulations, that particular Course in AR22 Regulations will be substituted by another Course to be suggested by the College.

Note: If a student readmitted to AR22 Regulations and has not studied any Courses/topics in his/her earlier regulations of study which is prerequisite for further Courses in AR22 Regulations, the College shall conduct remedial classes to cover those Courses/topics for the benefit of the students.

15. Student Transfers

15.1 There shall be no branch transfers after the completion of admission process.

15.2 The students seeking transfer to this college from other Universities/institutions should obtain NoC from the college and apply to Department of Technical Education, Government of Telangana, and Telangana state. The student, on transfer, shall pass additional courses, from the courses, from the courses prescribed in the curriculum of AR22, upto the class/ semester preceding the class/ semester into which the student is admitted, if he had not studied those courses or their equivalents, or failed in those courses at the previous institution.

15.3 Further, though the students have passed some of the Courses at the earlier institutions, if the same Courses are prescribed in different semesters of GCET, the students have to study those Courses in GCET in spite of the fact that those Courses are repeated.

15.4 The transferred students from other Universities/Institutions to GCET who are on rolls are to be provided one chance to write the written test (for internal marks) in the equivalent Course(s) as per the clearance letter issued by the University.

16. Scope

1. Where the words "he", "him", "his", occur in the write-up of regulations, they include "she", "her", "hers".
2. The Academic Regulations should be read as a whole, for the purpose of any interpretation.
3. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Head of the Institution is final.
4. The college may change or amend the Academic Regulations, Program 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.
5. B. Tech (Regular) program is B. Tech 4-year degree program to which students are admitted to FIRST year.
6. B. Tech LE Scheme refers to the system under which students are admitted to SECOND year of the B. Tech FOUR (4) year degree program.
7. The terms "mid-term" and "internal" are used interchangeably.

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17. PUNISHMENT FOR MALPRACTICE

	Nature of Malpractices	Punishment
	If the candidate:	
1 (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course 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 course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
1 (b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any 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 course only of all the candidates involved. In case of an outsider, he shall be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of

		seat. If the impostor is an outsider, he shall be handed over to the police and a case is registered against him.
4	Smuggles in 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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all 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 course.
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 examination hall or organizes a walk out or instigates others to 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 campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they shall be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or tears of the script or any part	Expulsion from the examination hall and cancellation of performance in that course and

	thereof inside or outside the examination hall with the mala fide intention of destroying any evidence of use of unfair means.	all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all 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 course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses 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.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the Courses of that semester / year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College shall be handed over to police and, a police case shall be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that Course and all other Courses the student has already appeared for including practical examinations and project work and shall not be permitted for the remaining examinations of the Courses of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that Course and all other Courses the student has appeared for including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to Chief Controller of Examination.	

18. ACADEMIC REGULATIONS FOR B.TECH **(LATERAL ENTRY SCHEME)** FROM THE AY 2024-2025

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

1. 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 ≥ 5 from SECOND year through FOURTH year B. Tech programme (LES) for the award of B. Tech degree.
3. The students, who fail to fulfill 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).

18.2 **Promotion rules**

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. (ii) Must have secured at least 60% of the credits specified in the program structure of second year (up to and including 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. (ii) Must have secured at least 60% of the credits specified in the program structure of third year (up to and including 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.

5. All the other regulations as applicable to B. Tech. FOUR (4) - year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).
6. LES students are not eligible for 2-year B. Tech Diploma Certificate.

18.3 **Punishment for Malpractice**

	Nature of Malpractices	**Punishment**
	If the candidate:	
1 (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course 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 course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
1 (b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any 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 course only of all the candidates involved. In case of an outsider, he shall be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the impostor is an outsider, he shall be handed over to the police and a case is registered against him.

4	Smuggles in 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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all 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 course.
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 examination hall or organizes a walk out or instigates others to 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 campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they shall be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or tears of the script or any part thereof inside or outside the examination hall with the mala fide intention of	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical

	destroying any evidence of use of unfair means.	examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is course 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 course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses 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.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the Courses of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College shall be handed over to police and, a police case shall be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that Course and all other Courses the student has already appeared for including practical examinations and project work and shall not be permitted for the remaining examinations of the Courses of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that Course and all other Courses the student has appeared for including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to Chief Controller of Examination.	

Vision of the Institution

Geethanjali visualizes dissemination of knowledge and skills to students, who would eventually contribute to well being of the people of the nation and global community.

Mission of the Institution

i. To impart adequate fundamental knowledge in all basic sciences and engineering, technical and Inter-personal skills to students.
ii. To bring out creativity in students that would promote innovation, research and entrepreneurship.
iii. To preserve and promote cultural heritage, humanistic and spiritual values promoting peace and harmony in society.

Vision of the Department

To impart quality technical education in Electronics and Communication Engineering emphasizing analysis, design/synthesis and evaluation of hardware/ embedded software using various Electronic Design Automation (EDA) tools with accent on creativity, innovation and research thereby producing competent engineers who can meet global challenges with societal commitment.

Mission of the Department

i. To impart quality education in fundamentals of basic sciences, mathematics, electronics and communication engineering through innovative teaching-learning processes.
ii. To facilitate Graduates define, design, and solve engineering problems in the field of Electronics and Communication Engineering using various Electronic Design Automation (EDA) tools.
iii. To encourage research culture among faculty and students thereby facilitating them to be creative and innovative through constant interaction with R & D organizations and Industry.
iv. To inculcate teamwork, imbibe leadership qualities, professional ethics and social responsibilities in students and faculty.

Program Educational Objectives (PEOs)

I. To prepare students with excellent comprehension of basic sciences, mathematics and engineering subjects facilitating them to gain employment or pursue postgraduate studies with an appreciation for lifelong learning.

II. To train students with problem solving capabilities such as analysis and design with adequate practical skills that are Program Specific wherein they demonstrate creativity and innovation that would enable them to develop state of the art equipment and technologies of multidisciplinary nature for societal development.

III. To inculcate positive attitude, professional ethics, effective communication and interpersonal skills which would facilitate them to succeed in the chosen profession exhibiting creativity and innovation through research and development both as team member and as well as leader.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

1. An ability to design an Electronics and Communication Engineering system, component, or process and conduct experiments, analyze, interpret data and prepare a report with conclusions to meet desired needs within the realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
2. An ability to use modern Electronic Design Automation (EDA) tools, software and electronic equipment to analyze, synthesize and evaluate Electronics and Communication Engineering systems for multidisciplinary tasks.

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B. TECH ELECTRONICS AND COMMUNICATION ENGINEERING

Academic Regulations: AR22 **Academic Year 2023-24**

PROGRAMME STRUCTURE

FIRST YEAR I – SEMESTER

S. No.	Course Code	Course	Category	Number of Periods/ Week			Scheme of Examination with Maximum Marks			Number of Credits
				L	T	P/D	CIE	SEE	Total	C
1	20PH11001	Solid State Physics	BSC	3	1	-	40	60	100	4
2	20MA11001	Basic Engineering Mathematics	BSC	3	1	-	40	60	100	4
3	20ME11002	Engineering Graphics	ESC	2	-	2	40	60	100	3
4	20CS11001	Programming for Problem Solving - I	ESC	2	-	-	40	60	100	2
5	20EE11001	Basic Electrical Engineering	ESC	3	-	-	40	60	100	3
6	20PH11L01	Solid State Physics Lab	BSC	-	-	2	40	60	100	1
7	20CS11L01	Programming for Problem Solving - I Lab	ESC	-	-	2	40	60	100	1
8	20EE11L01	Basic Electrical Engineering Lab	ESC	-	-	2	40	60	100	1
9	20ME11L01	Engineering Workshop	ESC	-	-	2	40	60	100	1
10		Induction Program	MC	-	-	-	-	-	-	-
Total				**13**	**2**	**10**	**360**	**540**	**900**	**20**
Total Periods Per Week				**25**						

FIRST YEAR II – SEMESTER

S. No.	Course Code	Course	Category	Number of Periods/ Week			Scheme of Examination with Maximum Marks			Number of Credits
				L	T	P/D	CIE	SEE	Total	C
1	20EN12001	English	HSMC	3	-	-	40	60	100	3
2	20MA12001	Multi Variable Calculus	BSC	3	1	-	40	60	100	4
3	20CS12001	Programming for Problem Solving -II	ESC	2	-	-	40	60	100	2
4	20CH12001	Engineering Chemistry	BSC	3	-	-	40	60	100	3
5	20EC12001	Semiconductor Devices and Circuits	ESC	3	1	-	40	60	100	4
6	20EN12L01	English Language Communication Skills Lab	HSMC	-	-	2	40	60	100	1
7	20CS12L01	Programming for Problem Solving -II Lab	ESC	-	-	2	40	60	100	1
8	20CH12L01	Engineering Chemistry Lab	BSC	-	-	2	40	60	100	1
9	20EC12L01	Semiconductor Devices and Circuits Lab	ESC	-	-	2	40	60	100	1
Total				**14**	**2**	**8**	**360**	**540**	**900**	**20**
Total Periods Per Week				**24**						

SECOND YEAR I – SEMESTER

S. No.	Course Code	Course	Category	Number of Periods/ Week			Scheme of Examination with Maximum Marks			Number of Credits
				L	T	P/D	CIE	SEE	Total	C
1	20MA21001	Theory of Complex Variables	BSC	3	-	-	40	60	100	3
2	20EC21001	Signals and Systems	PCC	3	-	-	40	60	100	3
3	20EC21002	Digital Design	PCC	3	-	-	40	60	100	3
4	20EC21003	Electronic Circuit Analysis and Design	PCC	3	-	-	40	60	100	3
5	20EC21004	Circuit Theory	PCC	3	-	-	40	60	100	3
6	20EC21L01	Signals and Systems Lab	PCC	-	-	2	40	60	100	1
7	20EC21L02	Digital Design Lab	PCC	-	-	2	40	60	100	1
8	20EC21L03	Electronic Circuit Analysis and Design Lab	PCC	-	-	2	40	60	100	1
9	20EN21P01	English for Effective Communication*	HSMC	-	-	2	100	-	100	1
10	20CH21M01	Environmental Science	MC	3	-	-	-	-	-	-
Total				**18**	**-**	**8**	**420**	**480**	**900**	**19**
Total Periods Per Week				**26**						

* Activity Oriented Non-Laboratory Course.

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SECOND YEAR II – SEMESTER

S. No.	Course Code	Course	Category	Number of Periods/ Week			Scheme of Examination with Maximum Marks			Number of Credits
				L	T	P/D	CIE	SEE	Total	C
1	20CS22007	Object Oriented Programming	ESC	3	-	-	40	60	100	3
2	20EC22001	Analog and Digital Communications	PCC	3	-	-	40	60	100	3
3	20EC22002	Linear Integrated Circuits	PCC	3		-	40	60	100	3
4	20EC22003	Random Variables and Stochastic Processes	PCC	3	-	-	40	60	100	3
5	20EC22004	Electromagnetic Theory and Transmission lines	PCC	3	-	-	40	60	100	3
6	20EC22L01	Analog Communications Lab	PCC	-	-	2	40	60	100	1
7	20EC22L02	Linear Integrated Circuits Lab	PCC	-	-	2	40	60	100	1
8	20CS22L04	Object Oriented Programming Lab	ESC	-	-	2	40	60	100	1
9	20EN22P01	English for Career Development*	HSMC	-	-	2	100	-	100	1
10	20EC22P01	Design Thinking*	PROJ	-	-	4	100	-	100	2
11	20MB22M04	Professional Ethics	MC	3	-	-	-	-	-	-
Total				**18**	**-**	**12**	**520**	**480**	**1000**	**21**
Total Periods Per Week				**30**						

Note: Students have to undergo internship program during the summer vacation which shall be evaluated internally during third year first semester. There is no Semester End Examination for the internship.

* Activity Oriented Non-Laboratory Course.

THIRD YEAR I – SEMESTER

S. No.	Course Code	Course	Category	Number of Periods/ Week			Scheme of Examination with Maximum Marks			Number of Credits
				L	T	P/D	CIE	SEE	Total	C
1	20EC31001	Computer Architecture and Microprocessors	PCC	3	-	-	40	60	100	3
2	20EC31002	Antennas and Wave Propagation	PCC	3	-	-	40	60	100	3
3	20EC31003	Control Systems Engineering	PCC	3	-	-	40	60	100	3
4	20MB31004	Engineering Economics and Accounting	HSMC	3	-	-	40	60	100	3
	Professional Elective - I									
5	20EC31004	Cellular and Mobile Communications	PEC	3	-	-	40	60	100	3
	20EC31005	Digital Systems Design								
	20EC31006	Digital Design Through Verilog HDL								
	20EC31007	Artificial Neural Networks								
6	20EN31L01	Professional Communication Skills Lab	HSMC	-	-	2	40	60	100	1
7	20EC31L01	Microprocessors and Assembly Language Programming Lab	PCC	-	-	2	40	60	100	1
8	20EC31L02	Digital Communications Lab	PCC	-	-	2	40	60	100	1
9	20EC31008	Internship	PROJ	-	-	-	100	-	100	2
10	20MA31P01	Logical Reasoning – I*	BSC	-	-	4	100	-	100	2
11	20CS31M02	Introduction to Artificial Intelligence	MC	3	-	-	-	-	-	-
Total				**18**	**0**	**10**	**520**	**480**	**1000**	**22**
Total Periods Per Week				**28**						

* Activity Oriented Non-Laboratory Course

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THIRD YEAR II – SEMESTER

S. No.	Course Code	Course	Category	Number of Periods/ Week			Scheme of Examination with Maximum Marks			Number of Credits
				L	T	P/D	CIE	SEE	Total	C
1	20EC32001	Microcontrollers and Embedded Systems	PCC	3	-	-	40	60	100	3
2	20EC32002	Digital Signal Processing	PCC	3	-	-	40	60	100	3
	Professional Elective – II									
3	20EC32003	Satellite Communications	PEC	3	-	-	40	60	100	3
	20EC32004	Electronic Sensors								
	20EC32005	VLSI Design								
	20EC32006	Principles of Machine Learning								
	Open Elective-I									
4	20CE32061	Building Technology	OEC	3	-	-	40	60	100	3
	20EE32062	Industrial Safety and Hazards								
	20ME32063	Nano Materials and Technology								
	20CS32065	Web Programming								
	20MB32066	Intellectual Property Rights								
5	20EC32L01	Microcontrollers and Embedded Systems Lab	PCC	-	-	2	40	60	100	1
6	20EC32L02	Digital Signal Processing Lab	PCC	-	-	2	40	60	100	1
7	20EC32L03	Project Oriented Lab	PCC	-	-	2	40	60	100	1
8	20EN32P01	English for Professional Success*	HSMC	-	-	2	100	-	100	1
9	20MA32P01	Logical Reasoning – II*	BSC	-	-	4	100	-	100	2
10	20CS32M03	Introduction to Cyber Security	MC	3	-	-	-	-	-	-
Total				**15**	**0**	**12**	**480**	**420**	**900**	**18**
Total Periods Per Week				**27**						

Note: Students have to do Mini Project during the summer vacation which shall be evaluated during fourth year first semester through Semester End Examination.
* Activity Oriented Non-Laboratory Course

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FOURTH YEAR I – SEMESTER

S. No.	Course Code	Course	Category	Number of Periods/ Week			Scheme of Examination with Maximum Marks			Number of Credits
				L	T	P/D	CIE	SEE	Total	C
1	20EC41001	Microwave Engineering	PCC	3	-	-	40	60	100	3
2	20EC41002	Electronic Measurements and Instrumentation	PCC	3	-	-	40	60	100	3
	Professional Elective - III									
3	20EC41003	Optical Communications	PEC	3	-	-	40	60	100	3
	20EC41004	Advanced Computer Architecture								
	20EC41005	System Design and Verification using System Verilog HDL								
	20EC41006	Robotic Process Automation								
	Professional Elective - IV									
4	20EC41007	Digital Image and Video Processing	PEC	3	-	-	40	60	100	3
	20EC41008	Internet of Things using Smart Sensors								
	20EC41009	ASIC Design								
	20EC41010	Adaptive Signal Processing								
	Open Elective-II									
5	20CE41071	Green Buildings	OEC	3	-	-	40	60	100	3
	20EE41072	Energy Conservation and Management								
	20ME41073	Digital Fabrication								
	20CS41075	Knowledge Management								
	20MB41076	Supply Chain Management								
6	20EC41L01	Microwave Engineering Lab	PCC	-	-	2	40	60	100	1
7	20EC41L02	EDA Tools and Simulation Lab	PCC	-	-	2	40	60	100	1
8	20EC41011	Project Seminar	PROJ	-	-	2	100	-	100	1
9	20EC41012	Mini Project	PROJ	-	-	-	-	100	100	2
Total				**15**	**0**	**6**	**380**	**520**	**900**	**20**
Total Periods Per Week				**21**						

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FOURTH YEAR II – SEMESTER

S. No.	Course Code	Course	Category	Number of Periods/ Week			Scheme of Examination with Maximum Marks			Number of Credits
				L	T	P/D	CIE	SEE	Total	C
1	20MB42005	Project Management and Finance	HSMC	3	-	-	40	60	100	3
	Professional Elective - V									
2	20EC42001	Radar Systems	PEC	3	-	-	40	60	100	3
	20EC42002	Mixed Signal Circuit Design								
	20CS42014	Computer Networks								
	20EC42003	5G Mobile Communications								
	Open Elective-III									
3	20CE42081	Disaster Management	OEC	3	-	-	40	60	100	3
	20EE42082	Micro-electro-mechanical Systems								
	20ME42083	Principles of Automobile Engineering								
	20CS42085	Database Systems								
	20MB42086	Entrepreneurship								
4	20EC42004	Technical Seminar	PROJ	-	-	2	100	-	100	1
5	20EC42005	Project	PROJ	-	-	20	40	60	100	10
Total				**9**	**0**	**22**	**260**	**240**	**500**	**20**
Total Periods Per Week				**31**						

Professional Electives

Track	Year and Sem	Communication Group	Digital Group	VLSI	Emerging Areas
PE - I	**III-I**	Cellular and Mobile Communications (PE-I) 20EC31004	Digital Systems Design (PE-I) 20EC31005	Digital Design Through Verilog HDL (PE-I) 20EC31006	Artificial Neural Networks (PE – I) 20EC31007
PE – II	**III-II**	Satellite Communications (PE-II) 20EC32003	Electronic Sensors (PE-II) 20EC32004	VLSI Design (PE-II) 20EC32005	Principles of Machine Learning (PE – II) 20EC32006
PE – III	**IV-I**	Optical Communications (PE-III) 20EC41003	Advanced Computer Architecture (PE-III) 20EC41004	System Design and Verification using System Verilog HDL (PE-III) 20EC41005	Robotic Process Automation (PE – III) 20EC41006
PE – IV	**IV-I**	Digital Image and Video Processing (PE – IV) 20EC41007	Internet of Things using Smart Sensors (PE – IV) 20EC41008	ASIC Design (PE – IV) 20EC41009	Adaptive Signal Processing (PE – IV) 20EC41010
PE - V	**IV-II**	Radar Systems (PE – V) 20EC42001	Computer Networks (PE – V) 20CS42014	Mixed Signal Circuit Design (PE – V) 20EC42002	5G-Mobile Communications (PE – V) 20EC42003

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B. Tech. ELECTRONICS AND COMMUNICATION ENGINEERING
AR 22 STRUCTURE FOR UNDERGRADUATE PROGRAM

S.No	Category/ Semester	Credits as per AR20	Credits as per AICTE Model Curriculum
1.	**Humanities and Social Sciences including Management**	**14**	**12**
2.	**Basic Sciences**	**24**	**25**
3.	**Engineering Sciences** including workshop, drawing, basics of electrical/mechanical/computer etc.	**23**	**24**
4.	**Program Core Courses**	**57**	**48**
5.	**Program Elective Courses:** Subjects relevant to chosen specialization/branch	**15**	**18**
6.	**Open Elective Subjects**: Electives from other technical and/or emerging subjects	**9**	**18**
7.	**Project work, seminar, internship** in industry or elsewhere and, Design Thinking	**18**	**15**
8.	**Mandatory Courses**: [Induction Program, Environmental Science, Professional Ethics, Introduction to Artificial Intelligence and Introduction to Cyber Security]	**5-Slots**	**-**
	Total	**160**	**160**

Course code and definition

S.No.	Category Abbreviation	Description
1.	PCC	Program Core Courses
2.	PEC	Program Elective Courses
3.	PROJ	Design Thinking, Internship, Mini Project, Technical Seminar, Project Seminar, and Project
4.	BSC	Basic Science Courses
5.	ESC	General Engineering Courses
6.	HSMC	Humanities and Social Sciences including Management Courses
7.	OEC	Open Elective Courses
8.	MC	Mandatory Courses

Definition of credit

S. No.	Abbreviation	Credits	Description
1.	L	1	1 Hr. Lecture (L) per week
2.	T	1	1 Hr. Tutorial (T) per week
3.	P	0.5 1	1 Hr. Practical (P) per week 2 Hours Practical(Lab)/week

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OPEN ELECTIVES FOR ECE

OPEN ELECTIVES offered by a department SHOULD NOT be taken by the students of the same department.

Open Elective - I		
S. No.	**Name of the Course**	**Course Code**
1	Building Technology (CE)	20CE32061
2	Industrial Safety and Hazards (EEE)	20EE32062
3	Nano Materials and Technology (ME)	20ME32063
4	Electronic Measuring Instruments (ECE)	20EC22064/20EC31064/ 20EC32064
5	Web Programming (CSE)	20CS32065
6	Intellectual Property Rights (MBA)	20MB22066

Open Elective - II		
S. No.	**Name of the Course**	**Course Code**
1	Green Buildings (CE)	20CE41071
2	Energy Conservation and Management (EEE)	20EE41072
3	Digital Fabrication (ME)	20ME41073
4	Principles of Communication Systems (ECE)	20EC32074/20EC 41074
5	Knowledge Management (CSE)	20CS41075
6	Supply Chain Management (MBA)	20MB41076

Open Elective - III		
S. No.	**Name of the Course**	**Course Code**
1	Disaster Management (CE)	20CE42081
2	Micro-electro-mechanical Systems (EEE)	20EE42082
3	Principles of Automobile Engineering (ME)	20ME42083
4	Biomedical Instrumentation (ECE)	20EC42084
5	Database Systems (CSE)	20CS42085
6	Entrepreneurship (MBA))	20MB42086

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20PH11001 - Solid State Physics
(Common to ECE and EEE)

B. Tech. ECE - I Year I Sem.

L	T	P/D	C
3	1	0	4

Prerequisite(s): None

Course Objectives

Develop ability to

1. Understand the quantum principles to analyze the behavior of quantum systems through Schrodinger's wave equation.
2. Understand the concepts of semiconductor physics to analyze the behavior of semiconductor diodes and optoelectronic devices for their suitability in electronic circuits.
3. Understand the principles of energy-matter interactions to various types of lasers, and optical fibers and analyze their characteristics for different applications.
4. Understand and classify dielectric, magnetic materials, and superconductors in the presence of external fields for various applications.

Course Outcomes

At the end of the course, students would be able to

1. Explain the quantum principles to analyze the behavior of quantum systems through Schrodinger's wave equation.
2. Apply the concepts of semiconductor physics to analyze the behavior of semiconductor diodes and optoelectronic devices for their suitability in electronic circuits.
3. Apply the principles of energy-matter interactions to various types of lasers, and optical fibers and analyze their characteristics for different applications.
4. Compare and classify dielectric, magnetic materials, and superconductors in the presence of external fields for various applications.

UNIT-I: Quantum Mechanics

Introduction to quantum physics, black body radiation, Planck's law (Qualitative), Photoelectric effect, Compton effect, de-Broglie's hypothesis, wave-particle duality, Davisson and Germer experiment, Heisenberg's Uncertainty principle, Born's interpretation of the wave function, Schrodinger's time independent wave equation, particle in one dimensional box.

UNIT-II: Semiconductor Physics

Classification of semiconductors, n-type, p-type, carrier concentration in intrinsic and extrinsic semiconductors, Fermi level in intrinsic and extrinsic semiconductors, variation of Fermi level with temperature and concentration of dopants in extrinsic semiconductors, carrier generation and recombination, Hall effect and its applications, p-n junction diode, Zener diode and their V-I characteristics, and the effect of temperature on it.

UNIT-III: Optoelectronics

Radiative and non-radiative recombination mechanisms in semiconductors, direct and indirect band gap semiconductors, LED and semiconductor lasers: Device structure, materials, characteristics and figure of merit. Semiconductor photodetectors: Solar cell, PIN, avalanche and their structure, materials, working principle and characteristics.

UNIT-IV: Lasers and Fibre Optics

Lasers: Interaction of radiation with matter, coherence, principle and working of Laser, population inversion, pumping. Types of lasers: Ruby laser, Carbon dioxide (CO_2) laser, He-Ne laser, applications of lasers.

Fibre Optics: Introduction, optical fibre as a dielectric wave guide, total internal reflection, acceptance angle, acceptance cone and numerical aperture, step and graded index fibres, losses associated with optical fibres, applications of optical fibres.

UNIT-V: Dielectric and Magnetic Properties

Polarization, permittivity and dielectric constant, dielectric polarization mechanisms: electronic, ionic, orientational (qualitative) and space charge polarization (qualitative), internal fields in a solid, Clausius-Mossotti equation, ferroelectricity, piezoelectricity and pyroelectricity. Magnetization, permeability and susceptibility, origin of magnetic moment, Bohr magneton, classification of magnetic materials, ferromagnetism, ferromagnetic domains and hysteresis. Superconductivity: Meissner's effect, type-I and type-II superconductors, BCS theory and applications of magnetic materials.

Text Books:

1. Engineering Physics, B.K. Pandey, S. Chaturvedi - CengageLearning.
2. Fundamentals of Physics, Halliday and Resnick – Wiley Publications.
3. A Textbook of Engineering Physics, Dr. M.N. Avadhanulu, Dr. P.G. Kshirsagar - S.Chand Publications.

References:

1. Quantum Mechanics, Richard Robinett- Oxford University Press.
2. Semiconductor Optoelectronics: Physics and Technology, J. Singh, McGraw-Hill inc.,1995.
3. Online Course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptha on NPTEL.
4. Introduction to Solid State Physics, C. Kittel, Wiley Publications, 8th edition.

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20MA11001 –Basic Engineering Mathematics
(Common to All Branches)

B. Tech. ECE - I Year I Sem.

L	T	P/D	C
3	1	0	4

Prerequisite(s): None

Course Objectives: Develop ability to

1. Understand various types of matrices, properties and rank of the matrix to find the solution for system of equations, if it exists.
2. Apply the knowledge of eigenvalues and eigenvectors of a matrix to reduce the quadratic form into a canonical form through transformation.
3. Solve first and higher order differential equations of various types.
4. Analyze properties of Laplace Transform, Inverse Laplace Transform and to understand how the product of the Transforms of two functions relates to their convolution.
5. Identify the methods of solving the differential equations of first and higher order applications namely, Newton's law of cooling, Natural growth and decay, Electrical circuits, Simple harmonic motion and Bending of Beams.

Course Outcomes (COs): At the end of course, the student would be able to

CO1: Apply elementary transformations to solve a system of linear equations and reduce the quadratic form to the canonical form using linear and / or orthogonal transformation.

CO2: Form first order differential equations for Heat flow, Growth and Decay, Electrical Circuits and apply appropriate methods for solving them.

CO3: Form higher order differential equations for Bending of beams, Simple harmonic motion, Electrical circuits and apply appropriate methods and / or Laplace Transforms for solving them.

UNIT-I: Matrices

Matrices: Types of Matrices, Symmetric**,** Hermitian, Skew-symmetric, Skew-Hermitian, Orthogonal matrices, Unitary 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 and Non-Homogeneous equations**,** *Gauss elimination method.

UNIT-II: Eigenvalues and Eigenvectors

Linear Transformation and Orthogonal Transformation: *Eigen values and *Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), *finding 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.

UNIT-III: Ordinary Differential Equations

First Order Ordinary Differential Equations: *Exact Differential Equations, *Linear Differential Equations and Bernoulli's Equations.

Second and Higher Order Linear Differential Equations with Constant Coefficients: Non homogeneous of the type e^{ax}, sin ax, cos ax, x^n, $e^{ax}V(x)$ and $xV(x)$**,** Method of variation of parameters, Equations reducible to linear ordinary differential equations with constant coefficients: Legendre's equation, Cauchy-Euler equation.

UNIT-IV: Laplace Transforms

Definition of Laplace transform, Existence of Laplace transform, Laplace transform of standard functions, first shifting theorem, Laplace transform of functions when they are multiplied or divided by "t", Laplace transforms of derivatives and integrals of functions, Unit step function, second shifting theorem, Dirac's delta function, Periodic function, Evaluation of integrals using Laplace Transforms, Inverse Laplace transform by Partial fractions (Heaviside method), Inverse Laplace transforms of functions when they are multiplied or divided by "s", Inverse Laplace transforms of derivatives and integrals of functions, Convolution theorem.

UNIT-V: Applications of Ordinary Differential Equations

Applications of First order Ordinary Differential Equations: *Newton's law of cooling, *Law of Natural growth and decay, Electrical circuits.

Applications of Higher order Ordinary Differential Equations: Electrical circuits, Simple harmonic motion, Bending of beams.

*****Enlightenment with flowchart and algorithmic approach.

Text Books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 44th Edition, 2017.
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 10th Edition, 2011.

Reference Books:

1. A Text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, 10th Edition, 2015.
2. Advanced Engineering Mathematics, H.K. Das, S. Chand and Company Ltd, 21st Edition, 2013.
3. Advanced Engineering Mathematics, Jaggi and Mathur, Khanna Publishers, 6th Edition, 2019.
4. Advanced Engineering Mathematics, R.K. Jain and S.R.K. Iyengar, Alpha Science International Ltd, 4th Edition, 2013.

20ME11002- Engineering Graphics
(Common to ALL Branches)

B. Tech. ECE - I Year I Sem.

L	T	P/D	C
2	-	2	3

Prerequisite(s): **None**

Course Objectives: Develop ability to

1. Understand basic concepts in engineering drawing.
2. Understand the principle of orthographic projection and isometric projection for planes and solids.
3. Draw sectional views of various solids.
4. Draw isometric views and pictorial views of solids.
5. Learn basic concepts and commands in AutoCAD.

Course Outcomes (COs): At the end of the course, student would be able to

CO1. illustrate dimensioning, specifications, conventions and CAD tools used in Engineering Drawing.

CO2. construct scales, geometric curves (conic sections & cycloids) and apply them in engineering drawing.

CO3. apply the principles of orthographic projections to draw projections of points, straight lines, planes, solids and sections of solids.

CO4. develop the isometric views from orthographic views and vice versa for the better visualization and communication.

UNIT - I: Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid, Hypocycloid.

UNIT - II: Engineering Scales – Plain, Diagonal. **Orthographic Projections:** Principles of orthographic Projections Conventions-Projections of Points.

UNIT - III: Projections of Lines- Projections of Plane regular geometric figures.

UNIT - IV: Projections of Regular Solids inclined to one plane, Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone, Sphere.

UNIT -V: Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple Solids – Isometric Projection of objects having non- isometric lines.
Conversion of Isometric views to Orthographic Views and vice versa.

Introduction to CAD: (For Internal Evaluation only): Introduction to CAD Software Package Commands. - Free Hand Sketches of 2D- Creation of 2D Sketches by CAD Package.

Text Books:

1. Engineering Drawing, N.D. Bhatt / Charotar, 53rd Edition 2016.
2. Engineering Drawing, Basant Agrawal and C M Agrawal, McGrawHill, 2nd Edition 2013.

Reference Books:

1. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford, 1st Edition 2015.
2. Engineering Drawing/ M. B. Shah, B.C. Rane / Pearson, 2nd Edition 2013.
3. Computer Aided Engineering Drawing – K Balaveera Reddy, CBS Publishers. 2nd Edition 2015.
4. Engineering Graphics with AutoCAD, Dr.D.M. Kulkarni and A. Sarkar., Prentice Hall India, New Delhi, 2009

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20CS11001-Programming for Problem Solving - I

B. Tech. ECE - I Year I Sem.

L	T	P/D	C
2	-	-	2

Prerequisite(s): None.

Course Objectives: Develop ability to

1. Developing flowcharts for given problem.
2. Understand the concepts of variables, constants, basic data types and input and output statements in C programming language.
3. Understand the use of sequential, selection and repetitive statements in algorithms implemented using C programming language.
4. Understand structured design by implementing programs with functions to solve complex problems.
5. Understand the concepts related to arrays and pointers along with dynamic memory allocation using C programming language.

Course Outcomes (COs): After completion of the course, student would be able to

CO1: Develop Flowchart and Convert it into C Program for a given problem.
CO2: Apply conditional branching, iteration and recursion to solve a given problem.
CO3: Analyze the given problem and write a C Program by applying the concept of function call mechanism for a given problem
CO4: Solve problems through C programs using the concepts of Arrays, Pointers and Dynamic Memory Allocation

UNIT – I

Basics of Computers- Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, compilers.
Logic Building: Flow chart, Algorithm, Pseudo code.
Introduction to Programming – Computer Languages, Creating and running programs, Program Development.
Introduction to the C Language – Background, C Programs, Identifiers, Data Types, Variables, Constants, Input/output functions.
Operators - Arithmetic, relational, logical, bitwise, conditional, increment/decrement, assignment, C program examples. Expressions, Precedence and Associativity, Expression Evaluation, Type conversions.

UNIT - II

Statements- Selection Statements (decision making) – if and switch statements with C program examples.
Repetition statements (loops) - while, for, do-while statements with C Program examples
Statements related to looping – break, continue, goto, Simple C Program examples.

UNIT - III

Functions-Designing Structured Programs, Functions, user defined functions, inter function communication, Scope and Lifetime of variables, Storage classes-auto, register, static, extern, type qualifiers, C program examples.

Recursion- recursive functions, Limitations of recursion, example C programs

UNIT -IV

Arrays – Concepts, using arrays in C, arrays and functions, Bubble Sort, Linear Search, two – dimensional arrays-matrix addition and matrix multiplication, Declaration of Multidimensional arrays, Pre-processor Directives, C program examples.

UNIT - V

Pointers – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, void pointer, null pointer.

Pointer Applications - Arrays and Pointers, Pointer Arithmetic and arrays, passing an array to a function.

Memory allocation functions – malloc(), calloc(), realloc(), free().

Array of pointers, pointers to functions, C program examples.

Text Books:

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.

Reference Books:

1. Raptor-A flow charting Tool http://raptor.martincarlisle.com
2. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI.
3. Programming in C. P. Dey and M Ghosh, Oxford University Press.
4. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.
5. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, 7th Edition, Pearson education.

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20EE11001 – Basic Electrical Engineering

B. Tech. ECE - I Year I Sem.

L	T	P/D	C
3	-	-/-	3

Pre requisites: None

Course Objectives: Develop ability to

1. understand the concepts of DC circuits and its analysis.
2. understand the concepts of AC single phase circuits and its analysis.
3. understand the concepts of single phase and three phase Transformers.
4. understand the concepts of AC and DC machines.
5. understand the working of various domestic electrical installation components.

Course Outcomes: At the end of the course, student would be able to

CO1: Analyze DC and AC electrical circuits using basic laws and network theorems
CO2: Illustrate the fundamental laws used in the working of different AC and DC machines
CO3: Determine the performance characteristics of various DC and AC machines
CO4: Differentiate various electrical installation components based on the application and perform the energy consumption calculations

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 RL-C circuit.

UNIT-III: Faradays Laws of Electromagnetic Induction. Statically and dynamically induced emf. Transformers: Ideal and practical transformers, equivalent circuit, losses in transformers and efficiency. Auto-transformer and Three-phase transformer connections, voltage and current relation.

UNIT-IV: Direct-Current Machines: Construction, operation and Types. Torque-Speed Characteristics of DC shunt and series motors and its applications. Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Single-phase induction motor: Construction and working and its applications.

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 and their applications. Elementary calculations for energy consumption.

Text-Books:

1. Basic Electrical Engineering - D.P. Kothari and I.J. Nagrath, 3rd edition 2010, Tata McGraw Hill.
2. Electrical Engineering Fundamentals, Vincent Del Toro, Second Edition, Prentice Hall India, Pvt. Ltd.

Reference-Books:

1. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
2. L.S. Bobrow, Fundamentals of Electrical Engineering", Oxford University Press, 2011
3. "Basic Electrical Engineering", T.K. Nagsarkar, M.S Sukhija, JNTU Edition, 2005
4. "A text book of Electrical Technology", Volume II, B.L.Thereja, A.K.Thereja

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20PH11L01-Solid State Physics Laboratory
(Common to ECE & EEE)

B. Tech. ECE - I Year I Sem.

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): None

Course Objectives: Develop an ability to
1. Understand the VI characteristics of various p-n junction diodes and nature of semiconductor.
2. Understand the concept of dual nature of light.
3. Understand the variation of magnetic field induction from the centre of circular current carrying coil.
4. Understand the charging and discharging of a capacitor connected in series with resistor.
5. Understand the Quality factor of a given series LCR circuit.
6. Understand the bending losses of a given optical fiber.

Course Outcomes: At the end of the course, student would be able to

CO1: Plot and analyse VI characteristics of various p-n junction diodes and identify type of semiconductor.
CO2: Demonstrate dual nature of light.
CO3: Demonstrate the variation of magnetic field with distance.
CO4: Measure the time constant of a given capacitor using RC circuit.
CO5: Determine the Bandwidth and quality factor for a given series LCR circuit.
CO6: Demonstrate bending losses of a given optical fiber.

Any eight of the following eleven experiments are mandatory to perform by each student

1. Determination of Planck's constant using V-I characteristics of LED.
2. Study the characteristics of LASER source.
3. Determination of energy gap of a given semiconductor.
4. V-I Characteristics of p-n junction diode.
5. V-I characteristics of a solar cell.
6. Determination of Hall coefficient of a given semiconductor.
7. Determination of work function of a given photosensitive material.
8. Determination of magnetic field along the axis of a current carrying coil.
9. Determination of time constant of a given RC combination.
10. Determination of resonant frequency and quality factor of series LCR circuit.
11. Determination of the bending losses of optical fibres.

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20CS11L01-Programming for Problem Solving - I Lab

B. Tech. ECE - I Year I Sem.

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): None.

Course Objectives: Develop ability to

1. Developing flowcharts for given problem.
2. Understand the concepts of variables, constants, basic data types and input and output statements in C programming language.
3. Understand the use of sequential, selection and repetitive statements in algorithms implemented using C programming language.
4. Understand structured design by implementing programs with functions to solve complex problems.
5. Understand the concepts related to arrays and pointers along with dynamic memory allocation using C programming language.

Course Outcomes (COs): After completion of the course, student would be able to

CO1. Develop Flowchart and Convert it into C Program for a given problem.
CO2. Apply conditional branching, iteration and recursion to solve a given problem.
CO3. Analyze the given problem and write a C Program by applying the concept of function call mechanism for a given problem
CO4. Solve problems through C programs using the concepts of Arrays, Pointers and Dynamic Memory Allocation

List of Experiments

Week-1
Introduction to RAPTOR Tool
Draw Flow chart using RAPTOR to,

a. Read two numbers from user and calculate addition and subtraction of those numbers
b. Read two numbers from user at the time of execution and calculate multiplication and division of those numbers
c. Find the square of a given number (take the number from the user)
d. Calculate the value of Y from the equation $y = x^2 + 2x + 3$ (read the value of X from user)
e. Calculate the area of a Circle
f. Find the sum of square of two numbers

Week-2

a. Write a C program to perform arithmetic operations
b. Write a C program to implement increment and decrement operators
c. Write a C program to implement conditional operator
a. Write a C program to implement bit wise operator

Week-3

Draw Flow chart using RAPTOR tool and Implement using C program to,

a. Check whether the given number is Positive or Negative.
b. Check whether the given number is even or odd.
c. Calculate the Largest of two numbers.
d. Check the given year is leap year or not.

Week-4

Draw Flow chart using RAPTOR tool and Implement using C program to,

a) Calculate and display the grade of a student
    a. < 30 % - Fail
    b. Between 31 and 50 – C grade
    c. Between 51 to 60 – B grade
    d. Between 61 to 75 – A grade
    e. Greater than 75 – distinction
b) Find the quadratic roots of an equation (real or imaginary)
c) Check the given number is multiple of 2,4and 8.

Week-5

Draw Flow chart using RAPTOR for,

a. Displaying n numbers using looping
b. Calculating the sum of n natural numbers
c. Calculating sum of even numbers and odd numbers from 1 to n (n value supplied by the user)

Week-6

a. Write a C program to implement arithmetic calculator using switch-case.
b. Write a C program to find sum of n natural numbers.
c. Write a C program to find sum of individual digits of the given number
d. Write a C program to find factorial of a given number

Week-7

a. Write a C program to check the given number is prime or not.
b. Write a C program to check the given number is Palindrome or not.
c. Write a C program to display the prime numbers below n.

Week-8

a. Write a C program to find GCD and LCM of two given numbers using functions
b. Write a C program to check the given number is Armstrong number or not using functions.

Week-9

a. Write a C program to find the sum of prime numbers from 1 to n using functions.
b. Write a C program to generate Fibonacci series for n number of terms.

Week-10

a. Write a C program to find the factorial of a given number using recursive function
b. Write a C program to generate the Fibonacci series using recursive function.
c. Write a C program to find GCD and LCM of two numbers using recursive function.

Week-11

a. Write a c program to find largest and smallest numbers in a list of array elements using functions
b. Write a C program to sort the given list of elements in ascending order using Bubble Sort.
c. Write a c program to search for a given element in the list of array and display the "location" if the number is found else print "the number is not found". Using fixed length and variable length array

Week-12

a. Find the duplicate elements in the list of sorted array
b. Write a C program that uses functions to perform the Addition of Two Matrices
c. Write a C program that uses functions to perform the Multiplication of Two Matrices

Week-13

a. Write a C program to swap two integers using following methods
   i. call by value
   ii. call by reference
b. Write a C program to find sum of even and odd numbers using functions and pointers

Week-14

a. Write a C program to find Largest Number Using Dynamic Memory Allocation.
b. Write a C program to return multiples values from a function using pointers

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20EE11L01 – Basic Electrical Engineering Lab

B. Tech. ECE - I Year I Sem.

L	T	P/D	C
-	-	2	1

Prerequisite(s): None

Course Objectives: Develop ability to

1. Analyze a given network by applying various electrical laws and network theorems
2. Know the response of electrical circuits for different excitations.
3. apply physical laws to solve for unknowns like currents, voltages, impedances, etc.
4. Inspect the speed torque characteristics of DC motor
5. Inspect the speed torque characteristics Three Phase Induction Motor

Course Outcomes: At the end of the course, the student would be able to

CO1: Apply various fundamental laws and theorems to electrical circuits with AC and DC excitations
CO2: Calculate electrical parameters in single phase and three phase circuits
CO3: Determine the performance characteristics of various AC and DC machines

List of experiments:

1. Verification of KVL and KCL
2. Verification of Superposition Theorem
3. Transient Response of Series RL and RC circuits using DC excitation
4. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits
5. Resonance in series RLC circuit
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Load Test on Single Phase Transformer (Efficiency Calculations)
8. Measurement of Active and Reactive Power in a balanced Three-phase circuit
9. Torque-Speed Characteristics of a DC Shunt Motor
10. Torque-Speed Characteristics of a Three-phase Induction Motor

Additional Experiments:

11. Verification of Thevenin's Theorem.
12. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star)

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20ME11L01- Engineering Workshop

(Common to ALL Branches)

B. Tech. ECE - I Year I Sem.

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): **None**

Course Objectives: Develop ability to

1. Provide hands on experience about use of different engineering materials, tools, equipment and processes those are common in the engineering field.
2. Impart a good basic working knowledge required for the production of various engineering products.

Course Outcomes: At the end of the course, the student would able to:

CO1: devise plan of experimentation encompassing process identification, preparatory sketches, and methodology
CO2: apply various hand tools and perform basic manufacturing operations in different trades to produce engineering components adhering to workshop safety regulations.
CO3: demonstrate usage of power tools in different trades
CO4: demonstrate the experimental learning through presentation/ prototype submission.

NOTE: *At least **TWO** exercises to be done from each trade.*

I. TRADES FOR EXERCISES:

A. Carpentry exercises:

a) Making of T-lap joint from given pieces of wood as per as for the job drawing.
b) Making of mortise and tenon joint from given pieces of wood as per as for the job drawing.
c) Making of Bridle joint from given pieces of wood as per as for the job drawing.
d) Making of Corner lap joint from given pieces of wood as per as for the job drawing.
e) Making of cross lap joint from given pieces of wood as per as for the job drawing.

B. Fitting exercises:

a) Making of L-Fitting joint from given pieces of mild steel as per as for the job drawing.
b) Making of "V" – joint from given pieces of mild steel as per as for the job drawing.
c) Making of "Half round" joint from given pieces of mild steel as per as for the job drawing.
d) Making of "Dovetail" joint from given pieces of mild steel as per as for the job drawing.
e) Making of "Square" joint from given pieces of mild steel as per as for the job drawing.

C. Tin-Smithy exercises:

a) Making of an Open scoop with soldering from given G.I. sheet as for the job drawing.
b) Making of Rectangular tray with soldering from given G.I. sheet as for the job drawing.
c) Making of Cylinder with soldering from given G.I. sheet as for the job drawing.
d) Making of Hopper with soldering from given G.I. sheet as for the job drawing.
e) Make a funnel with soldering from given G.I. sheet as for the job drawing

D. Black Smithy exercises:

a) Making of an "S-Hook" from given piece of mild steel rod by hand forging.
b) Making of "U-Hook" from given piece of mild steel rod by hand forging.
c) Making of "C-Hook" from given piece of mild steel rod by hand forging.
d) Making of "Flat chisel" from given piece of mild steel rod by hand forging.

E. House-wiring exercises:

a) Practicing of Wiring for simple light circuit for controlling light/fan point (PVC conduit wiring).
b) Practicing of Wiring for light/fan circuit using two way switches (staircase wiring)
c) Measurement of voltage, current and power in a single phase circuit using voltmeter, ammeter and wattmeter. Calculate power factor of the circuit.
d) Practicing of Wiring for a water pump with single phase starter.

F. Foundry exercises:

a) Preparation of mould for the given single piece pattern with green sand.
b) Preparation of mould for the given split piece pattern with green sand.

G. Welding Practice exercises:

a) Preparation of simple butt joint using arc welding from given pieces of mild steel.
b) Preparation of lap joint using arc welding from given pieces of mild steel.
c) Preparation of corner joint using arc welding from given pieces of mild steel.

Text Books:

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal / Anuradha.

Reference Books:

1. Work shop Manual – P. Kannaiah/ K. L. Narayana/ SciTech
2. Workshop Manual / Venkat Reddy/ BSP

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20EN12001-English

L	T	P/D	C
3	-	-/-	3

B. Tech. ECE - I Year II Sem.

Prerequisite(s): None

Course Objectives: The students would develop ability to

1. Improve their English Language proficiency with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Communicate formally in a given context.

Course Outcomes: At the end of the course, students would be able to

CO1. Infer and use the vocabulary/ grammatical components befitting the context.
CO2. Comprehend any given text and respond precisely.
CO3. Construct meaningful and explicit sentences in written form befitting the context.

UNIT - I

'Raman effect' from the prescribed text book 'English for Engineers' published by Cambridge University press.

Vocabulary Building: Etymology; The Concept of word formation, the use of Prefixes and Suffixes, One-word substitutes.

Grammar: Identifying Common Errors in writing with reference to Articles and Prepositions.

Reading: Improving Reading Comprehension Skills-Techniques for effective reading.

Writing: Importance of proper Punctuation, Types of sentences-simple, compound and complex sentences.

Unit – II

'Ancient Architecture in India', from the prescribed text book 'English for Engineers' published by Cambridge University press.

Vocabulary Building: Synonyms and Antonyms, homonyms, homophones, homographs.

Grammar: Identifying Common Errors in writing with reference to Noun-Pronoun Agreement and Subject Verb-Agreement.

Reading: Improving Reading Comprehension skills; Skimming and Scanning: Techniques for good Comprehension.

Writing: Paragraph writing: types, Structures and features of Paragraph, Creating Coherence, Organizing Principles of Paragraphs in a document, expansion of proverbs.

Unit – III

'Patriotism beyond politics and religion' from 'Ignited Minds'-unleashing the power within India by Dr. APJ Abdul Kalam-Published by Penguin Books.

Vocabulary Building: Words from Foreign Languages and their use in English-word roots.

Grammar: Identifying common errors in writing with reference to misplaced and dangling modifiers and Tenses.

Reading: Sub skills of Reading; Skimming and Scanning.

Writing: Format of a formal Letter, Writing Formal Letters: Letter of Complaint, Letter of Requisition, Cover Letter with Resume, Abstract Writing.

Unit – IV

'What should you be Eating' from the prescribed text book 'English for Engineers' Published by Cambridge University press.

Vocabulary Building: Idioms and phrases, phrasal verbs.

Grammar: Redundancies and Clichés in Oral and Written Communication.

Reading: Comprehension-Intensive Reading and Extensive Reading, searching for implied meaning-answering the questions on theme and tone.

Writing: Writing Practices-Writing Introduction and Conclusion, Blog Writing and Responding to Blogs, Essay Writing - Précis Writing.

Unit V

'How a Chinese Billionaire built her fortune' from the prescribed text book 'English for Engineers' Published by Cambridge University press.

Vocabulary Building: Practice exercises.

Grammar: Active and Passive Voice.

Reading: Reading Comprehension-Exercises for Practice-unseen passages.

Writing: Technical Reports; Introduction, Characteristics of report, categories of reports, Formats, Structure of reports (Manuscript Format) and Types of Report.

Text Books:

1. Sudarshana, N.P. and Savitha, C. (2018). *English for Engineers,* Cambridge University Press.
2. Penguin Books eBook: Ignited Minds-unleashing the power within India by Dr. A.P.J.Abdul Kalam-Published by Penguin Books.

Reference Books:

1. Swan, M. (2016) *Practical English Usage*. Oxford University Press.
2. Mikulecky Beatrice S & Linda Jeffries, Pearson Publications, 2007

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20MA12001 –Multi Variable Calculus

(Common to All Branches)

B. Tech. ECE - I Year II Sem.

L	T	P/D	C
3	1	-/-	4

Prerequisite(s): 20MA11001-Basic Engineering Mathematics

Course Objectives: Develop ability to

1. Compute partial derivatives, composite functions of several variables and apply the methods of differential calculus to optimize multivariable functions and evaluate improper integrals using Beta and Gamma functions.
2. Evaluate definite integrals to calculate surface and volume of revolutions of curves, multiple integrals and apply the same to solve engineering problems.
3. Explain properties of vector operators to determine solenoidal and irrotational vectors, directional derivatives of vectors.
4. Determine the length of a curve, area between the surfaces and volumes of solids using vector integration.
5. Formation of Partial differential equations and various methods to solve them.

Course Outcomes: At the end of course, the student would be able to

CO1: Apply the concept of partial differentiation to solve constrained optimization problems without graphical representation.

CO2: Apply the definite / multiple integrals to compute arc length and areas / volumes of any region / solids.

CO3: Transform line, surface and volume integrals by using vector integral theorems to measure the boundary of a region, area of a surface and / or volume of solids.

CO4: Form first and higher order partial differential equations and apply appropriate methods to solve one-dimensional heat and wave equations.

UNIT-I: Partial Differentiation, Applications and Beta, Gamma Functions

Definitions of Limit and Continuity, Partial Differentiation, Euler's Theorem, Total derivative, Jacobian, Functional dependence and independence, *Maxima and Minima of functions of two variables and three variables using method of Lagrange's multiplier.

Improper Integrals: Beta and Gamma functions and their applications.

UNIT-II: Multiple Integrals and Applications of Integration

Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates).

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 integrals, (Cartesian to Spherical and Cylindrical Polar coordinates) for triple integrals.

Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).

Unit-III: Vector Differentiation

Vector point functions and Scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Tangent plane and Normal line, Vector Identities, Scalar potential function, Solenoidal and Irrotational vectors.

UNIT-IV: Vector Integration

Line, Surface and Volume Integrals. Fundamental theorems of Vector Integration: Green's Theorem, Gauss divergence Theorem and Stokes Theorem (without proofs).

UNIT-V: Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order Linear (Lagrangian) equation, Method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation.

*****Enlightenment with flowchart and algorithmic approach.

Text Books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 44th Edition, 2017.
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 10th Edition, 2011.

Reference Books:

1. A Text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, 10th Edition, 2015.
2. Advanced Engineering Mathematics, H.K. Das, S. Chand and Company Ltd, 21st Edition, 2013.
3. Advanced Engineering Mathematics, Dr. A. B. Mathur and Prof. V.P. Jaggi, Khanna Publishers, 6th Edition, 2019.
4. Advanced Engineering Mathematics, R.K. Jain and S.R.K. Iyengar, Alpha Science International Ltd, 4th Edition, 2013.

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20CS12001 - Programming for Problem Solving - II

B. Tech. ECE - I Year II Sem.

Prerequisite(s): 20CS11001-Programming for Problem Solving - I

L	T	P/D	C
2	-	-/-	2

Course Objectives: Develop ability to

1. Understand the concepts of strings, structure, union, and enumerated types
2. Understand linear lists and their implementation using arrays and linked list.
3. Understand the classical approaches to sorting arrays: selection sort, quick sort, insertion sort; sequential and binary searching algorithms.
4. Concepts and principles of stacks and queues and their applications.
5. Understand the basic characteristics of text, binary files and C implementation of file I/O using streams and command line arguments.

Course Outcomes (COs): After completion of the course, student would be able to

CO1: Solve problems using concepts of string functions, structures, unions.
CO2: Perform basic operations by building Linear Linked List.

CO3: Build C Programs for searching and sorting algorithms

CO4: Build Stacks and Queues through C programs for different applications.

CO5: Perform operations on files using C programs.

UNIT – I

Strings – Concepts, C Strings, String Input / Output functions, string manipulation functions, arrays of strings, string / data conversion, C program examples.
Enumerated Types– The Type Definition (typedef), Enumerated types.
Structure and Union Types – Declaration, initialization, accessing structures, operations on structures, Complex structures, Structures and functions, passing structures through pointers, self-referential structures, unions, bit fields.

UNIT – II

Linear list - Singly linked list implementation, insertion, deletion and searching operations on linear list

UNIT - III

Sorting - Selection sort, Quick Sort, Insertion sort techniques (Using Arrays)
Searching - Linear search, Binary search techniques (Using Arrays)

UNIT – IV

Stacks – Introduction, Principle, Operations: Push and Pop, In-fix to Post-Fix Conversion and Post-Fix evaluation. (Array implementation.)
Queues - Introduction, Principle, Operations: Enqueue and Dequeue. (Array implementation.)

UNIT – V

File Input and Output – Concept of a file, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input / output functions (standard library input / output functions for files), file status functions (error handling), Positioning functions. Command line arguments.

Program Development – Multi-source files, Separate Compilation of functions.

Text Books:

1. Computer Science: A Structured Programming Approach Using C, B.A. Forouzan and R.F. Gilberg, Thompson Learning, 3rd Edition,

Reference Books:

1. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI.
2. Programming in C. P. Dey and M Ghosh , Oxford University Press.
3. Programming with C, B.Gottfried, 3rd edition, Schaum‟s outlines, TMH.
4. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, 7th Edition, Pearson education.
5. C & Data structures – P. Padmanabham, 3rd Edition, B.S. Publications.

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20CH12001-Engineering Chemistry

L	T	P/D	C
3	-	-/-	3

B. Tech. ECE - I Year II Sem.

Prerequisite(s): None.

Course objectives: Develop ability to

1. Acquire the knowledge of atomic, molecular and electronic modifications for understanding properties of transition complexes.
2. Comprehend the basic concepts of hardness of water, corrosion and their impact on industries.
3. Learn the essential concepts of electro chemistry and working of Lead acid battery and Lithium battery.
4. Learn the synthetic aspects of drugs and polymers through organic reaction mechanisms.
5. Understand the basic concepts of UV-Visible, IR, Microwave and NMR spectroscopy for identifying molecular/atomic changes.

Course Outcomes: At the end of the course, student would be able to

CO1. Apply the concepts of atomic and molecular changes for analyzing the nature of diatomic molecules and transition metal complexes.
CO2. Analyze the causes of hardness of water, corrosion and apply the knowledge acquired to solve the problems of industrial significance.
CO3. Utilize the concepts of electrochemistry to explain the functioning of Lead acid and Lithium batteries.
CO4. Apply the fundamentals of reaction mechanisms for the synthesis of organic compounds and polymers of industrial importance.
CO5. Identify the molecular/atomic changes using UV-Visible, IR, Microwave and NMR spectroscopic techniques.

UNIT – I: Molecular structure and Theories of Bonding

Atomic and Molecular orbitals. Linear Combination of Atomic Orbitals (LCAO), Molecular orbitals of diatomic molecules, Molecular Orbital Energy Level diagrams of N_2, O_2 and F_2 molecules. Crystal Field Theory (CFT): Salient Features of CFT – Crystal Field Splitting of transition metal ion d-orbitals in Tetrahedral and Octahedral geometries. Crystal Field Stabilization Energies (CFSE). Applications of CFT- Magnetic Properties of the Octahedral and Tetrahedral Complexes.

UNIT - II: Water and its treatment

Introduction – Hardness of water – Causes of hardness - Types of hardness: temporary and permanent – Expression and units of hardness – Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in treatment of water – Disinfection of water by chlorination and ozonization. Boiler feed water and its treatment – Calgon conditioning, Phosphate conditioning and Colloidal conditioning. External treatment of water – Ion exchange process. Desalination of water - Reverse osmosis. Numerical problems.

UNIT - III: Electrochemistry and corrosion

Electrochemical cells – Electrode potential, Standard electrode potential, Types of electrodes – calomel, quinhydrone and glass electrode. Nernst equation, Determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Numerical problems. Potentiometric titrations. Batteries – Primary (Lithium cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery).

Causes and effects of corrosion – Theories of chemical and electrochemical corrosion – Mechanism of electrochemical corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current cathodic methods. Surface coatings – metallic coatings – methods of application. Electroless plating of Nickel.

UNIT - IV: Reaction Mechanisms and polymeric materials

Reaction Mechanisms

Substitution reactions: Nucleophilic substitution reactions: Mechanism of S_N1, $S_N2$reactions. Electrophilic and Nucleophilic addition reactions: Addition of HBr to propene. Markovnikov's and anti-Markovnikov's additions. Grignard additions on carbonyl compounds. Elimination reactions: Dehydrohalogenation of alkylhalides, Saytzeff'srule. Oxidation reactions: Oxidation of alcohols using $KMnO_4$ and Chromic acid.

Reduction reactions: Reduction of carbonyl compounds using $LiAlH_4$& $NaBH_4$. Hydroboration of olefins. Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.

Polymeric materials

Classification of polymers, Types of Polymerization - addition and condensation, Differences between addition and condensation polymers, Mechanism of free radical addition polymerization. Preparation, properties and engineering applications of PVC, Teflon and Nylon- 6, 6.

UNIT - V: Spectroscopic techniques and applications

Introduction to spectroscopic techniques- Electronic spectroscopy- Beer lambert's law, Principle of UV-Visible spectroscopy, Selection rules, Types of electronic transitions and applications of UV-Visible spectroscopy; Vibrational and rotational spectroscopy- IR spectroscopy-Principle- Mode of vibrations, Selection rules, Applications of IR spectroscopy, Nuclear magnetic resonance Spectroscopy- Principle, Chemical shift, Factors influencing chemical shift, Medical application of NMR spectroscopy- Magnetic Resonance Imaging.

Text Books:

1. Engineering Chemistry by B.Ramadevi, Prasanta Rath and Ch.Venkata Ramana Reddy, Cengage Publications, 2018.
2. A Text Book of Engineering Chemistry by M. ThirumalaChary, E. Laxminarayana and K. Shashikala, Pearson Publishers, 2020.

Reference Books:

1. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company, 17th edition, 2015.
2. Elements of Physical Chemistry by P.W. Atkins 4th Edition.
3. Fundamentals of Molecular Spectroscopy, by C.N. Banwell, 4th Edition.
4. Selected topics in Inorganic Chemistry by Wahid U. Malik, G.D. Tuli and R.D Madan. S. Chand publications, 17th Edition.

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20EC12001- Semiconductor Devices and Circuits

(Common to ECE and EEE)

B. Tech. ECE - I Year II Sem.

L	T	P/D	C
3	1	-/-	4

Prerequisite(s): 20PH11001-Solid State Physics

Course Objectives: Develop ability to

1. Understand working principles of various diodes.
2. Understand the functionality of p-n junction diode as a rectifier.
3. Understand the working principle and operating characteristics of BJT in various configurations.
4. Understand the working principle and operating characteristics of FET in various configurations.
5. Understand low frequency analysis of BJT and FET using small signal models.

Course Outcomes: At the end of the course, the student would be able to

1. **Analyze** the characteristics of PN junction diodes, BJT, FET and MOSFETs.
2. **Analyze** the applications of PN junction diode as a rectifier and a regulator.
3. **Design** biasing circuits for BJT and FET amplifiers.
4. **Analyze** BJT and FET amplifiers using small signal models

UNIT –I

Review of p-n junction diode: Review of p-n junction as a diode, volt-ampere characteristics and temperature dependence of V-I characteristic**.**

Static and dynamic resistances of diode, Transition and Diffusion capacitances (quantitative), small signal diode model, Zener diode, Zener diode characteristics, Breakdown mechanisms in semiconductor diodes, Voltage regulation using Zener diode.

Special diodes (Qualitative treatment only): Symbol, working principle and V-I characteristics and applications of Photo diode, Varactor diode, Light Emitting Diode and Tunnel Diode.

Unit –II

Diode Rectifiers:

Half Wave Rectifier, Full wave and Bridge rectifiers, Derivation of expressions for ripple factor for capacitive and inductive filters. Qualitative treatment of L-section and Π-section filters.

Bipolar Junction Transistor:

The Bipolar Junction Transistor, transistor construction, transistor current components, BJT symbol, Common Base configuration, Early Effect, Common Emitter and Common Collector configurations, current gains α, β and γ. Regions of operation. Limits of operation, BJT specifications and areas of applications.

UNIT –III

Biasing of BJT and stabilization:

Operating Point, DC and AC Load lines, Need for biasing, Fixed Bias, Collector to Base Bias, Emitter Bias (Self Bias), Bias Stability, Stabilization Factors, Stabilization against variations in V_{BE} and β, Bias compensation using diodes and transistors, Thermal Runaway, Qualitative treatment on thermal stability and heat sinks.

UNIT –IV

Field Effect Transistor:

Junction Field Effect Transistor (construction, principle of operation and symbol), Pinch-off voltage - Volt-Ampere characteristics. CS, CD and CG configurations, small signal model of JFET. Enhancement and Depletion MOSFETs (Construction, principle of operation, symbol and Characteristics).

UNIT –V

Amplifiers:

Small signal low frequency h-parameter model of a BJT. Determination of h-parameters from characteristics. Comparison of CE, CB and CC configurations. Concept of an amplifier, amplifier parameters, frequency response of an amplifier, Mid-band analysis of CE amplifier using exact h-parameter model. Mid-band analysis of CS amplifier using low frequency model of JFET.

Text Books:

1. Millman's Electronic Devices and Circuits – J. Millman, C.C.Halkias, and Satyabrata Jit, 3rd Edition, TMH.
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, 9th Edition, PHI.

Reference books:

1. Microelectronics – Jacob Millman, Arvin Grabel, 2nd edition, TMH
2. Microelectronic circuits - Sedra and Smith, 5th Edition, Oxford University press.

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20EN12L01 -English Language Communication Skills Lab

B. Tech. ECE - I Year II Sem.

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): None

Course Objectives: Students would develop the ability to
1. Use computer-assisted multimedia instruction for independent language learning.
2. Enunciate English speech sounds, word accent, intonation and rhythm appropriately.
3. Present their ideas and views in any formal context.

Course Outcomes: At the end of the course students would be able to
CO1. Listen actively, speak intelligibly and write clearly.
CO2. Use Phonetics to neutralize accent.
CO3. Articulate ideas explicitly, both verbally and non-verbally.
CO4. Demonstrate basic skills to succeed in interviews.

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

a. Computer Assisted Language Learning (CALL) Lab

b. Interactive Communication Skills (ICS) Lab

Module-I

CALL Lab:

Understand: Listening: Listening Skill-Its importance - Purpose-Process-Types-Barriers to Listening.

Practice: Introduction to Phonetics-Speech Sounds-Vowels and Consonants-Minimal pairs.

ICS Lab:

Understand: Communication at Work Place-Spoken vs. Written language.

Practice: Speaking: Ice-Breaking Activity and JAM Session. Know your partner activity.

Module-II

CALL Lab:

Understand: Listening: Structure of Syllable, Word Stress and Rhythm, Weak Forms and Strong Forms in Context**.**

Practice: Basic Rules of Word Accent-Stress Shift-Weak Forms and Strong Forms in Context.

ICS Lab:

Understand: Features of Good Conversation–Non-verbal Communication.

Practice: Speaking: Telephone Etiquette, Situational Dialogues-Greetings-Taking Leave Making request and seeking permission-Introducing oneself and others.

Module-III

CALL Lab:

Understand: Listening: Intonation; Errors in pronunciation-The interference of Mother Tongue (MTI) examples from different parts of the country.

Practice: Common Indian Variants in Pronunciation- Differences in British and American Pronunciation.

ICS Lab:

Understand: How to make Formal Presentations.

Practice: Speaking: Descriptions- Places, Objects, Events and Process-Formal Presentations.

Module-IV

CALL Lab:

Understand: Listening for General Details. (2 practice exercises)

Practice: Listening Comprehension Tests. (2 practice exercises)

ICS Lab:

Understand: Public Speaking-Debate-Exposure to Structured talks.

Practice: Speaking: Making a Short Speech-Extempore. (2 practice exercises, Talks. (2 practice exercises) 'My Newspaper' activity.

Module-V

CALL Lab:

Understand: Listening: Listening for Specific Details. (2 practice exercises)

Practice: Listening Comprehension Tests. (2 practice exercises)

ICS Lab:

Understand: Speaking: General Interview Skills.

Practice: General Interview Strategies and Skills.

Text Books:

1. Krishna Mohan & N. P Singh: *Speaking English Effectively* 2nd ed., MacMillan Publishers, 2011.
2. ELCS Lab Manual prepared by Faculty, Department of English, GCET.

Reference Books:

1. English Language Communication Skills Lab Manual cum Workbook by Cengage Learning India, 2013.
2. Podcasts on Listening, Cambridge University Press.

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20CS12L01 - Programming for Problem Solving - II Lab

B. Tech. ECE - I Year II Sem.

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): 20CS11L1-Programming for Problem Solving-I

Course Objectives: Develop ability to

1. Understand the concepts of strings ,structure, union, and enumerated types
2. Understand linear lists and their implementation using arrays and linked list.
3. Understand the classical approaches to sorting arrays: selection sort, quick sort, insertion sort; sequential and binary searching algorithms.
4. Concepts and principles of stacks and queues and their applications.
5. Understand the basic characteristics of text, binary files and C implementation of file I/O using streams and command line arguments.

Course Outcomes: After completion of the course, student would be able to

CO1: Solve problems using concepts of string functions, structures, unions.
CO2: Perform basic operations by building Linear Linked List.

CO3: Build C Programs for searching and sorting algorithms

CO4: Build Stacks and Queues through C programs for different applications.

CO5: Perform operations on files using C programs.

List of Experiments

Week 1:

a. Write a C program to find whether a given string is palindrome or not.
b. Write a C program to insert characters at a given location in a given string.
c. Write a C program to delete characters from a given string and position
d. Write a C program to print the number of vowels and consonants using Strings

Week 2:

a. Write a C program to convert Roman number to Decimal Number.

b. Write a C program to find the 2's Compliment of a given string

c. Write a C program to Reverse a String by Passing it to function

d. Write a C Program to Input a String with at least one Number, Print the Square of all the Numbers in a String

Week 3:

Write a C program to implement complex structures for the following operations.

i. Addition of two Complex numbers
ii. Multiplication of two Complex Numbers

Week 4:

a. Write a C program to implement arrays of structures?

b. Write a C program to implement bit fields in C?

Week 5:

a. Write a C Program to store the information (name, roll no, and branch) of a student using unions.

b. Write a C program to implement inter function communication by passing pointers to a structure.

Week 6:

Write a C program to implement singly linked list for the following operations.

a) Insertion b) Deletion c) Search

Week 7:

a. Write a C program to sort the elements using Selectionsort

b. Write a C program to sort the elements using Quick sort.

Week 8:

a. Write a C program to sort the elements using Insertion sort

b. Write a C program to search a string in a list of strings using linear search. If the string is found display the position, otherwise print "string not present".

Week 9:

Write a C program to search an element in a list of elements using Binary search. If the element is found, display the position, otherwise print "element not present".

Week 10:

Write a C program convert infix to postfix notation and postfix evaluation using stack.

Week 11:

Write a C program implement Queue using arrays for the following operations.

i)Enqueue ii) Dequeue iii) Peek iv) Display

Week 12:

Write a C program open a new file and implement the following I/O functions.

i) fprintf(), fscanf()
ii) getw(), putw()
iii) getc(), putc()

Week 13:

a. Write a C program to copy data from one file to another.

b. Write a C program to merge two files, using command line arguments.

Week 14:

Write a C program to implement multi file programming for basic arithmetic operations

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20CH12L01-Engineering Chemistry Lab

L	T	P/D	C
-	-	2	1

B. Tech. ECE - I Year II Sem.

Prerequisite(s): None.

Course objectives: Develop ability to

1. Estimate the hardness content in water and check its suitability for drinking purpose.
2. Use instrumental methods namely, Potentiometry and Conductometry to find the concentration of a given solution.
3. Measure physical properties like surface tension, adsorption, acid value and viscosity.
4. Explain the synthesis of simple drug molecules such as Aspirin.
5. Determine the rate constant of reactions from concentrations as a function of time.

Course Outcomes: At the end of the course, student would be able to

CO1: Determine the temporary and permanent hardness in water to verify its suitability for drinking purpose.
CO2: Find the concentration of given solution using instrumental techniques such as Potentiometer and Conductometry.
CO3: Determine physical properties, namely, surface tension, acid value and viscosity of a given fluid.
CO4: Use fundamental preparatory techniques for the synthesis of drugs such as aspirin.
CO5: Estimate the rate constant of a reaction from concentration – time relationship.

List of Experiments

I. Titrimetry:

1. Determination of total hardness of water by complexometric method using EDTA.
2. Determination of acid value of coconut oil.

II Instrumental Methods

A. Potentiometry

1. Estimation of HCl by Potentiometric titrations.
2. Estimation of Fe^{2+} by Potentiometry using $KMnO_4$.

B. Conductometry

1. Estimation of HCl by Conductometric titrations.
2. Estimation of Acetic acid by Conductometric titrations.

III. Physical Constants

1. Determination of viscosity of a given liquid by using Ostwald's Viscometer.
2. Determination of surface tension of a given liquid using Stalagmometer.

IV. Synthesis

1. Synthesis of Aspirin.

V. Kinetics

1. Determination of rate constant of acid catalyzed hydrolysis of methyl acetate.

VI. Additional Experiments

1. Verification of Freundlich adsorption isotherm-adsorption of acetic acid on charcoal.
2. Determination of partition coefficient of acetic acid between n-butanol and water.

Reference Books:

1. Senior Practical Physical Chemistry, B.D. Khosla, A. Gulati and V. Garg (R. Chand & Co., Delhi).
2. An introduction to Practical Chemistry, K.K. Sharma and D. S. Sharma (Vikas publishing, N. Delhi).
3. Vogel's text book of practical Organic Chemistry 5^{th} edition.
4. Text book on Experiments and calculations in Engineering Chemistry – S.S. Dara.

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20EC12L01 – Semiconductor Devices and Circuits Lab
(Common to ECE and EEE)

B. Tech. ECE - I Year II Sem.

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): None

Course Objectives: Develop ability to
1. Identify various electronic components and understand their specifications.
2. Understand and operate various electronic measuring instruments
3. Understand the procedure for obtaining the characteristics of diode, BJT and FET
4. Understand the application of semiconductor diodes as rectifier and voltage regulator
5. Understand the procedure for biasing of BJT
6. Understand the procedure for obtaining frequency response of BJT and FET amplifiers

Course Outcomes: At the end of the course, the student would be able to
CO1. Use electronic instruments for measuring the parameters of various circuit components
CO2. Verify the operating characteristics of diode, BJT and FET
CO3. Measure the performance characteristics of a rectifier and voltage regulator
CO4. Design and verify various biasing circuits for a BJT
CO5. Plot and analyze frequency response of BJT and FET amplifiers

List of Experiments

Part A: Electronic Workshop Practice (Two lab sessions):
1. Identification, specification and testing of R, L, C Components, Potentiometers, Rheostats, Switches (SPST, SPDT, DPST, DPDT and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCBs, Sensors (LDR, Thermistors, Piezo-Buzzers)
2. Identification, specification, testing of Active Devices - Diode, BJT, JFET, MOSFET, Power Transistor, LED, LCD.
3. Study and operation of Multimeter, Voltmeter, Ammeter, Function Generator, Regulated Power Supply and CRO.
4. Soldering practice.

Part B: (A minimum of 8 experiments are to be conducted)
1. V-I characteristics of a PN junction diode.
2. Voltage regulation characteristics of Zener diode.
3. Ripple factor and percentage regulation of Half Wave Rectifier with & without filters (Capacitor filter).
4. Ripple factor and percentage regulation of Full Wave Rectifier with & without filters (L section).
5. Input & Output characteristics of BJT in CE Configuration and h-parameters calculation.
6. FET (Common Source) Characteristics and calculation of g_m and r_d.
7. Design and verification of Collector to Base bias circuit.
8. Design and verification of self-bias circuit for BJT.
9. Frequency response of CE amplifier.
10. Frequency response of common source FET amplifier.

Equipment required:

(a) Regulated Power Supplies (RPS) 0-30 V
(b) CROs 0-20 MHz
(c) Function Generators 0-1 MHz
(d) Multimeters
(e) Decade Resistance Boxes/ Rheostats
(f) Decade Capacitance Boxes
(g) Decade Inductance Boxes
(h) Ammeters 0-200 μA, 0-200 mA
(i) Voltmeters 0-20 V, 0-30 V
(j) Components:

Resistors, Inductors, Capacitors, BJTs, LCDs, FETs, LEDs, MOSFETs, Diodes-Ge & Si type, Transistors –NPN, PNP type, LDRs, Bread boards, Potentiometers, Rheostats, Switches – SPST, SPDT, DPST, DPDT and DIP, Coils, Gang condensers, Relays, PCBs, Thermistors, Piezo Buzzers and Power transistors.

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20MA21001– Theory of Complex Variables

(Common to ECE and EEE)

B. Tech. ECE - II Year I Sem.

L	T	P/D	C
3	-	-	3

Prerequisite(s): 20MA12001-Multi Variable Calculus

Course Objectives: Develop ability to

1. Distinguish real and complex valued functions and verify its analyticity.
2. Learn Cauchy's theorem, Cauchy's integral formula including Generalized one.
3. Express complex valued functions in terms of power series and test its convergence using complex integral theorems.
4. Understand residues and apply residue theorem to compute several kinds of real definite integrals.
5. Transform a given complex valued function from Z-plane to W-plane using conformal, standard and bilinear transformations.

Course Outcomes: At the end of the course, student would be able to:

CO1: Determine complex valued analytic function by applying Cauchy-Riemann equations.

CO2: Evaluate definite integrals by applying Cauchy's integral theorem/formula/residue theorem.

CO3: Determine the convergence of circular/annulus region of Taylor's/Laurent's series of a complex function.

CO4: Transform complex valued function from Z-plane to W-Plane by applying conformal mapping/standard transformation/bilinear transformation.

Unit-I: Complex Functions and Analyticity

Complex functions and its representation on Argand plane, Concepts of Limit and Continuity, Differentiability, Analyticity, Cauchy-Riemann conditions, Harmonic functions, Milne–Thompson method.

Unit-II: Complex Integration

Line integral: Evaluation along a path and by indefinite integration. Cauchy's integral theorem, Cauchy's integral formula, Generalized Cauchy's integral formula.

Unit-III: Power Series Expansions of Complex Functions

Radius of convergence, Expansion of complex functions using Taylor's series, Maclaurin's series and Laurent series, Singular point, Isolated singular point, Pole of order m, Essential singularity.

UNIT-IV: Contour Integration

Definition of Residue, Evaluation of residue by formula and by Laurent series, Residue theorem, Evaluation of improper real integrals a) $\int_{-\infty}^{\infty} f(x)dx$ b)$\int_{c}^{c+2\pi} f(cos\theta, sin\theta)\, d\theta$ c) $\int_{-\infty}^{\infty} e^{imx} f(x)dx$ d) Integrals by indentation.

UNIT-V: Conformal Mapping

Transformation of Z-plane to W-plane by a function, Conformal Transformation, Standard transformations, Translation**,** Magnification and rotation**,** inversion and reflection, Transformations like e^z, log z, z^2 and Bilinear transformation, properties of Bilinear transformation, determination of bilinear transformation when mappings of three points are given.

Text Books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 44th Edition, 2017.
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 10th Edition, 2011.

References:

1. Complex analysis for Mathematics and Engineering by John H, Jones and Bartlett India Pvt Ltd. - New Delhi. 6th Edition, 2010.
2. Foundations of Complex Analysis by S. Ponnuswamy, Narosa Publications, 2nd Edition, 2019.
3. Advanced Engineering Mathematics, H.K. Das, S. Chand and Company Ltd, 21st Edition, 2013.

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20EC21001-Signals and Systems

B. Tech. ECE - II Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20MA11001 – Basic Engineering Mathematics
20MA12001 – Multi variable Calculus

Course objectives: Develop ability to

6. Distinguish different types of Signals, Systems and understand their characteristics using convolution and correlation.
7. Understand the concept of orthogonality of signals and their frequency domain representation.
8. Interpret the process of discretization of signals and its effect on the spectral domain characteristics of the signal
9. Comprehend the similarity measures used for signals and the concept of frequency domain representation of energy and power of a signal
10. Appreciate the transform domain tools used in the analysis of continuous time/discrete time systems.

Course Outcomes: At the end of the course, the student would be able to

CO 1. Apply signal transformations for system characterization.
CO 2. Analyze the given Continuous/Discrete signal in time and frequency domains.
CO 3. Apply various similarity measures and corresponding frequency domain approaches for the computation of Energy and Power of signals.
CO 4. Determine the stability and physical realizability of the given LTI system using Laplace and 'Z' transforms.

UNIT – I

Introduction to signals and systems, classification of signals, basic operations on signals, classification of systems, convolution of signals, Graphical representation of convolution, Computation of response of an LTI system using convolution.

Analogy between vectors and signals, Orthogonal signal space, Approximation of a Function using mutually orthogonal functions, Mean square error, closed or complete set of orthogonal functions, orthogonality in complex functions.

UNIT - II

Signal Representation: Fourier series

Fourier series representation of continuous time periodic signals, Dirichlet's conditions, Trigonometric and Exponential Fourier series, Properties of Fourier series, Complex Fourier spectrum, Gibb's phenomenon.

Fourier Transform

Relation between Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, Properties of Fourier transform, Inverse Fourier transform, Introduction to Hilbert Transform.

UNIT - III

Sampling of Continuous Time Signals: Sampling Theorem for bandlimited signal – Graphical and analytical proof, Types of Sampling - Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass sampling.

UNIT - IV

Correlation: Auto correlation and Cross correlation of Signals, Properties of correlation function of signals, Relation between convolution and correlation of signals, Energy density spectrum, Power density spectrum, Parseval's Theorem for Energy and Power signals, Relation between auto correlation function and energy/power spectral density of a signal

UNIT-V

Laplace Transform and Z-Transform

Review of Laplace Transform and Properties. Concept of Region of Convergence (ROC) constraints on ROC, Laplace transform of certain signals using waveform synthesis.

Z Transform: Concept of Z- transform of and computation of Z-Transform of discrete signals, Properties, Region of Convergence (ROC) and constraints, computation of Inverse Z-transform, solution of differential equations using Z-Transform.

Text Books:

1. Signals and Systems – A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edition.
2. Analog and Digital Signal processing - Ashok Ambardar, Brooks/Cole Publishing company, 2nd Edition

References:

1. Signals and Systems: Continuous and Discrete by Rodger E.Ziemer , William H Tranter , D. R. Fannin, 4th Edition Pearson Education Limited.
2. Signals and systems, Schaum's outlines – Hwei Hsu, McGraw Hill Professional, 1995

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20EC21002 – Digital Design

(Common to ECE, EEE, CSE, CSE(AIML), CSE(DS), CSE(CS), CSE(IoT) and IT)

B. Tech. ECE - II Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): None

Course Objectives: Develop ability to

1. Understand basic concepts of various number systems used in digital systems.
2. Understand Boolean algebra and various Boolean simplification theorems.
3. Understand simplification of Boolean functions using k-map and tabular method.
4. Understand design and analysis of combinational and sequential logic circuits.
5. Understand symmetric functions and design the same using relay contacts.
6. Understand Threshold logic and design switching functions using threshold elements

Course Outcomes: At the end of the course, the student would be able to

CO1. Apply knowledge of number systems, codes and Boolean algebra to the analysis and design of digital logic circuits

CO2. Apply the knowledge of logic gates to design and implement various digital circuits

CO3. Identify, formulate, and solve simple problems in the area of digital logic circuit design.

CO4. Apply the concepts of symmetric functions, Threshold logic to design logic circuits.

CO5. Design digital circuits, component(s) or process to meet desired needs within realistic constraints

UNIT I: Number Systems

Number Systems, Base Conversion Methods, Binary arithmetic, Complements of Numbers, Codes-Binary Codes, Binary Coded Decimal (BCD) Code and its Properties, Unit Distance Codes, Alpha Numeric Codes, Error Detecting and Correcting Codes.

Boolean Algebra and Switching Functions: Switching algebra, Basic Gates, Basic Theorems and Properties, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates. Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT II: Minimization of switching functions

Introduction, Minimization with theorems, The Karnaugh Map Method – Three, Four, Five and Six Variable maps. Prime Implicants and essential Prime Implicants. Don't care map entries, using the map for simplifying Boolean expressions, Tabular method, partially specified expressions, Multi-output minimizations.

UNIT III: Design of Combinational Circuits

Adders, Subtractors, Multiplexers, Realization of Switching Functions using Multiplexers, De-multiplexers, Decoders, Encoders, Priority Encoder, Comparators, Parity Generators, Code Converters. Static Hazards and Hazard Free Realizations.

UNIT IV: Synthesis of Symmetric Networks

Relay Contacts, Analysis and Synthesis of Contact Networks, Symmetric Networks, Identification of Symmetric Functions and realization of the same.

Threshold Logic: Threshold Element, Capabilities and Limitations of Threshold logic, Elementary Properties, Synthesis of threshold networks (Unate function, Linear separability, Identification and realization of threshold functions, Map based synthesis of two-level Threshold networks).

UNIT V: Sequential Machines Fundamentals

Introduction, NAND/NOR latches, SR, JK, JK Master slave, D and T Flip-flops, Excitation functions of SR, JK, JK Master Slave, D and T Flip-flops. State table, State Diagram, State Assignment. Finite State Model - Basic Definitions. Synthesis of Synchronous Sequential circuits - Sequence Detector, Serial Binary adder, Binary counter and Parity bit generator.

Counters and Shift Registers: Ripple Counter, Shift Registers and their types, Ring Counters, Twisted Ring Counters.

Text Books:

1. Switching and Finite Automata Theory, Zvi Kohavi & Niraj K. Jha, 2nd Edition, 2009, Cambridge University Press.

Reference Books:

1. Digital Fundamentals - A Systems Approach", Thomas L. Floyd, Pearson, 2013.
2. Fundamentals of Logic Design, Charles H. Roth, Cengage Learning, 5th Edition, 2004.
3. Digital Design, Morris Mano, PHl, 3rd Edition

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20EC21003 - Electronic Circuit Analysis and Design

B. Tech. ECE - II Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC12001-Semiconductor Devices and Circuits

Course Objectives: Develop ability to

1. Understand analysis of single and multistage amplifiers in low and high frequency regions, for BJT and FETs.
2. Understand the concept of feedback in an amplifier and analysis of various feedback amplifiers.
3. Understand the concept of positive feedback in oscillators, analyze and realize R-C, L-C oscillators.
4. Understand large signal amplifiers - Class A, Class B and their power conversion efficiency.
5. Understand the analysis of tuned amplifiers - Single tuned, stagger tuned amplifiers.

Course Outcomes: At the end of the course, the student would be able to:

CO 1. **Design** small signal single stage and multistage amplifiers at low frequency using h-parameter model.
CO 2. **Analyze** small signal single stage amplifiers and tuned amplifiers at high frequency using hybrid-π model.
CO 3. **Analyze** different types of feedback amplifiers and oscillators with respect to their functional characteristics.
CO 4. **Analyze** the performance characteristics of large signal amplifiers.

UNIT –I SINGLE STAGE AMPLIFIERS:

Approximate h-parameter model of BJT. Effect of coupling and bypass capacitors on the gain of an amplifier. Hybrid- pi CE transistor model and its analysis, low and high frequency models of FET and their analysis. Design of single stage BJT and FET amplifiers for given specifications.

UNIT –II MULTI-STAGE AMPLIFIERS:

Cascading of amplifiers and frequency responses under various coupling methods. Analysis of two-stage RC coupled CE amplifier. Cascode Amplifier and Darlington Pair.

UNIT- III Feedback Amplifiers and Oscillators

Feedback Amplifiers: Concept of Feedback, Classification of Feedback Amplifiers, Effect of Feedback on Amplifier characteristics. Analysis of Voltage-Series, Voltage-Shunt, Current-Series and Current-Shunt Configurations.

Oscillators: Classification of Oscillators. Conditions for Oscillations. Analysis and design of RC Phase shift oscillator (using BJT and FET). Analysis of Wien–Bridge oscillator. Analysis and design of LC oscillators (Hartley and Colpitts). Crystal Oscillator: Principle of operation and applications. Stability of Oscillators.

UNIT- IV: Large Signal Amplifiers

Classification of power amplifiers (A, B, AB and C), Class-A Large Signal Amplifiers, Conversion Efficiency of Class-A Power Amplifier, Design of Transformer Coupled Class-A Audio Power Amplifier, Conversion Efficiency of Class-B push-pull power Amplifier, Class B power amplifier using Complementary Symmetry.

UNIT- V: Tuned Amplifiers

Analysis and design of Single Tuned Amplifier, Stagger Tuned Amplifiers. Applications of tuned amplifiers.

Text Books:

1. Millman's Electronic Devices and Circuits – J. Millman, C.C.Halkias, and Satyabrata Jit, 2nd Edition. 1998, TMH.
2. Electronic Circuits: Discrete and Integrated, Donald L.Schilling and Charle Belove, TMH.

References:

1. Integrated Electronics, Jacob Millman and Christos C Halkias,1991 Ed., 2008, TMH
2. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, 9th Edition, 2006, PHI

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20EC21004 - Circuit Theory

B. Tech. ECE - II Year I Sem.

L	T	P/D	C
3	-/-	-/-	3

Prerequisite(s): 20EE11001-Basic Electrical Engineering
20MA11001-Mathematics-I

Course objectives: Develop ability to

1. Understand and analyze first order differential equations of single time constant circuits.
2. Understand transient and steady state response of circuits using Laplace transforms.
3. Understand various parameters of symmetrical and asymmetrical two-port networks.
4. Classify and characterize various types of passive filters.
5. Understand different aspects of attenuators and equalizers.

Course outcomes: At the end of the course, the student would be able to:

CO1. **Analyze** transient and steady state responses of RL, RC and RLC circuits for step, impulse and sinusoidal inputs in time and frequency domains.
CO2. **Analyze** two-port networks using Z, Y, ABCD and h – parameters and their inter-relationship.
CO3. **Analyze** electrical characteristics of Symmetrical and Asymmetrical two-port networks.
CO4. **Design** constant-k, m-derived low pass and high pass passive filters for the given specifications
CO5. **Design** symmetrical and asymmetrical attenuators for T, π and L network configurations for the given specifications.
CO6. **Design** series and shunt equalizers for the given specifications.

Unit - I: Analysis of single time constant circuits in time domain

Review of circuit elements and sources, KVL and KCL, and formulation of network equations; Initial conditions in networks, Transient and steady state analysis of single time constant circuits in time domain for step, impulse and sinusoidal inputs.

Unit - II: Applications of Laplace transforms for circuit analysis

Transient and steady state analysis of single time constant circuits in s-domain for step, impulse and sinusoidal inputs. Transient and steady state analysis of RLC circuits in s-domain for step and sinusoidal inputs.

Unit - III: Two-port networks

Two-port parameters: Open circuit impedance (Z), Short circuit admittance (Y), Hybrid (h), Transmission (ABCD) parameters. Inter-relationship of parameters; Interconnection of two-port networks.

Unsymmetrical and symmetrical two-port networks:

L, T and π sections; concept of impedance matching; Image impedances and image transfer constant. Iterative impedances and iterative transfer constant. Characteristic impedance and propagation constant.

Unit - IV: Passive Filters

Need of filters in communication engineering. Classification of filters: Low pass, High pass, Band pass and Band elimination. Characteristics: Pass band, Stop band, transition band, attenuation constant (α) and phase constant (β). Examples of filter applications in communication engineering (LPF, BPF, Notch filter). Filter Networks: L, T, π and their characteristics. Analysis and design of constant - k filters: LP and HP. Analysis and design of m - derived filters: LP and HP.

Unit V: Attenuators and Equalizers

Need of attenuators; Analysis and design of Attenuators: Symmetrical T, π and Bridged T attenuators; Asymmetrical attenuators: T, π and L attenuators. Need of equalizers; Inverse Networks. Full series and Full shunt equalizers.

Text Books:

1. Network Analysis, M. E. Van Valkenburg, T.S. Rathore, Revised Third Edition Pearson, 2019
2. Circuits and Networks: Analysis and Synthesis, A. Sudhakar, Shyammohan S. Palli, TMH, 2017

Reference Books:

1. Engineering Circuit Analysis, W H Hayt, J E Kemmerly and S M Durbin, 4th Ed., TMH
2. Basic Circuit Theory, Charles A. Desoer and Ernest S. Kuh, TMH, 2010
3. Circuit Theory, A. Chakrabarti, Dhanpat Rai Educational Publishers, 2013.

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20EC21L01-Signals and Systems Lab

L	T	P/D	C
-	-/-	2/-	1

B. Tech. ECE - II Year I Sem.
Prerequisite(s): None

Course Objectives: Develop ability to

1. Understand the simulation of generating various signals/sequences; their synthesis and various transformations of signals
2. Realize the simulation of the study of the characteristics of an LTI system and finding its response for various excitations i.e. unit impulse, unit step and sinusoidal signals.
3. Understand the simulation of transform domain representation of a given signal
4. Understand the simulation of various similarity measures between signals /sequences.
5. Understand the principles of regularity of occurrence in signals

Course outcomes: At the end of the course, the student would be able to:

CO1. Synthesize a given waveform in terms of standard test signals/ sequences and simulate Various signal transformations .
CO2. Demonstrate the principles of system classification, using its characteristics in time and frequency domains.
CO3. Simulate the given time domain signal in frequency domain and demonstrate the respective convergence properties.
CO4. Demonstrate the applications of Auto/Cross correlation in signal processing through simulation.
CO5. Verify the periodicity and aperiodicity of signals.

List of Experiments

Note: All the experiments are to be simulated using MATLAB/Scilab/Octave software or equivalent software

1. Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp and Sine.
2. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power, computation of the Even and Odd parts of Signal/Sequence, Real and Imaginary parts of a complex Signal.
3. Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System.
4. Convolution and Correlation between (i) Signals (ii) sequences.
5. Computation of Unit Impulse, Unit Step and sinusoidal response of the given LTI system.
6. Verification of Gibb's Phenomenon.
7. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
8. Verification of Sampling theorem
9. Waveform Synthesis
10. Locating the Poles and Zeros of the given LTI system in S-Plane and Z-Plane, and checking the system for Physical realizability and Stability
11. Checking the given signal for Periodicity
12. Applications of Auto/Cross Correlation

Equipment required: **1. Hardware**: PCs
2. Software: MATLAB/Scilab/Octave software or equivalent software

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20EC21L02– Digital Design Lab

(Common to ECE and EEE)

B. Tech ECE - II Year I Sem.

L	T	P/D	C
-	-	2	1

Prerequisite(s): None

Course Objectives: Develop ability to

1. Understand the functionality of various logic gates using ICs
2. Understand the functionality of combinational logic circuits using ICs
3. Understand the functionality of Sequential logic circuits using ICs
4. Implement the logic functions using Combinational logic Circuits using ICs.
5. Realize the sequential logic functions using various ICs.

Course outcomes: At the end of the course, the student would be able to:

CO1. Verify the functionality of various logic gates using ICs
CO2. Verify the operation of various Combinational logic circuits using ICs
CO3. Verify the operation of various Sequential logic circuits using ICs
CO4. Design and implement combinational logic circuits using ICs on Trainer kits.
CO5. Design and implement Sequential logic circuits using ICs on Bread Boards / Trainer kits.

Introduction to IC details, connections to the ICs and digital IC trainer kit.

List of Experiments: (Any **12 experiments** are to be performed choosing at least FIVE from each PART)

PART A: To Verify the Functionality of the following using digital IC trainer kits

1. Study the operation of the logic gates using ICs.
2. 4-bit Binary Adder (74283).
3. 8x 1 Multiplexer (74151).
4. 3-8 Decoders (74138).
5. 4-Bit Comparator (7485)
6. 8-3-line Priority Encoder (74148)
7. Study the operation of Flip-Flops (D, JK) using ICs.
8. Binary Counter (7493).
9. Universal Shift Register (74194/195).

PART B: To design and implement the following logic circuits using ICs on the trainer kits.

1. 4-bit Adder cum Subtractor using Full Adders (74283)
2. BCD Adder using Full Adders (74283)
3. Full Adder and Full Subtractor using:
   a) 3 to 8 Decoder (74138) b) 4 to 1 Multiplexer (74153).
4. 4 Bit Binary to Gray and Gray to Binary code converters using XOR gates.
5. Decade Counter using a Binary counter (7493).
6. Digital Clock using Counters for Seconds/Minutes/Hours.
7. Design a 4-bit Ring Counter / Twisted Ring Counter using 4-bit Shift Registers (74194/74195) and using D-flip flops (7474).

Additional Experiments:

1. BCD to Excess-3 code converter using AOI logic.
2. 2 Bit comparator using gates.
3. BCD to 7-segment driver circuit.
4. Two bit carry lookahead adder using Full Adders.

Equipment required: 1. Digital IC trainer Kits
2. Components: 74XX ICs

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20EC21L03 - Electronic Circuit Analysis and Design Lab

B. Tech. ECE - II Year I Sem.

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): 20EC12001-Semiconductor Devices and circuits
20EC12L01-Semiconductor Devices and circuits Lab

Course Objectives: Develop ability to

1. Obtain the frequency response of amplifiers with and without feedback.
2. Understand the design considerations of amplifiers with and without feedback.
3. Understand the design considerations of oscillators namely, RC phase shift and LC oscillators for a given frequency of oscillations.
4. Understand the conversion efficiency of large signal amplifiers, Class A and Class B.
5. Understand the design considerations of single tuned amplifiers.

Course outcomes: At the end of the course, the student would be able to:

CO1. Design and verify the operation and parameters of BJT/ FET amplifier circuits with and without feedback for given specifications.
CO2. Design and verify the operation of RC and LC oscillators for a given frequency of oscillations.
CO3. Verify the power conversion efficiency of Class-A and Class-B power amplifiers.
CO4. Design and verify frequency response of a single tuned amplifier.

List of Experiments: (A minimum of **TEN** Experiments are to be conducted using hardware)

1. Design of single stage RC coupled BJT amplifier
2. To determine current gain and input impedance of Darlington pair.
3. Frequency response of Current Series Feedback Amplifier
4. Design of Current Shunt Feedback Amplifier
5. Frequency response of Voltage Shunt Feedback Amplifier
6. Design of RC Phase Shift Oscillator using BJT
7. Design of Hartley Oscillator
8. Design of Colpitts Oscillator
9. Determining efficiency of Class A Power Amplifier
10. Determining efficiency of Class B Complementary- Symmetry Power Amplifier
11. Design of Single tuned amplifier.

Equipment required:

1. Regulated Power Supply (0-30V)
2. CROs (0-20 MHz / 40 MHz / 60 MHz)
3. Functions Generators (0 – 1MHz)
4. Multimeters/Voltmeters
5. Components (Resistors, Capacitors, Diodes, BJTs, FETs)
6. Trainer kits/Bread Boards.
7. Power output meter.

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20EN21P01-English for Effective Communication

(Classroom Activity based Course)

B. Tech. ECE - II year I Sem.

L	T	P/D	C
-	-	2	1

Course Objectives: Develop ability to

1. Delineate the contextual meaning of various words and their functions in sentence.
2. Equip themselves with English language skills using appropriate vocabulary.
3. Improve English language proficiency with an emphasis on Reading skills.
4. Develop ability to think critically and articulate their views.

Course Outcomes: At the end of the course, the students would be able to

CO1. Use appropriate words befitting the context.
CO2. Draw valid inferences by comprehending the given text.
CO3. Interpret the given picture/text and draw implications.

Module-I
History of Words

Etymology: Word Origin, Advanced word roots, words borrowed from different languages to English, **Portmanteau words,** also called **blend**ed words (new coinage of words), assimilation of words.

Module-II
Word Analogy

Vocabulary**:** Same words with different meaning and different words with same meaning,
Analogies: different relationships: worker and tools, worker and article, time sequence, cause and effect, class and species, synonyms, antonyms, person and things sought or avoided, part to the whole and symbols that stand for, degree of intensity, parts of speech.

Module-III
Comprehension Techniques

Reading: Reading for facts, opinions and inferences, reading for critical understanding, addressing point of view of the author/writer, jumbled paragraphs.

Module-IV
Sentence Equivalence

Writing: Sentence completion, Picture perspective: critical thinking, individual perception and obtaining implications.

Text Book(s):

1. Quirk Randolph: *A Comprehensive Grammar of the English Language*, Pearson publications.
2. Lewis Norman: *Word Power Made Easy*, Goyal Publisher, 2011.

Reference Books:

1. Fernald James Champlin, Synonyms and Antonyms, Project Gutenberg, www.gutenberg.net
2. 501 Word Analogy Questions, Learning Express, New York, 2002.

20CH21M01-Environmental Science
(Mandatory Course)

B. Tech. ECE - II year I sem.

L	T	P	C
3	-	-	0

Course Objectives: Develop ability to

1. Identify the importance of ecosystem and its functions.
2. Understand the natural resources and their usage in day to day life.
3. Understand the concept of bio-diversity, its values and conservation.
4. Be aware of the causes of different types of pollution and its control.
5. Understand various environmental impacts, requirement of various policies, and legislations towards environmental sustainability.

Course Outcomes: At the end of the course, the student would be able to

CO1.Explain ecosystem and its functions namely, food chain, ecological pyramids etc.

CO2.Acquire knowledge about different types of natural resources such as land, water, minerals, non-renewable energy and their excessive usage leading to detrimental effects on environment.

CO3. Comprehend ecosystem diversity, its values and importance of hot spots to preserve the same.

CO4. Explain different types of pollution, its control and impact on global environment.

CO5. Recognize various environmental impacts and the importance of various acts and policies towards environmental sustainability.

UNIT-I Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, food chains, food webs, and ecological pyramids. Flow of energy, Bio-geochemical cycles, Bioaccumulation, Bio magnification.

UNIT-II Natural Resources: Classification of Resources: Living and Non-Living resources, Water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy Resources-renewable and non-renewable.

UNIT-III Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and optional values. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity Act.

UNIT-IV Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of

e-Waste and its management. Pollution control technologies: Waste water Treatment methods: Primary, Secondary and Tertiary. Overview of air pollution control technologies.

Global Environmental Issues and Global Efforts: Green House Gases and its effect, Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT-V Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects, Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economic aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). Towards Sustainable Future: Concept of sustainable development goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

Text Books:

1. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
2. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.

Reference Books:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by R. Rajagopalan, Oxford University Press. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
5. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.

20CS22007-Object Oriented Programming

B. Tech. ECE - II Year II Sem

L	T	P	C
3	-	-	3

Prerequisite(s): None.

Course Objectives: Develop ability to

1. Understand basic concepts of object-oriented programming.
2. Understand the primitive data types built into the Java language and features of strongly typed language.
3. Learn scope, lifetime, and the initialization mechanism of variables and parameter passing mechanisms.
4. Write simple graphics programs involving drawing of basic shapes.
5. Create Graphical User Interfaces by means of Java Programming Language.

Course Outcomes (COs): At the end of the course, the student would be able to

CO1. Apply Object Oriented concepts to develop programs.
CO2. Develop multi-threaded applications with synchronization.
CO3. Use exception handling towards successful execution of programs.
CO4.Develop programs using Java Collection Frameworks and I/O classes.
CO5.Design GUI based applications using AWT and Swing.

UNIT-I

OOP concepts - Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, procedural and Object-oriented programming paradigms.

Java Programming - History of Java, comments, data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control flow block scope, conditional statements, loops break and continue statements. simple java program, arrays, console input and output, formatting output, constructors, methods, parameter passing, static fields and methods, access control, this keyword, overloading methods and constructors recursion, garbage collection, building strings, exploring string class

UNIT-II

Inheritance - Definition, hierarchies, super and subclasses, Member access rules, super keyword, preventing inheritance: final classes and methods, the Object class and its methods. **Polymorphism** - Dynamic binding, method overriding, abstract classes and methods. **Interfaces** - Interfaces vs. Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interface.

Inner classes - Uses of inner classes, local inner classes, anonymous inner classes, static inner classes, examples.

Packages - Definition, Creating and Accessing a package, understanding CLASSPATH, importing packages.

UNIT-III

Exception handling – Dealing with errors, benefits of exception handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, exception specification, built in exceptions, creating own exception sub classes.

Multi-Threading - Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication, producer consumer pattern.

UNIT –IV

GUI Programming with java - The AWT class hierarchy, Introduction to Swing, Swing Vs AWT, Hierarchy for Swing components, containers- JFrame, JApplet, JDialog, JPanel, Overview of some swing components - JButton, Jlabel, JtextField, JTextArea, simple Swing Applications, Layout Management- Layout Manager types- border, grid and flow

Event handling - Events, event sources, event classes, event Listeners, Relationship between event sources and Listeners Delegation event model, Examples: handling a button click, handling mouse events, Adapter classes.

UNIT –V

Connecting to Database - JDBC type 1 to 4 drivers, connecting to a data base, querying a data base and processing the results, updating data with JDBC.

Files: streams – byte streams, character streams, text input/ Output binary input/ output Random access file operations, file management using File class

Collection Frame work in java - Introduction to java Collections, overview of java collection frame work, Generics, commonly used collection classes- ArrayList, Vector, Hash table, Stack, Enumeration, Iterator, String tokenizer.

Text Books

1. Java fundamentals- A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH, 1st Edition, 2013.

Reference Books

1. Core Java 2–Volume1, Cay S. Horstmann and Gary Cornell
2. Java for Programmers, PJ. Dietel and H.M Deitel Pearson education.
3. Object Oriented Programming through Java. P.Radha Krishna. Universities Press.
4. Thinking in Java, Bruce Eckel, Pearson Education.

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20EC22001- Analog and Digital Communications

B. Tech. ECE - II Year II Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite: 20EC21001 - Signals and Systems

Course Objectives: Develop ability to

1. Distinguish between various continuous wave modulation techniques and compare their noise performance
2. Understand the principles of signal Multiplexing and wave form coding techniques
3. Interpret various methods of Digital carrier modulation schemes
4. Comprehend the principle of base band signal reception
5. Understand the performance metrics of various Digital Carrier Modulation Schemes

Course Outcomes: At the end of the course, the student would be able to

CO1. **Analyze** different analog modulation schemes with respect to their performance characteristics.
CO2. **Analyze** different digital modulation schemes with respect to their performance characteristics.
CO3. **Explain** the concepts of Time Division and Frequency Division multiplexing schemes for transmission of multiple signals.
CO4. **Analyze** various band pass digital communication systems with reference to error performance

UNIT – I: Amplitude Modulation and Noise Performance

Amplitude Modulation (AM): Need for Modulation, Double Sideband Suppressed Carrier (DSBSC) Modulation, Normal AM, Suppressed Sideband Suppressed Carrier (SSBSC) Modulation and Vestigial Sideband (VSB) Modulation, Generation and detection of AM, DSBSC and SSBSC signals. Power Calculation in AM, Super heterodyne AM Radio Receiver.

Modelling of Channel Noise: White Noise, Narrowband Noise – in phase and quadrature phase components and its properties,

Noise in AM System- Signal to Noise Ratio (SNR) calculations in Normal AM, DSBSC and SSBSC Systems

UNIT – II: Angle Modulation and Noise Performance

Angle Modulation: Frequency Modulation and Phase Modulation, Spectrum of Frequency Modulated Signal, Power and Bandwidth of FM Signal, Generation of FM Signals-Direct and Indirect methods, Principle of FM Demodulation, Demodulation of FM Signal using Phase-Lock Loop, Pre-emphasis and De-emphasis, FM Radio Receiver

Noise in Angle Modulation Systems: Signal to Noise Ratio (SNR) calculations in FM and PM Systems.

UNIT – III: Wave form Encoding:

Pulse Modulation and Multiplexing: Generation and demodulation of Pulse Amplitude Modulation (PAM) and Pulse Time Modulation (PTM), Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM).

Pulse Code Modulation (PCM): PCM Generation and Reconstruction, Differential Pulse Code Modulation (DPCM), Delta Modulation (DM) and Adaptive DM.

UNIT – IV: Digital Carrier Modulation Schemes

Digital Carrier Modulation Schemes: Amplitude Shift Keying (ASK),ASK Modulator, Coherent and Non coherent ASK Detection, Frequency Shift Keying(FSK), FSK Modulator, Coherent and Non-Coherent FSK Detector, concept of M-ary PSK, Binary Phase Shift Keying (BPSK), BPSK Modulator, BPSK Detection, QPSK-Modulation and Demodulation, Power Spectrum, Bandwidth considerations and bandwidth efficiency of these Modulation schemes, Differential PSK.

UNIT –V: Baseband Transmission and Optimal reception of Digital signal

Baseband signal Receiver (Integrate and Dump receiver) Probability of error, Optimum Receiver, Matched Filter, Coherent Reception, Computation of Probability Error for ASK, BFSK, BPSK and QPSK modulation Schemes

Text Books:

1. Modern Digital and Analog Communication Systems, B P Lathi, 3rd Edition, Oxford University Press, 1998
2. Digital and Analog Communicator Systems, K. Sam Shanmugam, John Wiley, 2005.

References:

1. Principles of communication systems, Herbert Taub, Donald L Schiling and Goutam Saha, 3rd Edition, McGraw-Hill, 2008.
2. Electronics and Communication Systems, George Kennedy and Bernar Davis, TMH, 2004

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20EC22002- Linear Integrated Circuits

B. Tech. ECE - II Year II Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC21003- Electronic Circuit Analysis and Design

Course Objectives: Develop ability to

1. Understand the characteristics of Operational Amplifier; Design of differential amplifier, instrumentation amplifier, differentiators, integrators and active filters.
2. Understand waveform generatorsusing µA741 and voltage regulator using µA723.
3. Understand specialized applications of linear ICs: NE/SE 555 Timer and PLL IC 565.
4. Understand the design of various types of DACs and ADCs using op-amps.
5. Understand the design of clippers and clampers using operational amplifier.

Course Outcomes: At the end of the course, the student would be able to

CO1. **Design** op-amp based circuits viz. differential amplifier, Instrumentation amplifier, differentiator, integrator and first order Low pass and High pass Butterworth active filters.
CO2. **Design** op-amp based waveform generators for the given specifications.
CO3. **Design** voltage regulators using IC 723 as per the given specifications.
CO4. **Design** Monostable and Astable Multivibrators using IC 555 timer for the given specifications.
CO5. **Explain** the functionality and applications of PLL IC 565.
CO6. **Analyze** the functionality of op-amp based data converters.
CO7. **Design** op-amp based clippers, clampers and rectifiers for the given specifications.

UNIT – I: Operational Amplifier - Operational Amplifier and its DC, AC Characteristics, modes of operation, differential amplifier, instrumentation amplifier. design of Differentiators and Integrators. **Active Filters:** Analysis and Design of 1st order Low Pass and High Pass Butterworth Filters.

UNIT -II: Waveform Generators using µA741 and Voltage Regulator using µA723 - Comparators, Schmitt Trigger. Waveform generators using µA741– Square, Triangular, Sawtooth and Sine. Design of voltage regulators using µA723.

UNIT – III: Specialized Applications of Linear ICs - NE/SE 555 Timer - Functional Diagram, Monostable Operation and its applications as Frequency Divider and Pulse Stretcher. Astable Operation: Its application as Square Wave Oscillator and Free Running Ramp Generator. **IC565 PLL** - Block Schematic, Description of individual Blocks and Applications.

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

UNIT – V: Clippers and Clampers using Operational Amplifier - Positive and Negative Clippers, Small-Signal Half-Wave Rectifier, Precision Full Wave Rectifier, Positive and Negative Clampers.

Text Books:

1. Op-Amps and Linear Integrated Circuits, Ramakanth A. Gayakwad, PHI, 2003.
2. Linear Integrated Circuits, D. Roy Chowdhury, New Age International (p) Ltd, 2nd Ed., 2003.

Reference Books:

1. Op Amps and Linear Integrated Circuits: Concepts and Applications, James M. Fiore, Cengage Learning, Jaico, 2009.
2. Operational Amplifiers with Linear Integrated Circuits, William D. Stanley, 4th Ed., Pearson Education India, 2009.

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20EC22003-Random Variables and Stochastic Processes

B. Tech. ECE - II Year II Sem

L	T	P/D	C
3	-	-/-	3

Pre-requisites: None

Course Objectives: Develop ability to

1. Understand the concept of random variable and its classification
2. Comprehend the significance of distribution and density functions of random variable.
3. Interpret the principle of joint random variables and computation of their statistical parameters.
4. Realize the concept of a random process and its analysis in both time and frequency domain.
5. Understand the effect of an LTI system on its random excitation.

Course Outcomes: At the end of the course, the student would be able to

CO1. Determine the applications of various random variables based on individual CDF and pdf.
CO2. Compute the various statistical averages of single/multiple random variables and enumerate their significance.
CO3. Analyze a random variable as a function of time, with reference to its temporal and spectral characteristics.
CO4. Determine the effect of an LTI system on the time domain and frequency domain characteristics of the random excitation.

UNIT I: The Random Variable:

Review of Conditional Probability, Baye's Theorem on Probability. Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh random variables , Conditional Distribution, Conditional Density, Properties.

UNIT II: Operation on One Random Variable – Expectations:

Introduction, Expected Value of a Random Variable, function of a Random Variable, Moments about the Origin, Central Moments-Variance and Skew, Moment Generating Function and Characteristic Functions of a random Variable, Transformation of a Random Variable: Monotonic and Non-Monotonic

UNIT III: Multiple Random Variables:

Joint Distribution and density Functions- Properties Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence of random variables,
Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem (Qualitative treatment only).
Operations on Multiple Random Variables: Joint Moments about the Origin, Joint Central Moments, Jointly Gaussian Random Variables: Two Random Variables case

UNIT IV: Random Processes – Temporal and Spectral Characteristics:

Concept of Random Process, Classification of Random Processes, Concept of Stationarity - First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, Nth-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Process 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.

UNIT V: Linear Systems with Random Inputs:

Response of an LTI system for random input-Mean and Mean-squared Value of System's Response, Autocorrelation Function of system's Response, Cross-Correlation Functions of Input and Output of an LTI system, Spectral Characteristics of System's Response: Power Density Spectrum of Response, Cross-Power Density Spectrum of Input and Output of the system.

Text Books:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S. Unnikrishnan Pillai, PHI, 4th Edition, 2002.

References:

1. Probability and Random Processes with Applications to Signal Processing, Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
2. Schaum's Outline series of Probability, Random Variables, and Random Processes, Hwei Hsu

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20EC22004 - Electromagnetic Theory and Transmission Lines

B. Tech. ECE - II Year II Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20MA11001 – Basic Engineering Mathematics
20MA12001 – Multi variable Calculus

Course Objectives: Develop ability to

1. Understand the concept of electrostatic field and its implication on capacitance.
2. Understand the concept of magnetostatic field and its implication on inductance.
3. Understand the concept of electromagnetic wave and its propagation in various media.
4. Understand the concept of transmission line and its equivalent circuit.
5. Understand impedance matching properties of transmission line

Course Outcomes: At the end of the course, the student would be able to:

CO1. Apply basic laws of electric and magnetic fields to solve problems related to different charge and current distributions.
CO2. Analyze the applications of Maxwell's equations to time-harmonic fields, boundary conditions, and Poynting's theorem.
CO3. Analyze the propagation characteristics of uniform plane waves in conducting and dielectric mediums.
CO4. Analyze the characteristics of lossy and lossless transmission lines.
CO5. Illustrate the applications of lossless transmission lines at RF and UHF frequencies.

UNIT – I: Electrostatics

Review of Coordinate Systems, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and its Applications Electric Potential, Relation between Electric Field Intensity (E) and Potential (V) Maxwell's Equations for Electrostatic Fields, Energy Density.

Convection and Conduction Currents, Dielectric Constant, Linear, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations (treatment in Cartesian coordinate system); Capacitance – Parallel Plate, Coaxial and Spherical Capacitors.

UNIT – II: Magnetostatics

Biot-Savart's Law, Ampere's Circuital Law and its Applications, Magnetic Flux Density, Maxwell's Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Inductance and Magnetic Energy.

Maxwell's Equations for Time varying fields: Faraday's Law of induced emf, Inconsistency of Ampere's Law, Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric– Conductor Interfaces.

UNIT – III: EM Wave Characteristics

Wave Equations for Conducting and Dielectric Media, Uniform Plane Wave, Relation Between E and H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors and Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Linear 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's Theorem.

UNIT – IV: Transmission Lines – I

Types of transmission lines and parameters, Transmission Line Equations, Infinite Line, Characteristic impedance, Distortion less transmission Line, Loading – concept and Types of Loading of transmission line, Campbell's formula.

UNIT – V: Transmission Lines – II

Input Impedance of a transmission line, RF and UHF Lines, SC and OC Lines, $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines – Impedance Transformations, Reflection Coefficient, VSWR, Smith Chart and its applications, Single Stub Matching.

Text Books:

1. Elements of Electromagnetics, Mathew N. O. Sadiku, Oxford University Press, 4th Ed.
2. Electromagnetic Waves and Radiating Systems, E. C. Jordan and K. G. Balmain, Pearson publications, 2nd Ed.
3. Transmission Lines and Networks, Umesh Sinha, Satya Prakashan, Tech. India Publications, 8th Ed.

Reference Books:

1. Engineering Electromagnetics, William H. Hayt and John A.Buck, TMH publications, 7th Ed.
2. Electromagnetics, Joseph A. Edminister and Mahmood Nahvi, Schaum's Outlines series, Mc. Graw Hill publications, 2nd Ed.

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20EC22L01- Analog Communications Lab

B. Tech. ECE - II Year II Sem.

Prerequisite: 20EC21001 - Signals and systems

L	T	P/D	C
-	-	2	1

Course Objectives: Develop ability to

1. Interpret the time and frequency domain representations of various analog modulation methods
2. Understand the better noise performance of Angle Modulation system over Amplitude Modulation system
3. Comprehend the principles of Pulse Analog Modulation Methods
4. Understand the concept of channel sharing through Multiplexing
5. Understand the principle of Automatic Gain Control in a radio receiver

Course outcomes: At the end of the course, the student would be able to:

CO1. Implement various analog modulation/demodulation techniques
CO2. Design and verify the methods used for enhancing the noise performance of an FM system
CO3. Verify of Sampling Theorem for various signal conditions
CO4. Demonstrate the principle of sharing a communication channel on Time and Frequency basis
CO5. Demonstrate the effect of AGC on performance of radio receiver under variable input signal strengths.

List of Experiments: (A minimum of 10 experiments are to be performed)

1. Amplitude Modulation and Demodulation
2. DSB-SC Modulation and Detector
3. SSB-SC Modulator and Detector
4. Frequency Modulation and Demodulation
5. Pre-emphasis and De-emphasis
6. Verification of Sampling Theorem
7. Time Division Multiplexing and De-multiplexing
8. Frequency Division Multiplexing and De-multiplexing
9. Pulse Amplitude Modulation and Demodulation
10. Pulse Width Modulation and Demodulation
11. Pulse Position Modulation and Demodulation
12. AGC Characteristics

Equipment required:

1. RPS (Regulated Power Supply): 0-30V
2. CROs: 20MHz
3. DSOs: 50MHz
4. Function Generator: 0-1 MHz
5. Lab Trainer Kits(Minimum one of each type) for
   a. Amplitude Modulation and Demodulation
   b. Balance Modulator and Synchronous detector
   c. Single Side Band system
   d. Frequency Modulation and Demodulation
   e. Pre-emphasis and de-emphasis trainer
   f. Analog/digital Time Division Multiplexing and De multiplexing
   g. Frequency Division Multiplexing and De multiplexing
   h. Verification of Sampling Theorem
   i. Pulse Amplitude Modulation and demodulation
   j. Pulse Width Modulation and demodulation
   k. Pulse Position Modulation and demodulation
   l. AGC Characteristics

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20EC22L02 –Linear Integrated Circuits Lab

L	T	P/D	C
-	-	2/-	1

B. Tech. ECE - II Year II Sem

Prerequisite(s): 20EC21L03-Electronic Circuit Analysis and Design Lab

Course Objectives: Develop ability to

1. Understand Linear analog circuits using IC 741
2. Understand Multivibrator circuits using IC 555 Timer
3. Understand Low and high voltage regulators using IC 723.
4. Understand Frequency Multiplier using PLL IC 565
5. Understand Clipper, Clamper, Half wave and Full Wave Rectifier circuits using IC 741

Course Outcomes: At the end of the course, the student would be able to design and implement

CO1. Linear analog circuits using IC 741
CO2. Multivibrator circuits using IC 555 Timer
CO3. Low and high voltage regulators using IC 723.
CO4. Frequency Multiplier using PLL IC 565
CO5. Clipper, Clamper, Half wave and Full Wave Rectifier circuits using IC 741

List of Experiments: (**Minimum 10 experiments are to be conducted)**

Design and Verify the functionality of the following:

1. Summing and Difference Amplifier using OPAMP IC 741.
2. Integrator Circuit and Differentiator circuit using OPAMP IC 741.
3. Zero Crossing Detector and Schmitt Trigger Circuits – using IC 741.
4. Active Filters–1st order Butterworth Low Pass and High Pass Filters using OPAMP IC 741.
5. Waveform Generators using IC 741 – Sine and Square.
6. Monostable Multivibrator and Astable Multivibrator using IC 555.
7. Frequency Multiplier using PLL IC 565
8. Low and High Voltage Regulator using IC 723
9. R-2R ladder 3-bit DAC using IC 741
10. Positive and Negative Clipper Circuits using IC 741 and diodes
11. Half Wave and Full Wave Rectifier using IC 741 and diodes
12. Positive and Negative Clamper Circuits using IC 741 and diodes

Equipment required:

1. Regulated Power Supply (0-30V)
2. Cathode Ray Oscilloscope (20MHz)
3. Function Generators (1 MHz)
4. Multimeters/Voltmeters
5. Components
   a. ICs - 741, 555, 723, 565.
   b. Resistors, Capacitors, Diodes
   c. Breadboards

20CS22L04-Object Oriented Programming Lab

B. Tech. ECE - II Year II Sem.

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): None.

Course Objectives: Develop ability to

1. Understand basic concepts of object-oriented programming.
2. Understand the primitive data types built into the Java language and features of strongly typed language.
3. Learn scope, lifetime, and the initialization mechanism of variables and parameter passing mechanisms.
4. Write simple graphics programs involving drawing of basic shapes.
5. Create Graphical User Interfaces by means of Java Programming Language.

Course Outcomes (COs): At the end of the course, the student would be able to

CO1. Apply Object Oriented concepts to develop programs.
CO2. Develop multi-threaded applications with synchronization.
CO3. Use exception handling towards successful execution of programs.
CO4.Develop programs using Java Collection Frameworks and I/O classes.
CO5.Design GUI based applications using AWT and Swing.

LIST OF PROGRAMS

Week 1: (Basic programs to get used to java syntax)

Write a Java program to

a. Print the Fibonacci series up to the given number.
b. Print the reverse of the given number
c. Find factorial of the given number at command line.
d. Prompt the user for an integer and then prints out all prime numbers up to that integer

Week 2: Write a Java program to

a. Check whether a given string is a palindrome or not. Ex: MADAM is a palindrome.
b. Sort a given list of names in ascending order.
c. Find frequency count of words in a given text.

Week 3: Write a java program to

a. Illustrate creation of classes and objects
b. Illustrate constructor and method overloading
c. Create a stack ADT

Week 4: Write a java program to

a. Implement different types of inheritance
b. Illustrate method overriding and Dynamic method dispatch
c. Illustrate static keyword with variables and methods

Week 5: Write a java program to

a. Create an interface for stack of integers with abstract methods push, pop and display. Write an implementation of the above-mentioned abstract methods for a fixed size stack and a dynamic size stack.
b. Illustrate inner classes

Week 6: Write a java program to

a. Illustrate usage of try, catch, finally with multiple exceptions
b. Create user defined exceptions.

Week 7: Write a java program to

a. Create a thread by implementing Runnable interface.
b. Implement producer consumer problem using the concept of inter thread communication.

Week 8:

Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the+, -,*, % operations. Add a text field to display the result.

Week 9:

Write a java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired.

Week 10:

Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.

Week 11:

a. Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time No light is on when the program starts.
b. Write a Java program that allows the user to draw lines, rectangles and ovals.

Week 12:

Write a java program to create an abstract class namedShape that contains an empty method named numberOfSides ( ). Provide three classes named Trapezoid, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method numberOfSides( ) that shows the number of sides in the given geometrical figures.

Week 13:

a. Write a java Program that loads names and phone numbers from a text file where the data is organized as one line per record and each filed in a record are separated by a tab (\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables).
b. Implement the above program with database instead of a text file.

Week 14:

a. Write a java Program that takes tab separated data (one record per line) from a text file and inserts them into a database.
b. Write a java program that prints the meta-data of a given table.
c. Write a java program that connects to a database using JDBC and does add, delete, modify and retrieve operations.

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20EN22P01 - English for Career Development

(Classroom Activity based Course)

B. Tech. ECE - II Year II Sem

L	T	P/D	C
-	-	2/-	1

Course Objectives: Develop ability to

1. Understand the importance of vocabulary to be used in different situations.
2. Read, comprehend and summarize the given text.
3. Articulate in different socio-cultural contexts both oral and written.

Course Outcomes: At the end of the course, the student would be able to

CO1: Use appropriate collocations, connotations and prepositional phrases in any given text.
CO2: Predict the flow of information in a given text and draw inferences.
CO3: Articulate views, ideas and events in various contexts both oral and written.

Module-I
Must have words/Word power
Vocabulary: Collocations: noun and noun, noun and verb, noun and adverb, noun and adjective, prepositional phrases-connotative words.

Module-II
Cognitive Reading
Reading: Reading comprehension: rapid reading (vertical reading), meta-cognition, cloze tests, paragraph jumbles.

Module-III
Advanced Articulation
Speaking: Narrating: techniques, events, experiences, stories. Interactive speaking: Contextual Vocabulary and Oral presentations.

Module-IV
Essentials of composition
Writing: Picture interpretation: analyzing and expressing in either oral or written form. Sentences out of context, summarizing, Essay (Analytical, argumentative and exploratory) writing practice.

Text Books:

1. Wilfred J.Funk, Six Weeks to Words of Power, Binny Publishing House.
2. Sue Gilbert, The Essentials of Grammar and Composition, Oxford University Press.

Reference Books:

1. Inc. Bar Charts, English Composition & Style, Inc. Bar Charts, 2009-11-30
2. K.Buehler Huber Gray, Practical Exercises in English, Project Gutenberg, www.gutenberg.net

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20EC22P01 – Design Thinking

L	T	P/D	C
-	-	4/-	2

B. Tech. ECE - II Year II Sem

Prerequisite(s): None

Course Objectives: Develop ability to

1. Acquire knowledge about the problem-solving approach of design thinking, creativity and innovation.
2. Understand the concept and process of design thinking and other tools used to identify new opportunities and develop innovative solutions for real world problems.
3. Demonstrate various skills of analysis, synthesis, and making sense of difficult issues.
4. Develop different types of prototype, test to learn and iterate, and develop most appropriate solution.

Course Outcomes: At the end of the course the student would be able to

CO1: **Justify** the need for innovation, design thinking approach, and problem-solving.
CO2: **Analyze** the real world problem where inspiration and empathy are valuable.
CO3: **Apply** the ideation process to solve the problem.
CO4: **Develop** the prototype and obtain the feedback from end users.
CO5: **Demonstrate** the final product after embodiment phase of development.

Module 1:

Basic Terms: Innovation, Invention, Improvement, Technology, Business, Design, Design Thinking, Creativity, Product Design, Product development, Service design System Thinking etc.
Creativity and Innovation: What is thinking, Types of thinking: Creative, Analytical, Critical, Logical, Lateral thinking etc. Why we are not Creative, Barriers and overcoming personal barriers. Skills to become creative. I-shaped people, T-shaped people, Creativity Techniques/methods. Problem Types - wicked problems

Module 2:

Design thinking Process, Empathise Phase, Empathy, Ethnography, Understanding User requirements, Insights, Persona, Empathy Map, and other tools and methods to understand the right problem.

Module 3:

Define Phase, Synthesizing and making sense, Defining the right problem to solve, tools to select the right problems.

Module 4:

Ideate Process, exploring concept canvas, developing suitable concepts to learn and improve.

Module 5:

Prototype and Test, low fidelity and high-fidelity prototypes, user testing to learning from them, revising the solution and developing the final solution

Module 6:

Delivering the solution, Embodiment phase of product development, Product Design, Service Design,

Note: Module 2 to Module 6 are to be based on assignments and/or mini projects.

Text Books:

1. Design thinking for strategic Innovation, Idris, Wiley (eBook)
2. Design Thinking for entrepreneurs and small business, Ingle, Beverly Rudkin, apress (eBook)

Reference Books:

1. Design Thinking: New Product Development Essentials from the PDMA
2. The design Thinking Playbook, Michael Patrick Larry, Lewrick Link Leifer
3. Design Thinking, n the act or practice of using your mind to consider design, ava academia

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20MB22M04 – Professional Ethics

(Mandatory Course)

B. Tech. ECE - II Year II Sem

L	T	P/D	C
3	-	-	0

Pre-requisites: None

Course Objective: Develop ability to

1. imbibe and internalize the Values and Ethical Behavior in the personal and Professional lives.

Course Outcomes: At the end of the course, Students would be able to

CO1: Describe the importance of value and ethics in their personal lives and professional careers.
CO2: Examine the rights and responsibilities as an employee, team member, and a global citizen
CO3: Identify and analyze the global issues in Professional ethics

UNIT - I

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT - II

Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

UNIT - III

Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

UNIT - IV

Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation. Ethics in changing domains of research - The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

UNIT - V

Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.

Text Books:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

Reference Books:

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e, Cengage learning, 2015.
2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

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20EC31001 – Computer Architecture and Microprocessors

B. Tech. ECE - III Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC21002 - Digital Design

Course Objectives: Develop ability to

1. Understand the principles of the basic architectural concepts of computer systems.
2. Understand the organization and architectural details of 8086 microprocessor.
3. Write Assembly Level Programs for 8086 microprocessor.
4. Understand the I/O interface, serial communication interface and memory organizations of a Computer system.
5. Understand different parallel processing architectures.

Course Outcomes: At the end of the course, student would be able to

CO1. Explain various aspects of the stored program concept of computer architecture and organization.
CO2. Illustrate the functionality of 8086 microprocessor and its modes of operation.
CO3. Develop Assembly Language Programs using 8086 instruction set and Assembler directives.
CO4. Interface ADC, DAC, Keyboard, Memory and 8255, 8251, DMA with 8086 Microprocessor.
CO5. Differentiate Main memory, Associative memory, Cache memory and Virtual memory.
CO6. Differentiate various parallel processing architectures.

UNIT - I

Introduction to Digital Computer: Block diagram of Digital Computer, Basic operational concepts, Bus structures, Performance, CISC Characteristics, RISC Characteristics, Arithmetic, logic and shift micro-operations, Arithmetic logic shift unit.

UNIT - II

8086 Architecture: Register Organization of 8086, 8086 Architecture, Signal Description of 8086, Memory segmentation, Physical Memory Organization, Minimum mode Timing diagrams for read and write operation, Maximum mode Timing diagrams for read and write operation. Interrupt Structure of 8086

UNIT-III

8086 Instruction Set and Assembler Directives: Instruction Formats and Addressing Modes of 8086, Instruction Set, Assembler Directives, Assembly Language Programs

Input-Output Interface: 8255-PPI, various Modes of operation and interfacing keyboard, Display, D/A and A/D converter. Direct memory Access concepts.

UNIT – IV

Communication interface: Serial Communication Standards, 8251-USART Architecture and Interfacing.

Memory Organization: Memory Hierarchy, Main Memory, Associate Memory, Cache Memory, Virtual memory.

UNIT – V

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline.

Multi Processors: Characteristics of Multiprocessors, Interprocessor communication and synchronization, Cache Coherence.

Text Books:

1. Mano M. Morris, Computer System Architecture, 3/e, Pearson Education. 2017.
2. A K Ray, Advanced Micro Processor and Peripherals, 2/e, McGraw Hill Education, 2006.

Reference Books:

1. Carl Hamacher, ZvonksVranesic, SafeaZaky. Computer Organization, 5/e, McGraw Hill. 2011
2. William Stallings, Computer Organization and Architecture. 6/e, Pearson/PHI.
3. Andrew S. Tanenbaum,Structured Computer Organization, 4/e, PHI/Pearson. 2006.
4. D. V. Hall, Microprocessors and Interfacing, 2/e, McGraw Hill,1991.

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20EC31002 - Antennas and Wave Propagation

L	T	P/D	C
3	-	- / -	3

B. Tech. ECE – III Year I Sem.

Prerequisite(s): 20EC22004 - Electromagnetic Theory and Transmission Lines

Course Objectives: Develop ability to:

1. Understand radiation mechanisms of various Antennas.
2. Understand various characteristics and parameters of Antennas
3. Understand working principle of antenna arrays
4. Understand various aspects of Antenna Measurements
5. Understand various methods of wave propagation.

Course Outcomes: At the end of the course, student would be able to:

CO1: Analyze the radiation mechanism in a current element, Microstrip, Reflector and Lens antennas.
CO2: Deduce relationships among various antenna parameters.
CO3: Design Loop, Folded dipole, Yagi-uda, Helical, and Horn antennas for the given specifications
CO4: Analyze the radiation mechanism of Broad side, End fire and Binomial arrays
CO5: Demonstrate the procedures for measurement of different antenna parameters
CO6. Analyze various mechanisms of wave propagation and the atmospheric effects on radio wave propagation.

UNIT – I

Antenna Basics & Dipole antennas

Introduction, Basic antenna parameters - Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective height, Fields from oscillating dipole, Field Zones, Polarization – Linear, Elliptical and Circular polarizations, Antenna temperature, Antenna impedance, Front-to-back ratio, Antenna theorem (Reciprocity theorem), Radiation –Potential Functions and the Electromagnetic Field, Potential Functions for Sinusoidal Oscillations-Helmholtz Theorem, The Alternating Current Element, Power radiated by a current element, Radiation from Quarter wave Monopole and Half wave Dipole.

UNIT – II

VHF, UHF and Microwave Antennas – I

Loop Antennas - Introduction, Small Loop, Comparison of far fields of small loop and short dipole, Radiation Resistance of loops (Qualitative Treatment only), Arrays with Parasitic Elements - Folded Dipoles, Yagi - Uda Antenna. Helical Antennas - Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial mode, Normal Mode. Horn Antennas - Types, Fermat's Principle, Optimum Horns, Design considerations of Pyramidal Horns (Qualitative treatment only).

UNIT – III

VHF, UHF and Microwave Antennas – II

Micro-strip Antennas - Introduction, salient features, advantages and limitations, Rectangular micro-strip antennas - Geometry, parameters and characteristics (Qualitative treatment only) Reflector antennas - Introduction, Paraboloidal reflectors- geometry, pattern, characteristics, Feed Methods. Lens Antennas - Geometry of Non-metallic Dielectric Lens antennas, Zoning, Applications.

UNIT- IV

Antenna Arrays and Measurements

Point sources - Definition, Patterns, arrays of 2 Isotropic sources - Different cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End-fire Arrays, Derivation of their characteristics and comparison, BSA with Non-uniform Amplitude Distributions - General considerations and Binomial Arrays, Illustrative problems.

Antenna Measurements- Introduction, Concepts- Reciprocity in antenna measurements, Near and Far Fields, Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements (by comparison, Absolute and 3-Antenna Methods).

UNIT – V

Wave Propagation

Introduction, Friis transmission formula, Modes of wave propagation - Ground wave propagation (Qualitative treatment) - Introduction, Plane earth reflection, wave tilt, Space wave propagation - Introduction, field strength of space or tropospheric wave, effect of earth's curvature, Super refraction, fading. Sky wave propagation - Introduction, structure of Ionosphere, refraction and reflection of sky waves by Ionosphere, Critical frequency, MUF, LUF, OF, Virtual height and Skip distance, Relation between MUF and Skip distance, multi-HOP propagation, Illustrative problems.

Text Books:

1. John D. Kraus, Ronald. J. Marhefka and Ahmad S Khan "Antennas and Wave Propagation", Tata McGraw-Hill Education Private Limited, 4th Edition.
2. K.D. Prasad, Satya Prakashan, "Antennas and Wave Propagation," Tech. India Publications.

Reference Book:

1. E. C. Jordan and K. G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI,2007.

20EC31003 - Control Systems Engineering

B. Tech. ECE- III Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC21001 - Signals and Systems
20EE11001 - Basic Electrical Engineering
20EC21004 - Circuit Theory

Course Objectives: Develop ability to:

1. Understand the principles and mathematical modeling of various control systems.
2. Understand the time domain analysis of LTI systems.
3. Understand different aspects of stability analysis of control systems
4. Understand the principles of frequency domain analysis of control systems
5. Understand the differences of conventional control theory and modern control theory.

Course Outcomes: At the end of the course, the student would be able to:

CO1. Determine the transfer function of a physical system in its simplest form from its mathematical model.
CO2. Analyze the given LTI system with reference to its time response under various standard test excitations.
CO3. Determine the stability of the given LTI system using frequency domain techniques.
CO4. Analyze the behaviour of a Linear control system using state space approach.

UNIT –I

Introduction: Components of Control Systems, Different Examples of Control System Applications, Open- Loop and Closed-Loop control systems, Effects of Feed-Back Characteristics, Mathematical Models – Differential Equations, Impulse Response and Transfer functions, Transfer Function Representation: Block Diagram-Block Diagram Algebra, Signal Flow Graph-Mason's Gain Formula for SFG.

UNIT –II

Time Response Analysis: Standard test signals - Time Response of First Order Systems – Characteristic Equation of Feedback Control Systems, Time Response of Second Order Systems - Time Response Specifications, Steady State Response - Steady State Errors and Error Constants – Effects of Proportional Derivative, Proportional Integral Systems.

UNIT –III

Stability Analysis in S-Domain: The Concept of Stability, Necessary Conditions for Stability, Routh's Stability Criterion, Relative Stability Analysis – Limitations of Routh's Stability. Root Locus Technique: The Root Locus Concept, Construction of Root Loci, Effects of Adding Poles and Zeros to G(s) H(s).

UNIT –IV

Frequency Response Analysis: Introduction, Frequency Domain Specifications-Resonant, Peak, Resonant Frequency and Bandwidth of the Second Order System, Bode Plots, Polar Plotsand Nyquist Stability Criterion, Principle of a compensator, Lag, Lead and Lead - Lag Compensators, PID controllers.

UNIT –V

State Space Analysis of Continuous Systems: Concepts of State, State Variables and State Model-Derivation of State Models from Block Diagrams, Diagonalization, Solution of State Equations- State Transition Matrix and it's Properties, Concepts of Controllability and Observability.

Text Books:

1. I. J. Nagarath and M. Gopal, Control Systems Engineering, 4th Edition, New Age International (P) Limited, Publishers, 2005
2. B.C.Kuo, Automatic Control Systems , 7th Edition, PHI, 2003

Reference Books:

1. N.C. Jagan, Control Systems, 2nd Edition, BS Publications, 2008
2. A. Anand Kumar, Control systems, 2nd Edition, PHI. 2014

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20MB31004- Engineering Economics and Accounting

B. Tech. ECE- III Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): None

Course Objective: Develop ability to

1. Learn the basic Business types
2. Understand the impact of the Economy on Business and Firms specifically.
3. Analyze the Business from the Financial Perspective.
4. Understand the importance of handling Capital.
5. Learn fundamental concepts of accounting.

Course Outcome: At the end of the course, the student would be able to

CO1: Apply micro and macroeconomic concepts of business entities.
CO2: Explain elasticity of demand and types of market structures in business operations.
CO3: Apply the concepts of theories of production and demand forecasting in decision-making.
CO4: Categorize sources of raising capital and analyze the methods of capital budgeting.
CO5: Evaluate and interpret the financial statements.

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, and Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

UNIT - IV

Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital – Trading Forecast, Capital Budget, Cash Budget. Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (AR A) and Net Present Value Method (simple problems).

UNIT - V

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, and Preparation of Final Accounts.

TEXT BOOKS:

1. Managerial Economics, Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.
2. Financial Management, S.N.Maheswari & S.K. Maheswari, Vikas, 2012.

REFERENCES:

1. Financial Accounting for Management, Paresh Shah, 2e, Oxford Press, 2015.
2. Financial Accounting, S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, 5e, Vikas Publications, 2013.

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20EC31004- Cellular and Mobile Communications
(Professional Elective - I)

B. Tech. ECE III Year - I Sem

L	T	P/D	C
3	-	- / -	3

Prerequisite(s): 20EC22001–Analog and Digital Communications

Course Objectives: Develop ability to

1. Understand basics of cellular system, their generations and characteristics of mobile communications.
2. Understand co-channel and non-cochannel interferences in mobile communications and their mitigation techniques.
3. Understand the coverage prediction models for different geographical environments (Over water, point-to-point, flat terrain and so on) and link budget analysis for radio network planning.
4. Understand operational techniques and technologies used in cellular mobile Communication systems to increase traffic capacity.
5. Understand the implementation and applications of intelligent cell concepts, CDMA, MIMO,4G perspective systems and physical layer scheme (CS-OFDMA), and 60GHz cellular System.

Course Outcomes: At the end of the course, the student would be able to:

CO1: **Explain** the basic concepts of cellular system and the associated functionalities such as frequency reuse and Hand off mechanisms.
CO2: **Analyze** cochannel, non-cochannel interferences and their reduction mechanisms in cellular system.
CO3: **Apply** the Lee model to determine the propagation loss in different geographical environments.
CO4: **Explain** the fixed channel and non-fixed channel assignment strategies.
CO5: **Explain** the fundamental concepts of intelligent cell, CDMA and MIMO
CO6: Explain the concepts of Code Division Duplexing (CS-OFDMA), Smart antennas, Mobile antennas and 60-GHz Cellular System

UNIT I

Introduction to Cellular Mobile Systems: History of mobile Cellular – AMPs System (First-Generation System), Second-Generation system, 3G systems, 4G systems, Spectrum allocation, Basic Cellular Systems – Circuit switched and Packet Switched systems, Noise level in Cellular Frequency Band, Amplifier Noise.

Concept of Frequency Reuse Channels, Co-channel interference Reduction factor, Desired C/I from a normal case in an Omni-directional Antenna system, Handoff Mechanism and types of handoffs, and cell splitting.

UNIT II

Co-Channel and Non-Cochannel Interference Reduction: Co-channel interference, exploring co-channel interference areas in a system, Real-Time measurement at mobile Radio Trans receivers, Design of an Omni directional antenna system in the worst case, Design of Directional antenna system, Lowering Antenna Height, Reduction of co-channel interference by means of notch in tilted antenna pattern, Umbrella pattern effect and Diversity Receiver.

Non-Co-channel Interference

SINAD, Adjacent Channel Interference, Near-End-Far-End Interference, Effect on Near-end mobile units and Cross talk.

UNIT III

Cell Coverage and Antennas: General introduction, Obtaining the Mobile Point-to-Point Model (Lee Model), Propagation over water or flat open area, Foliage loss, Propagation in near-in distance, long distance propagation, Obtain pathloss from a Point-to-Point Prediction Model (General approach) and its form, Smart Antennas, Mobile Antennas.

UNIT IV

Operational techniques and technologies: Adjusting the parameters of a system, Fixed Channel assignment schemes, Non-Fixed Channel assignment algorithms, Coverage hole filter, Cell Splitting, and small cells (Micro cells), Narrow Beam concept.

UNIT V

Intelligent Cell Concept: Intelligent cell concept, Applications of intelligent microcell systems, CDMA Cellular Radio Network and MIMO.

4Gsystems: Perspective Systems of 4G, Code Division Duplexing (CS-OFDMA), and Study of a 60-GHz Cellular System.

Text Books:

1. William C.Y. Lee, Wireless and Cellular Telecommunications, 3rd International ed., McGraw Hill, 2006.
2. Theodore S Rappaport, Wireless Communications Principles and Practice, 2nd ed., Prentice Hall PTR, 2002.

Reference Books:

1. Gordon L. Stuber, "Principles of Mobile Communication", 3rd ed., Springer, 2011.
2. William C.Y. Lee, Mobile Cellular Telecommunications Analog and Digital Systems, 2nd ed., McGraw Hill Education (India) Pvt. Ltd., 2006.

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20EC31005 – Digital Systems Design
(Professional Elective - I)

B. Tech. ECE- III Year I Sem.

L	T	P/D	C
3	-/-	-/-	3

Prerequisite(s): 20EC21002 - Digital Design

Course Objectives: Develop ability to:
1. Understand the basic concepts of Finite state models, and minimization methods.
2. Understand Asynchronous sequential machines.
3. Understand Algorithmic State Machine charts and realize circuits.
4. Understand the concept of Fault diagnosis and various faults in digital systems.

Course Outcomes: At the end of the course, student would be able to:
CO1. Apply the concepts of set theory, state equivalence, graph theory, minimization and transformation methods for analyzing and simplifying completely and incompletely specified state machines.
CO2. Analyze and design asynchronous fundamental and pulse mode sequential circuits
CO3. Apply Algorithmic State Machine concepts, design simple state machines.
CO4. Generate tests for finding and locating faults in combinational circuits
CO5. Apply experiments to generate tests to identify faults in sequential circuits, design diagnosable state machines

UNIT –I

Minimization and Transformation of Sequential Machines: The Finite State Model – Capabilities and limitations of FSMs – State equivalence and machine minimization – Simplification of incompletely specified machines – Merger graph and Merger Table.

UNIT –II

Asynchronous sequential Circuits: Fundamental mode circuits, Synthesis – Flow table, reduction of flow tables, State Assignment in Asynchronous sequential circuits – Races and cycles, Pulse mode circuits.

UNIT –III

State Machine Design and SM Charts: State machine charts, Derivation of SM Charts, Realization of SM Chart, Implementation of Binary Divider, Binary Multiplier and Dice game controller using SM charts.

UNIT -IV

Fault Diagnosis of Digital Systems: Logic Fault model, Stuck at zero and Stuck at one faults, Fault detection in Combinational Circuits: Fault table method and Fault location experiment, Path Sensitization technique and Boolean Difference method.

UNIT –V

Fault Diagnosis in Sequential Circuits: State Identification and Fault detection: Experiments, Homing experiments, Distinguishing experiments, Machine Identification and Design of diagnosable machines.

Text Books:

1. ZviKohavi, Switching and Finite Automata Theory, 2/e., TMH.2001,
2. Charles H. Roth, Fundamentals of Logic Design, 5/e., Cengage Learning, 2003.

Reference Books:

1. MironAbramovici, Melvin A. Breuer and Arthur D. Friedman, Digital Systems Testing and Testable Design, John Wiley & Sons Inc.2000-21.
2. Samuel C. Lee,Digital Circuits and Logic Design, PHI. 1980.
3. N. N. Biswas,Logic Design Theory, PHI, 1993.
4. Morris Mano, M.D.Ciletti,Digital Design, 4/e, PHI, 2008.

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20EC31006 -Digital Design through Verilog HDL
(Professional Elective - I)

B. Tech. ECE III Year, I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC21002 - Digital Design

Course Objectives: Develop ability to:
1. Understand Verilog language constructs.
2. Understand gate level and data-flow modeling techniques.
3. Understand behavioral modeling techniques.
4. Understand tasks, functions and UDPs.
5. Understand logic synthesis, gate level netlist and state machine coding.

Course Outcomes: At the end of the course, student would be able to:

CO1. **Apply** Verilog HDL language constructs and develop programs for simple combinational designs.
CO2. **Implement** and **verify** digital circuits using gate level, and data-flow modeling techniques.
CO3. **Realize** Combinational and sequential circuits using behavioral modeling.
CO4. **Implement and verify** designs using Tasks, Functions and UDPs.
CO5. **Synthesize** RTL code for combinational and Sequential circuits.

UNIT – I

Introduction to Verilog HDL: Overview of Digital Design with Verilog HDL, Hierarchical Modeling Concepts, Basic Concepts: Language Constructs and Conventions; Modules and Ports, Levels of abstraction-Gate-Level Modeling, Dataflow Modeling, Behavioral Modeling, Concurrency, Functional Verification, System Tasks, Programming Language Interface (PLI), Simulation and Synthesis Tools.

UNIT – II

Gate Level Modeling: Modeling using basic Verilog gate primitives: AND, OR, BUF/NOT Gate Primitives; Module Structure, Components test and verification, Design of multiplexer, 4-bit ripple carry full-adder, Gate Delays. Tri-State Gates, Array of Instances of Primitives, Design of combinational circuits with delays, Design of sequential circuits using Gate Primitives.

Modeling at Data flow Level: Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vectors, Operators. Design of 4-bit adder.

UNIT– III

Behavioral Modeling: Introduction, Operations and Assignments, Functional Bifurcation, initial Construct, always Construct, Assignments with Delays, wait construct, Multiple always Blocks, Designs at Behavioral Level, Blocking and Non-Blocking Assignments, The case statement, Simulation Flow, if and if-else constructs, assign and de-assign constructs, repeat construct, for loop, the disable construct, while loop, forever loop, Parallel Blocks, force- release construct, timing control-delay-based, Event-based and level-sensitive. Design of 4-bit counter and clock divider.

UNIT– IV

Tasks and Functions: System Tasks and Functions, File-Based Tasks and Functions, Parameters, Timing and delays, Module Parameters; Design of parity calculation and left/right shifter.

User Defined Primitives: UDP, Examples of combinational and sequential UDPs. Overview of Switch Level Modeling.

UNIT– V

Logic synthesis with Verilog HDL: Introduction, Synthesis flow, Illustrative example of RTL–to-Gates: magnitude comparator; Verification of Gate-level net list.

Sequential circuit synthesis: State Machine Coding and three consecutive 1's sequence detection.

TEXT BOOKS:

1. Samir Palnitkar, Verilog HDL, 2nd Edition, Pearson Education, 2009.
2. T R Padmanabhan, Design through Verilog HDL, Wiley, 2009.

REFERENCE BOOKS:

1. Zainalabdien Navabi, Verilog Digital System Design, 2nd Edition, TMH, 2017
2. Micheal D. Coletti, Advanced Digital Design with the Verilog HDL, PHI, 2009.
3. Stephen Brown, Fundamentals of Digital Logic with Verilog Design, 2nd Edition, TMH, 2010.
4. Sunggu Lee, Advanced Digital Logic Design using Verilog: State Machine and Synthesis for FPGA, Cengage Learning, 2012.

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20EC31007 - Artificial Neural Networks
(Professional Elective-I)

B. Tech. ECE - III Year I Sem

L	T	P/D	C
3	-	-/-	3

Pre-requisite: None

Course Objectives: Develop the ability to
1. Understand the biological neural network and equivalent artificial neuron models.
2. Understand the architecture, learning algorithms
3. Know the issues of various feed forward and feedback neural networks.
4. Understand the concepts of Associative Memories.
5. Learn the feature mapping in Self-Organization Maps.

Course Outcomes: After completion of the course, the student would be able to
CO1: Explain the neuron models and apply the learning rules.
CO2: Explain the error minimization and optimization techniques for Perceptron networks.
CO3: Describe the properties related to Backpropagation learning algorithm.
CO4: Explain the concepts of Auto and Bidirectional Associative Memories.
CO5: Describe feature mapping in Self-Organization Maps and Linear Vector Quantization.

UNIT-I

Introduction: Biological Neuron and Neural Network, Basic Models of Artificial Neurons, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks.

Learning Process: Supervised learning and Unsupervised learning, Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive Learning, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption.

UNIT-II

Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques.

Perceptron –Convergence Theorem, Multilayer Perceptron: Back Propagation Algorithm, XOR Problem, Heuristics, Feature Detection.

UNIT-III

Back Propagation: Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence.

UNIT-IV

Associative Memories: Basic Concepts, Linear Associator, Auto-associative Memory-Concepts, Retrieval Algorithm, Storage Algorithm. Performance Analysis of Recurrent Auto-associative Memory- Energy function reduction, capacity, Memory convergence versus Corruption. Advantages and Limitations. Bi-directional Associative memory (BAM)-Architecture, Encoding and Decoding, Stability considerations, Memory Example and Performance Evaluation.

UNIT-V

Self-Organization Map (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Learning Vector Quantization, Adaptive Pattern Classification. Basics of Adaptive Resonance Theory (ART-1).

TEXT BOOKS:

1. Neural Networks a Comprehensive Foundations, Simon S Haykin, PHI Ed.,
2. Introduction to Artificial Neural Systems, Jacek M. Zurada, JAICO Publishing House Ed. 2006.

REFERENCE BOOKS:

1. Neural Networks -James A Freeman and David M Skapura Pearson Ed., 2004.
2. Artificial Neural Networks - B. Yagnanarayana Prentice Hall of India P Ltd 2005.
3. Neural Networks – James A Freeman and David M Skapura, Addison-Wesley, ISE reprint 1999.

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20EN31L01 - Professional Communication Skills Lab

B. Tech. ECE - III Year I Sem

L	T	P/D	C
-	-	2	1

Pre-requisite: None

COURSE OBJECTIVES:

1. Improve students' fluency in spoken English.
2. Enable them to acquire behavioural skills required for their personal and professional life.
3. Help students develop their vocabulary.
4. Read and comprehend texts and respond appropriately in different Socio-Cultural contexts.
5. Communicate their ideas effectively orally and in written form.

COURSE OUTCOMES: At the end of the course, students would be able to:

CO1. Use acquired vocabulary from etymology in different contexts
CO2. Demonstrate self-management, interpersonal skills and group discussion skills
CO3. Interpret and infer from the given text employing different reading techniques
CO4. Prepare diverse documents for various purposes

Module-I

Activities on Fundamentals of Inter-Personal Communication: Responding appropriately and relevantly using the right body language, discourse skills. Resilience and Personal Management-Managing stress, time, anger and other emotions, assertiveness and culture shock.

Module-II

Activities on Reading Skills: Reading for facts, reading for specific information, reading between the lines, negative facts, inferential reading, critical reading.

Module-III

Activities on Writing Skills: Writing process, gather information, analyzing the content, formatting, editing, Resume writing and CV preparation, writing SOP, letter writing and email writing and Video Resume or Visume.

Module-IV

Activities on Presentation Skills: Oral Presentations (individual & group), seminars, ppts and written presentations through posters, projects, portfolio building or management, brochures and reports.

Module-V

Activities on Group Discussion and Interview Skills: Dynamics of Group Discussion-Videos of Mock GDs-intervention, summarizing, body language, relevance and organization of ideas and rubrics for evaluation. Three stages of Interviews-pre ,during and post interview planning, opening strategies, answering strategies, interview through Tele-Conference and Video Conference and Mock Interviews, Videos of Mock Interviews, H.R questions, SJT questions.

Text Book(s):

1. PCS Lab Manual prepared by the Faculty of English, Freshman Engineering Department.
2. David A. Mc Murrey& Joanne Buckley: Handbook for Technical Communication, Cengage Learning Pvt. Ltd ., New Delhi, 2012.

Reference Book(s):

1. Paul V.Anderson: Technical Communication, Cengage Learning Pvt. Ltd., New Delhi, 2007.
2. O'Connor Tamara, Generic Skills Integration Project (GENSIP)Interpersonal Skills Module Exercises & Handouts, University of Dublin, Trinity College, 2003

20EC31L01 – Microprocessors and Assembly Language Programming Lab

B. Tech. ECE- III Year I Sem.

L	T	P/D	C
-	-/-	2	1

Prerequisite(s): 20EC21L02 - Digital Design Lab
20EC21002 – Digital Design

Course Objectives: Develop ability to

1. Write Assembly Language Programs for various arithmetic and logical operations using 8086.
2. Interface various I/O devices with 8086 processor kits.
3. Write and execute interfacing programs in Assembly Language for 8086 processor.
4. Write and execute Assembly language program for serial and parallel communication between two microprocessors.

Course Outcomes: At the end of the course, student would be able to

CO1. Write and verify 8086 assembly language programs using MASM and/ or 8086 Kit.
CO2. Interface different I/O devices with 8086.
CO3. Write the program for serial and parallel communication between two microprocessors

List of experiments: (Minimum 10 experiments are to be conducted using MASM software and/or Hardware Kits).

Part A: 8086: Kit and/or MASM Programming (Minimum 4 experiments to be conducted)

1. Programs for 16 bit addition and subtraction operations (using various addressing modes)
2. Programs for 16 bit multiplication and division operations (using various addressing modes)
3. Program for sorting an array
4. Program for searching for a number or character in a string
5. Program for String manipulations
6. Program to generate Fibonacci Series
7. Program for digital clock design using 8086

Part B: Interfacing with 8086 Microprocessor: (Minimum 4 experiments to be conducted)

8. Interfacing ADC and DAC to8086
9. Interfacing to 8086 and programming to control stepper motor.
10. Parallel communication between two microprocessors using 8255.
11. Serial communication between two microprocessor kits using 8251.
12. Verification of various modes of operation of 8255.
13. Interfacing LCD to 8086.
14. Interfacing Keyboard to 8086.
15. Interfacing seven segment display to 8086 using 8279.

Equipment Required:

1. 8086 Trainer Kits.
2. Interface cards :
   a) 8 bit ADC &DAC,
   b) Stepper motor
   c) 8251/8253 study cards,
   d) Keyboard/Display,
   e) LCD Display,
   f) 8255 Study card

Software Required:

MASM (Open Source)

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20EC31L02 - Digital Communications Lab

B. Tech. ECE- III Year I Sem.

L	T	P/D	C
-	-	2	1

Prerequisite(s): 20EC22001 – Analog and Digital Communications

Course Objectives: Develop ability to

1. Understand various digital modulation techniques through generation and detection of signals.
2. Study the spectral Characteristics of QPSK
3. Understand the generation of (7,4) bit Hamming Code
4. Understand the generation of OFDM signal.

Course Outcomes: At the end of the course, the student would be able to

CO1. Demonstrate various digital modulation and demodulation techniques
CO2. Analyze the spectral Characteristics of QPSK
CO3: Generate (7,4) bit Hamming code
CO4. Demonstrate the generation of OFDM signals.

List of Experiments: (At least 10 experiments are to be conducted)

1. Pulse Code Modulation (PCM) - Generation and Detection
2. Differential Pulse Code Modulation (DPCM)- Generation and Detection
3. Delta Modulation and demodulation
4. Amplitude Shift Keying: Generation and Detection
5. Frequency shift keying-Generation and Detection
6. Phase Shift Keying-Generation and Detection
7. QAM: Generation and Detection
8. DPSK: Generation and Detection
9. QPSK: Generation and Detection
10. Study of the spectral characteristics of QPSK.
11. Study of Hamming Code – (7,4) bit Generation
12. Demonstration of OFDM Generation and Detection

Equipment required:

1. DSO (0-20 MHz minimum)
2. Function Generators (0.1Hz -1 MHz minimum)
3. Experimental Kits/Modules

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20EC31008 – Internship

B. Tech. ECE- III Year I Sem.

L	T	P/D	C
-	-	-	2

Prerequisites: None

There shall be an internship, which the student shall carryout immediately after Second year second semester examinations and pursue it during summer vacation for a duration of about four weeks. The Work carried out during Internship shall be submitted in the form of a report, and a presentation of the same shall be made before a committee, which evaluates it for 100 marks. The committee shall consist of Head of the Department or his nominee, the supervisor allocated for the internship, and two Professors / Assoc-Professors of the department. There shall be only CIE for 100 marks for internship and shall be evaluated during third year first semester. There shall be no SEE for Internship.

Course outcomes: At the end of the course, the student would be able to:

CO1. **Research** independently in collecting the required information through various resources during the course of internship.
CO2. **Apply** knowledge of basic sciences, mathematics and engineering for real life applications.
CO3. **Present** the skills acquired during the internship in an effective manner**.**
CO4. **Demonstrate** the writing skills in the preparation of report.
CO5. **Exhibit** critical and analytical thinking skills acquired during the internship.

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20MA31P01 – Logical Reasoning-I

B. Tech. ECE III Year I Sem.

L	T	P/D	C
0	0	4	2

Prerequisite(s): None

Course Objectives: Develop ability to

1. Distinguish between simple and compound interest and demonstrate how to determine each; Evaluate profit/loss for the given various price related problems; Understand the importance of percentage, ratio and proportions while solve the problems in different scenarios.

2. Evaluate the average by various methods; Understand the concepts of speed, distance and time, solve the related problems; Understand the concepts of work done in a given period of time in various contexts.

3. Understand the statements and their connectives; Identify the validity of conclusions drawn from the given statements and identify strong/weak arguments from a given statement; Determine various Analogies to identify the similarities of the objects.

4. Understand the various concepts of Non Verbal reasoning; Create awareness on blood relations and solve the related problems; Understand the concepts of binary logic and solve the analytical problems.

Course Outcomes: At the end of the course, the students will be able to:

CO 1: Interpret the validity conclusion from arguments and / or statements.

CO 2: Develop strategies to find solutions and persevere in solving them.

CO 3: Perform advance tricky approaches for solving reasoning and aptitude problems.

Quantitative Aptitude:

1. Simple Interest: Definitions, Problems on interest and amount, Problems when rate of interest and time period are numerically equal. **Compound Interest:** Definition and formula for amount in compound interest, Difference between simple interest and compound interest for 2 years on the same principle and time period.

2. Profit & Loss: Cost price, selling price, marked/list price, profit/gain, discount, use of false scale for selling an article, discount series and net selling price, successive Selling.

3. Percentages, Ratio & Proportions:

Calculating a percentage, calculating increase or decrease, calculating percent change, calculating successive percentages, definition of ratio and proportions, direct proportion, Inverse or reciprocal proportion, continued proportion, Mean proportion, Third proportion, Fourth proportion, compound ratio.

4. Averages: Definition of Average, Rules of Average, Problems on Average, Problems on Weighted Average, finding average using assumed mean method**.**

5. Time and Distance: Relation between speed, distance and time, converting km/h into m/s and vice versa, Problems on average speed, Problems on relative speed, Problems on trains.

6. Time and Work: Problems on Unitary method, Relation between Men, Days, Hours and Work, Problems on Man-Day-Hour's method, Problems on alternate days, Problems on Pipes and Cisterns.

Logical Reasoning:

7. Logical Connectives: Definition of simple statement, Definition of compound statement, finding the implications for compound statements, finding the negations for compound statements

8. Syllogism: Definition of statement/premises and conclusion, explanation through Venn diagram, problems on two/three statements and one/two conclusions, identification of statements and conclusions from the given set of statements. **Statements and Arguments**: Types of arguments, Strong argument, weak argument, identifying strong/weak arguments from a given statement

9. Analogy Classifications: Definition of Analogy, Problems on number analogy, Problems on letter analogy, Problems on verbal analogy.

10. Non-Verbal Reasoning: Identification of continued figure or odd figure by using analogy, series, rotation in clockwise and rotation in anticlockwise, vertical, horizontal, alternative rotation, addition, subtraction

11. Blood Relations: Blood relations on Family Tree concepts (relationships in the family), paternal side relations, maternal side relations, simple and direct relationships, relation puzzles, coded relations.

12. Binary Logic: Definition of a truth-teller, Definition of a liar, Definition of an alternator, solving problems using method of assumptions, solving analytical puzzles using binary logic.

TEXT BOOKS

1. A modern approach to Logical reasoning, R S Agarwal, S. Chand Publications, 2013.
2. Quantitative Aptitude for Competitive Examinations, Dinesh Khattar, Pearson Education, 4th Edition, 2019.

REFERENCE BOOKS

1. Quantitative Aptitude and Reasoning, R. V. Praveen, PHI Learning Private Ltd, 2nd Edition, 2013.
2. Quantitative Aptitude for competitive examinations, Abhijith Guha, McGraw Hill Education, 6th Edition, 2017.
3. Analytical & Logical Reasoning, Peeyush Bhardwaj, Arihant Publications, 4th Edition, 2015.
4. Logical Reasoning for the CAT, Arun Sharma, McGraw Hill Education, 2nd Edition 2014.

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20CS31M02-Introduction to Artificial Intelligence
(Mandatory Course)

B. Tech. ECE- III Year I Sem.

L	T	P/D	C
3	-	-/-	-

Prerequisite(s): None

Course Objectives: To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning. Study of Markov Models enable the student ready to step into applied AI.

Course Outcomes:
After completion of the course, student would be able to
CO1. Apply search techniques to given problem instances.
CO2. Use basic and advanced search techniques for a given problem
CO3. Explain various basic and advanced knowledge representation and reasoning techniques.
CO4. Explain different types of learning mechanisms
CO5. Explain domain knowledge acquisition and representation in building an expert system.

UNIT - I

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents **Basic Search Strategies**: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

UNIT - II

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning

Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

UNIT - III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Non- monotonic Reasoning, Other Knowledge Representation Schemes

Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

UNIT - IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

UNIT - V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOK(S)

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice- Hall, 2010.

REFERENCE BOOK(S)

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.

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20EC32001 – Microcontrollers and Embedded Systems

B. Tech. ECE- III Year II Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC31001 - Computer Architecture and Microprocessors

Course Objectives: Develop ability to:

1. Understand design principles of an Embedded System.
2. Understand the architecture and features of 8051 Microcontroller, and programming.
3. Understand interrupts, timers/ counters and serial communication modes of 8051.
4. Understand the operation of ARM Processors.
5. Understand the functions of RTOS.

Course Outcomes: At the end of this course, the student would be able to

CO1: Illustrate the hardware requirements of an Embedded System Design.
CO2: Explain the functionality of 8051 microcontroller and its memory organization
CO3: Develop Assembly Language Programs using 8051 instructions and Addressing modes.
CO4: Explain the functionality of timer/counter, Interrupt, serial communication of 8051
CO5: Explain the functions and features of ARM Processors.
CO6: Illustrate the role of Real Time Operating System and its functions in Embedded Systems.

UNIT – I: Introduction to Embedded Systems & 8051 microcontroller:

Definition of Embedded System, Embedded Systems Vs General Computing Systems, Major Application Areas, Purpose of Embedded Systems. Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer. Introduction, 8051 microcontrollers, Pin Diagram and Architecture, I/O ports, memory organization, Memory interfacing.

UNIT – II:

8051 INSTRUCTIONS SET AND PROGRAMMING: Addressing modes, Instruction set of 8051, Simple programs – arithmetic and logic operations, sorting, branch and call instructions.

Timers/Counters: Various modes of timers/counters, Programming 8051 timers/counters.

UNIT – III:

Serial communication: serial communication standards, serial data transfer schemes, UART operation.

Interrupts: Interrupt structure of 8051, vector interrupt table and interrupt service routine, Programming – Timer, serial communication and external hardware interrupts.

UNIT – IV: ARM processor fundamentals

The RISC Design Philosophy, Registers, Current Program Status register, Pipeline, Exceptions, Interrupts and Vector table, Architecture Revisions, ARM Processor Families.

UNIT – V: RTOS Based Embedded System Design

Real time Operating System Basics, Types of Real time Operating Systems, Selection of RTOS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

Text Books:

1. Shibu K.V, "Introduction to Embedded Systems", 2/e, McGraw Hill Education (India) Private Limited, 2009.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide: Design and Optimizing System software", Morgan Kaufmann Publishers, 2004.
3. Kenneth J. Ayala, The 8051 Microcontroller. 3/e., Cengage Learning. 2007.

References:

1. Ajay. V. Deshmukh, Micro controllers and Applications, TMGH,2005
2. Steve Furber, "ARM System-on-Chip architecture", 2/e, Pearson Education limited 2000.
3. Raj Kamal, "Embedded Systems –Architecture, Programming and Design", 2/e, Tata McGraw Hill, 2008.

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20EC32002 - Digital Signal Processing

B. Tech. ECE- III Year II Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisites: 20EC21001- Signals and Systems
20EE22003- Signals, Systems and Transformation Techniques for EEE

Course Objectives: Develop Ability to

1. Understand the principles of analyzing discrete signals and systems.
2. Understand frequency domain analysis of discrete time signals
3. Understand the principles of designing of Infinite Impulse Response (IIR) filters and respective stability constraints.
4. Understand the concept of linear phase response of an LTI system and the design of Finite Impulse Response (FIR) filters.
5. Understand the concept of Multi-rate signal processing and its applications.

Course Outcomes: At the end of the course, Students would be able to

CO1: Determine the stability and physical realizability of a discrete LTI system using Z-Transform and DTFT techniques
CO2: Analyze the spectral characteristics of the given Discrete signal.
CO3: Design and realize a digital filter for the given specifications
CO4: Determine the effects of non-uniform sampling on the spectral characteristics of the signal relative to uniform sampling.

UNIT-I

Introduction to Digital Signal Processing - Digital Signal Processing and its benefits. Review of Z-Transform and Inverse Z-transform. Discrete time Fourier transform (DTFT) and Inverse DTFT, Relation between Z-transform and Discrete Time Fourier Transform (DTFT). Analysis of Discrete Time Invariant Systems: Causal Linear Time Invariant Systems (LTI), Stability of LTI Systems, LTI Systems characterized by constant coefficient difference equations using z-transforms, Solution of Linear Constant coefficient difference equations using Z-transform.

UNIT-II

Discrete Fourier Transform (DFT) –DFT, properties of DFT, Relation between of DFT with DTFT/ Z-Transform, Inverse Discrete Fourier Transform (IDFT), Linear Convolution and Circular convolution of sequences using DFT.

Fast Fourier Transform (FFT): Efficient computation of DFT: FFT algorithms, Radix-2 FFT algorithms for decimation in time (DIT) and decimation in frequency (DIF).

UNIT-III

Design of IIR DIGITAL FILTERS–Realization of IIR systems: Direct Form I and II, Cascade form and Parallel form structures. Design of IIR Filters lowpass and high pass from analog filters: Analog filter approximations-Butterworth and Chebyshev. IIR filter design using Impulse invariant transformation and Bilinear Transformation method. Frequency transformations in filters.

UNIT-IV

Design of FIR DIGITAL FILTERS–Realization of FIR Systems: Direct form, Cascade realization and Linear phase realization; Characteristics of linear phase FIR filters and their frequency response; Comparison between IIR and FIR filters; Design of linear phase FIR filters using windowing method (Rectangular window, Hanning window, Hamming window, Bartlett window and Kaiser window), frequency-sampling method.

UNIT-V

Introduction to Multi-rate Digital Signal Processing - Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D. Multistage implementation of sampling rate conversion. Applications of multi-rate signal processing.

Textbooks

1. John G. Proakis, D. G. Manolakis: Digital signal Processing: Principles, Algorithms and Applications - 4th Edition, Pearson/PHI, 2009.
2. S.K. Mitra: Digital Signal Processing, 3/e, TMH, 2006.

References

1. A.V. Oppenheim and R.W. Schaffer :Discrete time signal Processing, 2nd Edition, Pearson, 2007
2. Emmanuel C. Ifeacher, Barrie. W. Jervis,: Digital signal Processing-A Practical Approach-2nd Edition, Pearson Education, 2009.
3. Lonnie. C. Ludeman:Fundamentals of Digital Signal Processing ,1st Edition, Wiley, 1986.

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20EC32003 - Satellite Communications
(Professional Elective - II)

III Year. B. Tech. ECE-II Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC22001– Analog and Digital Communications
20EC31002 - Antennas and Wave Propagation

Course Objectives: Develop ability to

1. Understand the basics of orbital mechanics, frequency bands and launch vehicles for satellite communication systems.
2. Understand the operation of various sub-systems of communication satellites.
3. Understand the basic transmission theory and design of satellite link.
4. Understand various digital modulation and multiple access techniques for satellite-earth links.
5. Understand the small satellite system design, their operational use and future space technologies.

Course Outcomes: At the end of the course, the student would be able to

CO1. **Explain** the overview of satellite communication systems and its orbital mechanics.
CO2. **Explain** the operation of various sub systems to support satellite commutations mission.
CO3. **Design** satellite links for meeting a minimum C/N, considering the propagation impairments.
CO4. **Analyze** different multiple access techniques in terms of their applicability
CO5. **Compare** the throughput of satellite channel using different multiple access protocols for satellite packet communication.

UNIT – I: Elements of Satellite Communication System

Brief history of satellite communications, overview of satellite communications, Orbital mechanics, Look Angle determination, Orbital Perturbations, Launches and Launch Vehicles, Orbital effects in communications systems performance.

UNIT – II: Satellite Sub-Systems

Satellite Sub-Systems, Attitude and Orbit Control system, Telemetry, Tracking, Command and Monitoring subsystem, Power systems, Communication subsystems, Satellite Antennas, Equipment Reliability and Space Qualification.

UNIT – III: Satellite Link Design and Propagation Effects

Basic transmission theory, System noise temperature and G/T ratio, Design of D-downlinks, Uplink design, Design for specified C/N: combining C/N and C/I Values in satellite links, System Design for Ku Band Uplink and Down link Design and Rain effects at Ku Band.

Propagation Effects: Quantifying Attenuation and Depolarization, Propagation effects that are not associated with Hydrometeors, Rain and Ice effects, Propagation Impairment Countermeasures.

UNIT – IV: Multiple Access Techniques

Multiple Access Techniques: Multiple Access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Synchronization in TDMA Networks, Onboard Processing, Demand Assignment Multiple Access (DAMA), Random Access (RA), Packet Radio Systems and Protocols, Code Division Multiple Access (CDMA)

UNIT –V: Satellite Packet Communications and small satellites:

Message transmission by FDMA: MI G/i Queue, Message transmission by TDMA, PURE ALOHA

Satellite Packet switching, Slotted aloha, Packet reservation, Operational Use of SmallSats

Text Books

1. Timothy Pratt, Charles Bostian, Jeremy Allnutt, "Satellite Communications", 2nd Edition, 2003, John Wiley & Sons.
2. Tri T–Ha, "Digital Satellite Communications", 2nd Edition, 1990, McGraw Hill.

Reference Books

1. Timothy Pratt, Jeremy Allnutt, "Satellite Communications", 3rd edition, John Wiley and Sons, 2020.
2. Louis J. Ippolito, Satellite Communications Systems Engineering. Atmospheric Effects, Satellite Link Design and System Performance, 2nd edition, 2017, Wiley.

20EC32004 – Electronic Sensors
(Professional Elective - II)

B. Tech. ECE- III Year II Sem.

L	T	P/D	C
3	-	-/-	3

Pre requisite(s): 20EC22002 - Linear Integrated Circuits

Course Objectives: Develop ability to
1. Understand the need of transducers/sensors in instrumentation systems.
2. Learn various passive sensors based on resistance, inductance and capacitance.
3. Understand various active transducers.
4. Understand the working principle of few modern sensors.

Course Outcomes: At the end of this course, the student would be able to
CO1. Select a suitable sensor/transducer for sensing a given physical parameter.
CO2. Explain the principles of sensing and noise in sensors.
CO3. Explain the working principle of various passive transducers.
CO4. Explain the working principle of various active and optoelectronic transducers.
CO5. Explain about modern sensors.

UNIT - I: Introduction to sensors/transducers:
Principles, classifications, selection of a transducer, parameters, characteristics, factors influencing the choice of transducers and applications.

UNIT - II: Principles of Sensing and noise in sensors:
Principles of sensing - Capacitance, magnetism, induction, resistance, Hall Effect, thermoelectric effect, temperature and thermal properties of materials. Qualitative treatment on noise in sensors and circuits.

UNIT - III: Passive Transducers
Resistive Transducers: Principles, potentiometric transducer, Strain gauges, resistance thermometers and thermistors.
Inductive Transducers: Principles, magnetostrictive transducer and differential transformer transducers.
Capacitive Transducers: Variable capacitance pressure gauge and capacitor microphone.

UNIT - IV: Active Transducers
Thermocouples: Construction of thermocouples, compensation circuits, advantages and disadvantages of thermocouples.
Piezoelectric transducer: Piezoelectric effect, modes of operation, properties, equivalent circuit and **Photovoltaic Cell.**

UNIT - V: Modern sensors (Qualitative treatment only)
Load cell, LDR, humidity/moisture sensors, integrated circuit temperature sensors, gas/smoke sensor, ultrasonic distance sensor, IR sensor, liquid level sensor and PIR sensors.

Text Books:

1. A.D. Helfrik, W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", 5/e, PHI, 2003
2. Ernest O. Doebelin, "Measurement Systems-Application and Design", 6/e, TMH, 2017.

Reference Books:

1. A.K. Sawhney, "A course in Electrical and Electronic Measurements and Instrumentation". Dhanpat Raj and company, 2015.
2. Jacob Fraden, "Handbook of Modern Sensors, Physics, Designs and Applications", 4/e, Springer, 2014.

20EC32005- VLSI Design

(Professional Elective - II)

B. Tech. ECE - III Year, II Sem.

L	T	P	C
3	-	-	3

Prerequisite(s): 20EC12001 - Semiconductor Devices and Circuits
20EC21002 - Digital Design

Course Objectives: Develop ability to

1. Understand MOS technology and MOS transistor electrical properties.
2. Understand MOS Circuit Design Processes and layout rules.
3. Understand architectural aspects of VLSI Subsystem.
4. Understand the principles of data path and array subsystems.
5. Understand VLSI design methodology and principles of verification and test.

Course Outcomes: At the end of the course, student would be able to:

CO1. **Compare** MOS based IC fabrication processes viz. NMOS, PMOS, CMOS and BiCMOS.
CO2. **Explain** the basic electrical properties of MOS circuits.
CO3. **Construct** stick diagram and layout diagram for NMOS, PMOS & CMOS based logic circuits.
CO4. **Implement** different MOS inverter logic circuits based on power and delay requirements
CO5. **Design** building blocks of data path subsystems.
CO6. **Analyze** the functionality of MOS transistor based memory circuits.
CO7. **Compare** the design aspects of semi-custom and full custom methodologies.
CO8. **Explain** the methods used for design verification and manufacturing testing.

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UNIT –I: Introduction to IC Technology:

NMOS, PMOS and CMOS; Comparison between CMOS and Bipolar technologies.
Basic Electrical Properties: Basic Electrical Properties of MOS Circuits: I_{ds}-V_{ds} relationship, Threshold Voltage, g_m, g_{ds}, Figure of merit ω_o. NMOS Inverter: $Z_{p.u}/Z_{p.d}$ ratio(4:1), Alternate forms of pull-up. CMOS Inverter and its characteristics.

UNIT -II: MOS Circuit Design Processes:

VLSI Design Flow, CMOS Logic Gates and compound gates, MOS Layers, Stick Diagrams, Lambda based design Rules and Layout, 2μm CMOS Design rules for wires, Contacts and Transistors; Layout Diagrams for NMOS and CMOS Inverters; Scaling of MOS circuits.

UNIT –III: Subsystem Design:

Architectural issues**;** Switch logic: Pass transistors and Transmission gates; Alternate gate circuits: Pseudo nMOS inverter and Domino Logic; Inverter Delays, Driving large capacitive loads, wiring capacitance, Fan–in and Fan–out.

UNIT -IV: Datapath Subsystems:

Introduction to system design, Adders: Ripple Carry and Carry Look Ahead, ALU, One/Zero Detector, Barrel Shifter and Multipliers: Array, Braun and Booth multiplier
Array Subsystems: Qualitative analysis of 6T SRAM, DRAM, NAND based ROM, Serial Access Memories and Content-addressable memory.

UNIT -V: Design Methodology:

Programmable Logic, Gate Array and Sea of Gates Design, Cell-based design, Introduction to Full Custom Design and System on a Chip.

VLSI Design Verification and Test: Introduction, need of testing, Overview of Logic Verification, Debugging and Manufacturing Testing.

Text Books:

1. Kamran Eshraghian, Douglas A. Pucknell, Sholeh Eshraghian, Essentials of VLSI circuits and Systems, PHI, 2005 Edition
2. Neil H. E Weste, David Harris, Ayan Banerjee, CMOS VLSI Design – A Circuits and Systems Perspective, 3/e, Pearson, 2009.

Reference Books:

1. Ming-Bo Lin, Introduction to VLSI Systems: A Logic, Circuit and System Perspective, CRC Press, 2011
2. K. Lal Kishore, V. S. V. Prabhakar, VLSI Design- I.K International, 2009.

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20EC32006 - Principles of Machine Learning

(Professional Elective - II)

L	T	P/D	C
3	-	-/-	3

B. Tech. ECE - III Year II Sem

Course Objectives: Develop ability to

1. Understand the difference between Human learning and machine learning
2. Understand the principles of Machine learning Techniques
3. Differentiate between the principles of supervised and unsupervised learning
4. Understand the concepts of Hypothesis testing
5. Understand the principles of evaluating a machine learning model

Course Outcomes: After completion of the course, the student would be able to

CO1. Classify different Machine Learning Algorithms and the context of their application with reference to the given attributes of the data

CO2. Apply and analyze various classification algorithms for the given data set

CO3. Apply the concept of Maximum A posteriori (MAP) criterion for classification problems pertaining to data sets.

CO4. Apply and analyze various regression algorithms that are used to relate the dependent and independent variables with reference to a given data set.

CO5. Apply different Clustering techniques used to group instances under unsupervised learning

UNIT –I:

Introduction to Machine Learning-Basic Machine learning process, Types of Machine learning, -Supervised learning, unsupervised learning, reinforcement learning, Aspects of developing a learning system, Machine learning life cycle, basic types of data in machine learning.

UNIT –II:

Supervised Learning- Classification: Classification learning steps, nearest neighbor methods, Decision Tree Learning – Introduction, decision tree representation, Supervised learning: Random Forest, Principles of Support Vector machines (SVM)

UNIT –III:

Bayesian concept learning: Bayes Theorem, Brute-Force Bayes concept learning, MAP Hypothesis and consistent learners, Bayes optimal classifier, Naive Baye's classification, Bayesian Belief network-independence and conditional independence

UNIT –IV:

Supervised Learning-Regression: Common regression algorithms-Simple and Multiple linear regression, Assumptions in regression analysis, improving the accuracy of linear regression model, Polynomial regression, Logistic regression and applications. Evaluating performance of a Model

UNIT –V:

Unsupervised Learning: Comparison with supervised learning, Applications of Unsupervised learning, requirements of clustering, Clustering techniques: Partitioning Methods k-means algorithm, hierarchical, Density based and grid-based clustering.

Textbooks:

1.Tom M Mitchell- Machine Learning-McGraw-Hill, 1997

Reference Books:

1. Ethem Alpaydin-Introduction to Machine Learning-MIT Press, Cambridge, 2nd Edition, 2010

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20CE31061-Building Technology
(Open Elective – I)

B. Tech. B. Tech. ECE - III Year II Sem

L	T	P/D	C
3	-	-/-	3

Pre-Requisites: **None**

Course Objectives: Develop ability to
1. Know the various materials used in the buildings.
2. Understand the building by-laws and ventilation required in the buildings.
3. Estimate the repairs and transportation systems required in buildings.
4. Know the prefabrication and Air condition requirements.
5. Know the plumbing systems required in building.

Course Outcomes: At the end of the course, student would be able to
CO 1: Explain characteristics of building materials.
CO 2: Describe the types of buildings, building by-laws and prefabrication systems in buildings
CO 3: Describe ventilation, lighting, acoustics and plumbing services for a building.
CO 4: Explain the repairs, fire protection measures and vertical transportation for a building.

UNIT – I

Stones: Uses of stones as building materials, Characteristics of good building stones. Types of stones and their significance.
Bricks: Characteristics of good building bricks. Types of bricks and their significance.
Cement and Concrete: Ingredients of cement – Types of cement, properties and uses of cement. Overview on concrete.

UNIT – II

Building: Basic definitions, Types, components, economy and design, principles of planning of buildings and their importance, building bye-laws.
Ventilation: Definitions and importance of circulation; Lighting and ventilation; how to consider these aspects during planning of building.

UNIT – III

Repairs in Buildings: Inspection, control measures and precautions for various construction defects, General principles of design of openings, and various types of fire protection measures to be considered while planning a building.
Vertical transportation in buildings: Types of vertical transportation, Stairs, different forms of stairs, planning of stair cases, other modes of vertical transportation – lifts, ramps, escalators.

UNIT – IV

Prefabrication systems: Prefabrication systems in residential buildings – walls, openings, cupboards, shelves, etc., planning and modules and sizes of components in prefabrication.
Air conditioning: Process and classification of air conditioning, Dehumidification. Systems of air conditioning, ventilation, functional requirements of ventilation.

UNIT – V

Acoustics: Acoustics, effect of noise, properties of noise and its measurements, Principles of acoustics of building. Sound insulation – Importance and measures.

Plumbing services: Water supply system, maintenance of building pipe line, Sanitary fittings, principles governing design of building drainage.

Text Books:

1. Building Materials, P.C. Varghese, Prentice Hall of India Learning Pvt. Ltd., 2015.
2. Building Construction, B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, 2016.

Reference Books:

1. Building Materials, S.K. Duggal, New Age, 2016.
2. Building Materials, S.S. Bhavikatti, Vikas Publishers, 2016.
3. Engineering Materials and Building Construction, Rangwala, Charotar Publishing House, 2015.
4. A Text book of Building Construction, Arora and Bindra, Dhanpat Rai Publications, 2014.

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20EE32062 - Industrial Safety and Hazards
(Open Elective-I)

B. Tech. ECE - III Year II Sem

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): None

Course Objectives: Develop ability to

1. Understand the fundamental concepts of accident prevention with a basic knowledge of safe work rules designed to promote an accident free workplace.
2. Understand the relief systems.
3. Understand the electrical hazards and safety handling of equipment.
4. Understand the effects of momentum and buoyancy.
5. Gain knowledge from different case studies.

Course Outcomes (COs): At the end of the course, student would be able to

CO1: Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and electrical hazards.
CO2: Apply the methods of prevention of fire and explosions.
CO3: Analyze the effect of release of toxic substances.
CO4: Interpret and apply legislative requirements, industry standards, and best practices in a variety of workplaces.

UNIT I:

Fire and explosion: Introduction-Industrial processes and hazards potential, mechanical electrical, thermal and process hazards. Safety and hazards regulations, Industrial hygiene. Factories Act, 1948 and Environment (Protection) Act, 1986 and rules thereof. Shock wave propagation, vapour cloud and boiling liquid expanding vapours explosion (VCE and BLEVE), mechanical and chemical explosion, multiphase reactions, transport effects and global rates.

UNIT II:

Relief systems: Preventive and protective management from fires and explosion-inerting, static electricity passivation, ventilation, and sprinkling, proofing, relief systems –relief valves, flares, scrubbers.

UNIT III:

Electrical hazards: Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity. Energy leakage-clearances and insulation-classes of insulation-voltage classifications excess energy-current surges-Safety in handling of war equipments-over current and short circuit current-heating effects of current-electromagnetic forces-corona effect-static electricity –definition, sources, hazardous conditions, control, electrical causes of fire and explosion-ionization, spark and arc-ignition energy-national electrical safety code ANSI. Lightning, hazards, lightning arrestor, installation–earthing, specifications, earth resistance, earth pit maintenance.

UNIT – IV:

Leaks and leakages: Spill and leakage of liquids, vapors, gases and their mixture from storage tanks and equipment; Estimation of leakage/spill rate through hole, pipes and vessel burst; Isothermal and adiabatic flows of gases, spillage and leakage of flashing liquids, pool evaporation and boiling; Release of toxics and dispersion. Naturally buoyant and dense gas dispersion models; Effects of momentum and buoyancy; Mitigation measures for leaks and releases.

UNIT V:

Case studies: Flixborough, Bhopal, Texas, ONGC offshore, HPCL Vizag and Jaipur IOC oil-storage depot incident; Oil, natural gas, chlorine and ammonia storage and transportation hazards.

TEXT BOOK (S):

1. Fordham Cooper, W., "Electrical Safety Engineering" Butterworth and Company, London, 1986.

REFERENCE BOOKS:

1. Crowl D.A. and Louvar J.F., "Chemical Process Safety: Fundamentals with Applications", 2nd Ed., Prentice Hall.2001
2. Mannan S., "Lee's Loss Prevention in the Process Industries", Vol.I, 3rdEd., Butterworth-Heinemann.2004.
3. Indian Electricity Act and Rules, Government of India.
4. Power Engineers –Handbook of TNEB, Chennai, 1989.
5. Martin Glov Electrostatic Hazards in powder handling, Research Studies Pvt.LTd., England,1988.

20ME32063 - Nano Materials and Technology
(Open Elective-I)

B. Tech. ECE - III Year II Sem

L	T	P/D	C
3	-	-/-	3

Pre-Requisites:
Pre-requisites: None

Course Objectives: Develop ability to

1. Expose the students to a highly interdisciplinary subject
2. Enable the students to understand the basic concepts of Nanotechnology
3. Enhance the knowledge of students in nanomaterials, properties and their applications

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

CO1. identify the need of nano materials in engineering applications
CO2. explain the synthesis of zero dimensional, one-dimensional and two-dimensional nano structured materials
CO3. illustrate the synthesis of thin films and special nano materials

UNIT I:
Introduction: Importance of Nano-technology, Emergence of Nano-Technology, Bottom-up and Top-down approaches, challenges in Nano Technology.

UNIT II:
Zero Dimensional Nano-Structures: Nano particles through homogenous nucleation; Growth of nuclei, synthesis of metallic Nano particles, Nano particles through heterogeneous nucleation; Fundamentals of heterogeneous nucleation and synthesis of nano particles using micro emulsions and Aerosol.

UNIT III:
One Dimensional Nano-Structures: Nano wires and nano rods, Spontaneous growth: Evaporation and condensation growth, vapor-liquid-solid growth, stress induced re-crystallization.
Template based synthesis: Electrochemical deposition, Electro-phoretic deposition. Electro-spinning and Lithography

UNIT IV :
Two Dimensional Nano-Structures: Fundamentals of film growth. Physical vapour Deposition (PVD): Evaporation molecular beam epitaxy (MBE), Sputtering, Comparison of Evaporation and sputtering.
Chemical Vapour Deposition (CVD): Typical chemical reactions, Reaction kinetics, transportant phenomena, CVD methods, diamond films by CVD.

UNIT V:

Thin Films: Atomic layer deposition (ALD), Electro-chemical deposition (ECD), Sol-Gel films.
Special Nano Materials: Carbon fullerence and nano tubes. Carbon fullerness: formation, properties and applications. Carbon nano tubes: formation and applications.

Text books:

1. Nano structures and Nano materials: Synthesis, properties and applications, Guozhong Cao, Imperial College press in 2004, 2nd edition.
2. Nanotechnology, Rechard Booker and Earl Boysen, Willey, 2006.

References:

1. Nano: The Essentials; T. Pradeep, Tata McGraw-Hill, 2008.
2. Nanotechnology and Nano electronics, W.R. Fahrner, Springer, 2006.

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20CS31065-Web Programming
(Open Elective-I)

B. Tech. ECE - III Year II Sem

L	T	P/D	C
3	-	-/-	3

Pre-Requisites: **None**

Course Objectives: Develop ability to
1. Understand web programming
2. Use HTML language to design web pages
3. Use CSS to for designing interfaces
4. Understand Java Script programs
5. Use XML and PHP as back end and server-side technologies

Course Outcomes (COs): At the end of the course, the student would be able to

CO1. Design static webpages with HTML and CSS.
CO2. Implement client side scripts using Java Script.
CO3. Prepare and parse XML schemas.
CO4. Implement and deploy server side programs using PHP

UNIT-I

Introduction – HTML, XML, and the World Wide Web. Protocols, IP and TCP, HTTP, CGI HTML – Basic HTML, The Document Body, Text, Hyperlinks, Lists, Using color and images, Images, More HTML – Tables, Frames, Forms.

UNIT-II

CSS – Introduction, Using Styles, Defining your own styles, Properties and Values in styles, Formatting blocks of Information.

UNIT-III

JavaScript – Basics, Variables, String manipulation, Mathematical functions, Statements, Operators, Arrays, Functions, Objects in Java Script – Data and Objects in JavaScript, Regular Expressions, Built – in Objects, Events

UNIT-IV

XML – Basic XML, Document Type Definition, XML Schema

UNIT-V

PHP – Introduction, Data Types, Program Control, Arrays, User-defined Functions, Built-in Functions, Using Files, Building web applications using PHP

TEXT BOOK(S)

1. Web Programming: Building Internet Applications, 3rd Edition, Chris Bates

REFERENCE BOOK(S)

1. Programming the World Wide Web, 4th edition, Robert W Sebesta
2. Web Technologies, Uttam K Roy, Oxford University Press

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20MB32066-Intellectual Property Rights
(Open Elective-I)

B. Tech. ECE - III Year II Sem

L	T	P/D	C
3	-	-	3

Pre-Requisites: **None**

Course objectives: Develop ability to
1. Understand the various concepts, importance and types of intellectual property rights.
2. Discuss the purpose of trademarks.
3. Analyze the fundamental laws of copyrights and patents.
4. Understand trade secret laws, trade secret litigation and unfair competition.
5. Understand the latest developments in IPR.

Course outcomes (COs): At the end of the course, the student would be able to

CO1: Define the fundamental concepts of IPR and distinguish between patents, copyrights, trademarks, and trade secrets.
CO2: Distinguish between fundamental laws of copyright, patents, and trademark.
CO3: Explain the registration process of IPR.
CO4: Evaluate unfair competition practices in business.
CO5: Justify the need for IPR and IP Audits to protect business secrets.
CO6: Evaluate the national and international developments in IPR.

UNIT - I:

Introduction to Intellectual property: Concepts, types of intellectual property, international organizations, agencies and treaties, and 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: Fundamentals 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 laws.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT - IV:

Trade Secrets: Trade Secrets law, determination of trade secret status, liability for misappropriation of trade secrets, protection for submission, trade secret litigation. Unfair competition-misappropriation right of publicity, false advertising.

UNIT - V:

Latest development of intellectual property Rights: 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 Books

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, Prabuddha Ganguli, Tata Mc Graw Hill Publishing Company Ltd.

References

1. Cases and materials on intellectual property. Cornish, William Rodolph. Sweet & Maxwell, 5/e, 2006.
2. How to make patent drawings: a patent it yourself companion, Lo, Jack and Pressman, David.. Nolo, 5/e 2007.

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20EC32L01 – Microcontrollers and Embedded Systems Lab

B. Tech. ECE- III Year II Sem.

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): 20EC31001 - Computer Architecture and Microprocessors
20EC31L01 - Microprocessors and Assembly Language Programming Lab

Course Objectives: Develop ability to

1. Write Assembly Language and Embedded C Programs for various operations using 8051 Microcontroller kits.
2. Verify the operations of the timer, counter and serial port (UART) of 8051.
3. Interface various I/O devices with 8051 Microcontroller kits.
4. Program LPC2148 for various applications using Assembly Language and Embedded C.
5. Interface LPC2148 with LEDs, displays and various sensors.

Course outcomes: At the end of the course, the student would be able to:

CO1: Write and verify the programs in Assembly language and Embedded C for various operations using 8051, LPC2148.
CO2: Verify the operations of the timer, counter and serial port (UART) of 8051.
CO3: Interface LPC2148 with LEDs, displays and various sensors.
CO4: Use software namely, Keil µvision, Flash Magic and Talk.

List of Experiments: (Minimum of 10 experiments are to be conducted)

Using Assembly Language:

Note: The following programs are to be implemented using 8051 (Kit) and LPC2148 (Keil)

1. Programs for arithmetic and logical operations.
2. Program for finding largest number in an array.
3. Program for finding LCM of two numbers.
4. Program to generate Fibonacci Series.
5. Program to generate Multiplication Table of a number.

Using Embedded C:

6. Program to verify Timer/Counter in 8051.
7. Program to verify Interrupt Handling in 8051.
8. Verification of UART operation in 8051.
9. Interfacing Keyboard with 8051.
10. LED Blinking using LPC2148.
11. LCD interfacing with LPC2148.
12. Interfacing of temperature sensor (LM 35) with LPC2148.

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20EC32L02- Digital Signal Processing Lab

B. Tech, III Year, ECE, II Sem

L	T	P/D	C
--	--	2/-	1

Prerequisite(s):

1. 20EC21001 - Signals and Systems
2. 20EC21L01 - Signals and Systems Lab

Course Objectives: Develop ability to

1. Understand the procedure for generating sine wave using the given difference equation.
2. Understand the computation of various transforms for a given discrete signal
3. Understand the concepts of Digital filter design
4. Understand the principles of multirate signal processing and sampling rate conversion.
5. Understand the principles of hardware implementation of various DSP algorithms

Course outcomes: At the end of the course, the student would be able to:

CO1. Simulate the waveform generation using the given difference equation and simulate the process of power spectrum estimation.
CO2. Simulate the process of finding Magnitude and phase spectra of a given discrete time signal
CO3. Simulate the process of Designing a digital filter for the given specifications
CO4. Simulate various multirate signal processing algorithms
CO5. Implement a given DSP algorithm on DSP Processor (TMS3206713)

List of Experiments (Minimum 12 Experiments are to be conducted)

The programs shall be implemented employing MATLAB/SCILAB/OCTAVE/CC-Studio or Equivalent in software and DSP processor kits in hardware.

1. Generation of Sinusoidal waveform / signal based on recursive difference equations.
2. To find DFT / IDFT of given DT signal.
3. To find frequency response of a given system given in (Transfer Function/ Differential equation form).
4. Implementation of FFT of given sequence.
5. Determination of Power Spectrum of a given signal(s).
6. To obtain Linear Convolution of two finite length sequences.
7. Design and Implementation of LP FIR filters for given specifications.
8. Design and Implementation of HP FIR filters for given specifications.
9. Design and Implementation of LP IIR filters for given specifications.
10. Design and Implementation of HP IIR filters for given specification.
11. Implementation of Decimation Process.
12. Implementation of Interpolation Process.
13. Implementation of I/D sampling rate converters.
14. Impulse response of first order and second order systems.

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20EC32L03 – Project Oriented Lab

B. Tech. ECE- III Year II Sem.

L	T	P/D	C
-	-	2/-	1

Prerequisite(s): 20EC31L01 - Microprocessors and Assembly Language Programming Lab

Course Objectives: Develop ability to

Understand interfacing of sensors, actuators and communication modules with 8051 microcontroller, ARM7, Arduino, Raspberry Pi and NodeMCU

Course outcomes: At the end of the course, the student would be able to:

CO1. Interface sensors, actuators and communication modules with 8051 microcontrollers
CO2. Interface sensors, actuators and communication modules with ARM7
CO3. Interface sensors, actuators and communication modules with Arduino
CO4. Interface sensors, actuators and communication modules with Raspberry Pi
CO5. Interface sensors, actuators and communication modules with NodeMCU

List of Experiments: (At least 10 experiments are to be conducted)
(Minimum Two experiments from each category)

Using 8051

1. Automatic Street Light Controller.
2. Traffic signaling system for Ambulances based on priority switch.

Using ARM7

3. Voice controlled DC motors.
4. Automatic Railway gate control system.

Using Arduino

5. Home appliances control using Bluetooth.
6. Automatic vehicle accident avoidance system using Ultrasonic Sensor.
7. Gas leakage detection and automatic control system.

Using Raspberry Pi

8. Image capturing using eye blink detection.
9. Alcohol detection system.
10. Switching on lights based on human movement detection.

Using NodeMCU

11. Patient health monitoring using IoT.
12. Weather monitoring using IoT.

Equipment Required:

Computers: 15 Nos.
8051, ARM7, Arduino, Raspberry Pi and NodeMCU : 3 Kits each

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20EN32P01- English for Professional Success*

B. Tech. ECE- III Year II Sem.

L	T	P/D	C
-	-	2	1

Prerequisite(s): Nil

Course Objectives: Students will be able to

1. Identify and practice the most commonly used Phrases, Phrasal verbs, Idioms and Technical vocabulary.
2. Read critically and comprehend the given text.
3. Understand the importance of presentation skills to prepare an effective presentation.
4. Realize the importance of organizational communication.

Course Outcomes: At the end the students would be able to

CO1: Use Phrases, Phrasal verbs, Idioms and Technical vocabulary befitting the context in communication.
CO2: Review a book and an article by analyzing arguments and viewpoints.
CO3: Prepare and deliver engrossing and impressive presentations.
CO4: Correspond formally in a given context

Module-I: Advanced Vocabulary
Vocabulary: Idioms and phrases, phrasal verbs: practice exercises. Jargon-Technical Vocabulary

Module-II: Critical Reading
Reading: Book review/ Article review: reviewing skills.

Module-III: Oral Skills
Speaking: Oral and Technical Presentations, Project Presentations: genre, originality and accountability.

Module-IV: Official Correspondence
Writing: Circulars, Notices, Memos, Agenda, Minutes of Meeting (MoM)
Letter of Recommendation.

***Classroom Activity based Course. Hence, Lab. is not required.**

Text Book(s)

1. Objective English by Edger Thorpe and Showick Thorpe, Pearson, 6th Edition.
2. All About Words: an adult approach to vocabulary by Maxwell Nurnberg, Prentice-Hall.

Reference book(s):

1. Oxford Collocation Dictionary by Diana Lea.
2. Ed Swick, Writing Better English for ESL Learners, Mc.GrawHill, 2nd ed.

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20MA32P01 – Logical Reasoning-II

B. Tech. ECE- III Year II Sem.

L	T	P/D	C
0	0	4	2

Prerequisite(s): Logical Reasoning-I

Course Objectives: Develop ability to

1. Distinguish between permutation and combination and demonstrate how to determine each; Understand the basic concept of probability and illustration of Venn diagram; Classify the numbers and compute LCM, HCF, Square Roots, Cube Roots, Surds and Indices; Understand the concepts of allegation and mixture

2. Distinguish between the linear and circular sitting arrangements and also understand the coding and decoding problems; Understand the pattern of number and letter series.

3. Understand concepts of calendars; Classify the different forms of Alphabet Arrangements; Interpret the clues in the form of direction wise.

4. Identify the placements of numerals and hands on clock; Understand the various properties of cubes; Understand the concepts of data sufficiency and data interpretation.

Course Outcomes: At the end of the course, the students will be able to:

CO1: Apply logical thinking and analytical abilities to solve quantitative aptitude questions.

CO2: Critique and evaluate quantitative arguments that utilize mathematical, statistical and quantitative information.

CO3: Think constructively and apply logic to solve problems.

Quantitative Aptitude:

1. **Permutation and Combinations:** Fundamental Principle of Counting, Counting Methods, Definition of permutation, Linear Permutations, Rank of a word, Circular Permutations, Definition of Combinations, Problems on Combinations.
2. **Probability:** Definitions of Probability, Addition and Multiplication Theorems. Deductions: Introduction, expressing different types of statements using Venn diagrams, Definition of complimentary pairs, finding the conclusions using Venn diagrams for two and more statements.
3. **Number system:** Classification of numbers, Divisibility rules, Finding the units digit, Finding remainders in divisions involving higher powers, LCM and HCF Models**,** Decimal fractions, Simplifications, Square Roots & Cube Roots, Surds and Indices.
4. **Allegation and Mixture:** Definition of allegation, mean price, rules of allegation on quantity and cost price, diagrammatic explanation, removal and replacement.

Logical Reasoning:

1. **Sitting Arrangement:** Problems on Linear arrangement, Problems on Circular arrangement, Problems on Double line-up, Problems on Selections, Problems on Comparisons. **Coding and decoding:** Coding using same set of letters, Coding using different set of letters, Coding into a number Comparison & Elimination.
2. **Number and letter Series:** Difference series, Product series, Squares series, Cubes series, Alternate series, Combination series, Miscellaneous series, Place values of letters.

3. **Day sequence/Calendars**: Definition of a Leap Year, Finding the number of Odd days, framing the year code for centuries, finding the day of any random calendar date. **Alphabet Test:** Alphabetical order of verbs, letter-word problems, rule-detection, alphabetical quibble, word formation.
4. **Direction sense Test:** Direction from the initial point: directions, cardinal directions, problems on distances, problems on clocks, problems on angles, problems on shadows.
5. **Clocks**: Finding the angle when the time is given, Finding the time when the angle is known, Relation between Angle, Minutes and Hours, Exceptional cases in clocks.
6. **Cubes:** Basics of a cube, finding the minimum number of cuts when the number of identical pieces are given, Finding the maximum number of pieces when cuts are given, Problems on painted cubes of same and different colours, Problems on cuboids, Problems on painted cuboids, Problems on Dice.
7. **Data Sufficiency:** Different models in Data Sufficiency, Problems on Data sufficiency, Problems on data redundancy. **Data Interpretation:** Problems on tabular form, Problems on Line Graphs, Problems on Bar Graphs, Problems on Pie Charts.

TEXT BOOKS:

1. A modern approach to Logical reasoning, R S Agarwal, S. Chand Publications, 2013.
2. Quantitative Aptitude for Competitive Examinations, Dinesh Khattar. Pearson Education, 4th Edition, 2019.

REFERENCE BOOKS:

1. Quantitative Aptitude and Reasoning, R. V. Praveen, PHI Learning Private Ltd, 2nd Edition, 2013.
2. Quantitative Aptitude for competitive examinations, Abhijith Guha, McGraw Hill Education, 6th Edition, 2017.
3. Analytical & Logical Reasoning, Peeyush Bhardwaj, Arihant Publications, 4th Edition, 2015.

Logical Reasoning for the CAT, Arun Sharma, McGraw Hill Education, 2nd Edition 2014.

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20CS32M03- Introduction to Cyber Security
(Mandatory Course)

B. Tech. ECE- III Year II Sem.

L	T	P/D	C
3	-	-/-	-

Prerequisite(s): None

Course objectives:

1. To familiarize various types of cyber-attacks and cyber-crimes
2. To give an overview of the cyber laws
3. To study the defensive techniques against these attacks

Course Outcomes: At the end of the course, the student would be able to

CO1. Explain different aspects of cyber security ecosystem
CO2. Explain Indian and International laws for cyber security and basics of cyber forensics
CO3. Explain cyber security related threats to organizations in general and when using mobile and wireless devices and organizational policies to protect against them.
CO4. Analyze various case studies in the area of cyber crime

UNIT - I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT - II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.
Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT - III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT- IV

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

UNIT - V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime: Examples and Mini-Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.
Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TEXT BOOK(S)

1.Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2.B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCE BOOK(S)

1.Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

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20EC41001- Microwave Engineering

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3		- / -	3

Prerequisite: 20EC2204 – Electromagnetic Theory and Transmission Lines

Course Objectives: Develop ability to

1. Understand the electrical characteristics of waveguides and micro-strip lines.
2. Understand the working principles of various microwave components in terms of scattering parameters.
3. Understand the generation and amplification of microwave signal using microwave tubes and solid state devices.
4. Understand the methods of measuring various characteristics of Microwave devices.

Course Outcomes: At the end of the course, the student would be able to

CO1: Analyze the operational characteristics of rectangular waveguides and micro strip lines.
CO2: Explain the operation of cavity resonators, waveguide irises, posts and tuning screws, coupling probes and loops, and waveguide terminations
CO3: Analyze the characteristics of Directional Coupler, Tees and Ferrite devices using Scattering matrix
CO4: Analyze the operation of Reflex klystron oscillator and two cavity klystron amplifier
CO5: Explain the operation of TWT amplifier, Magnetron and BWO.
CO6: Explain the operation of various microwave solid state devices
CO7: Demonstrate the process of measurement of different microwave parameters.

UNIT – I: Wave Guides and Micro-Strip Lines

Wave Guides: Introduction, Microwave frequencies, Microwave Devices, Microwave systems. Rectangular Waveguides – solutions of wave equations in Rectangular Coordinates, TE modes in rectangular wave guides, TM modes in rectangular waveguides, Impossibility of TEM mode, Power transmission in rectangular wave guides, Power losses in rectangular waveguides.

Micro-Strip Lines: Introduction, Characteristic impedance of Micro strip lines, Losses in Micro strip lines, Quality factor of Micro strip lines.

UNIT – II: Microwave Components

Cavity Resonators: Introduction, Expression for f_0 in a Rectangular Cavity resonator, Applications of Cavity resonator, Quality factor of cavity resonators, Reentrant cavities.

Waveguide Components: Introduction, Waveguide microwave junctions and Scattering parameters: E-plane Tee, H-Plane Tee, Magic Tee, Directional couplers. Waveguide Joints, Waveguide Irises, Posts and tuning screws, Coupling Probes, Coupling Loop, waveguide terminations.

Ferrite Devices: Faraday Rotation in ferrites, Gyrator, Isolator and Circulator.

UNIT – III: Microwave Tubes-I

Introduction, Limitations of Conventional Vacuum tubes at Microwave frequencies

Linear beam Tubes (O-Type): Klystron amplifiers - Velocity Modulation Process, Bunching Process, Output power and beam loading. Multi-cavity Klystron Amplifiers, Reflex Klystron - Velocity Modulation, Power Output and Efficiency, Electronic admittance.

UNIT – IV: Microwave Tubes-II

Helix TWTs – Slow wave structures, Amplification Process, Convection current, Axial electric field, Wave Modes, Gain Considerations (Qualitative treatment only).

Microwave Crossed – Field tubes (M-Type): Introduction, Cylindrical Magnetron: Operation in π - mode, Strapping, Applications (Qualitative treatment only). Backward Wave Oscillator: Operation and Performance Characteristics (Qualitative treatment only).

UNIT – V: Solid State Microwave Devices and Microwave Measurements

Solid State Microwave Devices: Transferred Electron Devices – Introduction, Gunn diodes – GaAs diode, Ridley - Watkins - Hilsum (RWH) Theory, Modes of operation.

Avalanche Transit Time Devices: Introduction, IMPATT diode.

Microwave Measurements: Microwave Bench general measurement setup, Frequency measurement, Measurement of Power, Attenuation Measurement, Measurement of VSWR, Measurement of Impedance, Measurement of Q of a cavity resonator.

TEXT BOOKS:

1. Samuel Y. Liao , "Microwave Devices and Circuits", PHI, 3rd Edition, 2003.
2. M. Kulkarni, "Microwave and Radar Engineering", Umesh Publications,1998.

REFERENCES:

1. M.L. Sisodia and G.S. Raghuvanshi, "Microwave Circuits and Passive Devices", Wiley Eastern Ltd., New Age International Publishers Ltd.,1995.
2. Herbert J. Reich, J.G. Skolnik, P.F. Ordung and H.L. Krauss, "Microwave Principles", CBS Publishers and Distributors, New Delhi,2004.

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20EC41002- Electronic Measurements and Instrumentation

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3		- / -	3

Prerequisite(s): 20EE11001- Basic Electrical Engineering

Course Objectives: Develop ability to

1. Understand the characteristics of measurement systems and errors in measurement.
2. Learn the working principle of various signal generators.
3. Understand various DC and AC measuring instruments.
4. Understand the working principle of DC and AC bridge circuits.
5. Understand the operation of a CRO and methods of measuring phase, time and frequency.

Course Outcomes: At the end of this course, the student would be able to

CO1. **Analyze** static and dynamic characteristics of measurement systems
CO2. **Analyze** different errors in measurements.
CO3. **Illustrate** the functionality of various signal generators.
CO4. **Explain** the operations of various DC and AC measuring instruments.
CO5. **Illustrate** the working principles of DC and AC bridges.
CO6. **Illustrate** the functionality of different types of oscilloscopes.

UNIT - I: Parameters of Measurement Systems:

Block diagram of an instrumentation system, Measurement system characteristics, Static characteristics, Accuracy, Precision, Resolution, Sensitivity, Repeatability, Drift and dead zone. Dynamic Characteristics, Fidelity, Lag, speed of response, dynamic error, Classifications of Standards.

UNIT - II: Errors in Measurements and Signal Generators:

Limiting errors, Type of error, Gaussian error, probability of errors Statistical analysis. **Signal Generators**: Sine-wave generator, Sweep Frequency Generators, Pulse and Square wave generators, Function Generators, AF signal generator.

UNIT - III: Measuring Instruments: DC Indicating Instruments:

Suspension Galvanometer, PMMC, DC Voltmeters, DC Ammeters, Voltmeter Sensitivity, Ohmmeters, Multimeters, True RMS Responding Voltmeter.

AC Indicating Instruments: Electrodynamometers, Rectifier type instruments. Digital voltmeter (DVM).

UNIT - IV: Bridges:

Introduction, DC Bridges: Wheatstone bridge and Kelvin Bridge. AC Bridges: Maxwell Bridge, Hay Bridge, Schering Bridge, Wien Bridge and Wagner ground connection**.**

UNIT - V: Oscilloscopes:

Oscilloscopes block diagram, Cathode ray tube, electrostatic deflection, screens for CRTs, delay line, probes of CRO, phase, frequency and time measurement, Lissajous figures. Special Oscilloscope (Qualitative treatment only)**:** Storage oscilloscope, Sampling oscilloscope, Digital storage oscilloscope (DSOs).

Text Books:

1. A.D. Helfrik, W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, 5/e, PHI, 2003.
2. David A Bell, Electronic Instrumentation and Measurement, Oxford Univ. Press, 1997.

Reference Books:

1. A.K. Sawhney, Electrical and Electronic Measurements and Instrumentation, 4/e, Dhanpat Rai & Sons, 1985.
2. H.S. Kalsi, Electronic Instrumentation, 2/e, TMH, 2004.
3. K. Lal Kishore, Electronic Measurements and Instrumentations, Pearson Education, 2010.

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20EC41003 - Optical Communications
(Professional Elective - III)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20PH11001 - Solid State Physics,
20EC22004 - Electromagnetic Theory and Transmission Lines

Course Objectives: Develop ability to

1. Understand the structure, fabrication and wave guiding characteristics of optical fibers.
2. Understand the concepts of attenuation and dispersion, optical source materials, principle of operation, structure and efficiency.
3. Understand the Source-to-Fiber power launching, Fiber-to-Fiber Joints and splicing techniques.
4. Understand the photo detector types and their characteristics, operation and performance of digital optical receivers.
5. Understand the power consideration of digital links and operational principles of WDM, passive and active components.

Course Outcomes: At the end of the course, student would be able to

CO1: **Explain** different structures, propagation modes and losses related to optical fibers.
CO2: **Describe** the functional characteristics of optical sources, photo detectors and optical receivers.
CO3: **Explain** different types of power launching and coupling mechanisms for optical fibers.
CO4: **Analyze** the power budget for the design of point-to-point links.
CO5: **Explain** the working principle of WDM, and different passive and active optical components.

UNIT -I:

Overview of Optical Fiber Communications- Motivations for Light wave Communications, Optical Spectral Bands, Key Elements of Optical Fiber Systems.

Optical Fibers: Structures, Wave guiding and Fabrication- The nature of Light, Basic Optical Laws and Definitions, Optical Fiber Modes and Configurations, Mode Theory for Circular Waveguides, Single Mode Fibers, Graded Index Fiber Structure, Fiber materials, fiber fabrication.

UNIT -II:

Attenuation and Dispersion- Attenuation – Absorption, scattering losses, Bending Losses, Core and Cladding Losses, Signal Dispersion in Fibers – Group Delay, Material Dispersion, Waveguide Dispersion, Characteristics of Single-Mode Fibers.

Optical Sources- Light-Emitting Diodes (LEDs) – LED structures, Light Source Materials, Quantum Efficiency and LED Power, Laser Diodes – Laser Diode Modes and Threshold Conditions, Laser Diode Rate Equations, External Quantum Efficiency, Resonant Frequencies, Laser Diode Structures and Radiation Patterns.

UNIT -III:

Power Launching and Coupling- Source-to Fiber Power Launching, Lensing Schemes for Coupling Improvement, Fiber-to-Fiber Joints, Fiber Splicing – Splicing Techniques, Splicing single mode Fibers, Optical Fiber Connectors – Connector Types, Single mode connectors, connector return loss.

UNIT -IV:

Photo detectors- Physical Principles of Photodiodes, Photo detector Noise, Detector Response Time, Avalanche Multiplication Noise, Structures for InGaAs APDs, Temperature Effect on Avalanche Gain, Comparisons of Photo detectors

Optical Receiver Operation- Fundamental Receiver Operation, Digital Receiver Performance, Eye Diagrams, Burst Mode Receiver.

UNIT -V:

Digital Links- Point-to-Point Links - System Considerations, Link Power Budget, Rise-time Budget, Power Penalties – Chromatic Dispersion Penalty, Polarization-Mode Dispersion Penalty and Extinction Ratio Penalty.

Wavelength Division Multiplexing - Operational Principles of WDM, Passive Optical Coupler, Isolators and Circulators, Active Optical Components.

Text Books:

1. Optical Fiber Communications – Gerd Keiser, TMH, 4th Edition, 2008.
2. Optical Fiber Communications – John M. Senior, Pearson Education, 3rd Edition, 2009

References:

1. Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.

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20EC41004 – Advanced Computer Architecture
(Professional Elective III)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC31001 Computer Architecture and Microprocessors.

Course Objectives: Develop ability to understand:
1. Instruction level parallelism
2. Memory hierarchy in computer systems
3. Thread level parallelism
4. Different types of storage systems

Course Outcomes: At the end of the course, student would be able to:
CO1. Analyze various approaches towards Instruction level parallelism and quantify performance aspects of computer design.
CO2. Analyze various memory organization techniques of advanced processors.
CO3. Analyze various multiprocessor architectures and explain multicore processor performance issues.
CO4. Explain various Storage systems and the process of designing an I/O system.

UNIT I:
Introduction: Fundamentals of Computer design- Technology trends- cost- measuring and reporting performance quantitative principles of computer design. **Instruction level parallelism (ILP)** - over coming data hazards- reducing branch costs –high performance instruction delivery- hardware based speculation- limitation of ILP

UNIT II
ILP software approach - compiler techniques- static branch protection - VLIW approach - H.W support for more ILP at compile time- H.W verses S.W Solutions

UNIT III
Memory hierarchy design- cache performance- reducing cache misses penalty and miss rate – virtual memory- protection and examples of VM.

UNIT IV
Multiprocessors and thread level parallelism- symmetric shared memory architectures- distributed shared memory- Synchronization- multi threading.

UNIT V
Storage systems- Types – Buses - RAID- errors and failures- bench marking a storage device- designing a I/O system.

TEXT BOOKS:
1. Kai Hwang and A.Briggs,"Computer Architecture and parallel Processing" Tata McGraw-Hill. 2017.

REFERENCES:
1. John L. Hennessy & David A. Patterson,Computer Architecture -A quantitative approach,3/e, Morgan Kufmann (An Imprint of Elsevier), 2007
2. DezsoSima,Terence Fountain, Peter Kacsuk-Advanced Computer Architectures, Pearson. 2002.
3. David E. Culler, Jaswinder Pal singh with Anoop Gupta,Parallel Computer Architecture, A Hardware / Software Approach, Elsevier 2003.

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20EC41005 - System Design and Verification using System Verilog HDL
(Professional Elective - III)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC21002- Digital Design

Course Objectives:
1. Understand the basic System Verilog features.
2. Learn new data types, tasks, functions and procedures.
3. Appreciate the enhanced features in System Verilog and their importance.
4. Learn to choose the functional coverage techniques in System Verilog.
5. Understand the salient features of OVM and UVM concepts.

Course Outcomes: At the end of the course, student would be able to:
CO1. **Develop** System Verilog code for logic circuits using different data types, procedural blocks, tasks and functions.
CO2. **Implement** features of Object Oriented Programming in System Verilog based verification.
CO3. **Develop** code for connection of modules using interfaces and threads for inter-process communication
CO4. **Develop** test bench to meet the verification requirements and functional coverage.
CO5. **Explain** the concepts of behavioral and transaction level modeling at system level, and its correlation with industry standard UVM & OVM methodologies.

Unit I: Introduction to System Verilog:
System Verilog origins, Key System Verilog enhancements for hardware design, enhanced literal value assignments, System Verilog variables, Using 2-state types in RTL models, System Verilog User-Defined and Enumerated Types.

Arrays, Structures, Unions: Structures, Unions, Arrays, 'foreach' array looping construct, Array querying system functions, $bits system function, Overview of Dynamic arrays, associative arrays, sparse arrays and strings.

Unit II: Procedural Blocks, Tasks and Functions:
System Verilog specialized procedural blocks, Enhancements to tasks and functions.

Fundamentals of Object-Oriented Programming: Procedural vs OOPs, Classes and Objects, Object Relationships, Virtual Functions and Polymorphism.

Unit III: System Verilog Interfaces:
Interface concepts, Interface declarations, Using interfaces as module ports, Instantiating and connecting interfaces, Referencing signals within an interface, Interface modports, Using tasks and functions in interfaces, Using procedural blocks in interfaces, Reconfigurable interfaces, Verification with interfaces. System Verilog Assertions.

Threads and Interprocess Communication: Working with Threads, Disabling Threads, Interprocess Communication, Events, Semaphores, Mailboxes, Building a Test bench with Threads and IPC.

Unit IV: Verification Guidelines:

The verification process, Basic Test Bench functionality, Directed Testing, Methodology Basics, Constrained-Random Stimulus, What Should You Randomize? Functional Coverage, Test bench Components, Layered Test bench, Building a Layered Test bench, Simulation Environment Phases.

Functional Coverage: Introduction to Randomization and Constraints, Coverage Types, Functional Coverage Strategies, Simple Functional Coverage Example.

Unit V: Behavioral and Transaction level Modeling:

Behavioral modeling, what is a transaction? Transaction level modeling in System Verilog, Transaction level models via interfaces, Bus arbitration.

Introduction to UVM and OVM: Overview of UVM and OVM. UVM and OVM Library basics.

Text Books:

1. Stuart Sutherland, System Verilog for Design: A Guide to Using System Verilog for Hardware Design and Modeling, 2/e, Springer USA, 2006.
2. Chris Spear, System Verilog for Verification: A Guide to Learning the Testbench Language Features, 2/e, Springer USA, 2008.

Reference Books:

1. Mintz, Hardware Verification with System Verilog: An Object-Oriented Framework, Springer, 2007.
2. Mark Zwolinski, Digital System Design with System Verilog, Pearson, 2010.
3. Sharon Rosenberg, A Practical Guide to Adopting the Universal Verification Methodology (UVM), Cadence Design Systems, 2010.
4. Sasan Iman, Step-by-step Functional Verification with SystemVerilog and OVM, Hansen Brown Publishing, 2008.

20EC41006-Robotic Process Automation
(Professional Elective - III)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Pre-requisites: Basic Programming Concepts

Course Objectives: Develop Ability to

1. Understand the RPA, differentiate it from other types of automation, benefits of RPA and the UiPath Stack and wizard-based tools.
2. Understand the model sequences, nesting activities, store and manipulate the data controls and Handling Events Recording
3. Understand use of these plugins and extensions, utility of Assistant Bots and Handling User Events
4. Understand exception handling and trouble shooting
5. Understand the workflow to deploy and maintaining the bot.

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

CO 1: Explain the fundamental aspects of Robotic Process Automation.
CO 2: Describe different Control Flow and data manipulation techniques.
CO 3: Explain the process of interacting with UI automation utility of Assistant Bots
CO 4: Describe various types of Exceptions and Debugging techniques.
CO 5: Explain the process of Deploying and maintaining a robot

UNIT-I:

Introduction: What is Robotic Process Automation (RPA), Scope & techniques of Automation, Benefits of RPA, Components of RPA, RPA Platforms, Learning and Installation of UiPath Studio.

UNIT-II:

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow, various types of loops and decision making. An Example.

Data Manipulation: Variables and scope, Collections, Arguments, Building a Data Table, Clipboard management, File Operations.

Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events: Element triggering events, Image triggering events and System triggering events.

Recording and advanced UI Interaction: Basic recording, Desktop recording, Web recording, Citrix, Screen Scraping, when to use OCR, Types of OCR available, how to use OCR, Avoiding typical failure points.

UNIT-III:

Plugins and Extensions: Terminal plugin, Java plugin, Java plugin with UiPath Studio, Citrix automation, Citrix environment, Mail plugin, PDF plugin, Web integration, Excel and Word plugins, Credential management

Extensions Handling User Events and Assistant Bots: What are assistant bots, Monitoring system event triggers: Hotkey trigger, Mouse trigger, System trigger, Monitoring image and element triggers, Launching an assistant bot on a keyboard event

UNIT-IV:

Exception Handling, Debugging, and Logging: Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, debugging techniques, setting breakpoints, Slow step, Highlighting, Break, collecting crash dumps: Enabling crash dumps, Disabling crash dumps, Error reporting.

Managing and Maintaining the Code: Project organization, picking an appropriate layout for each workflow, Breaking the process into smaller parts, using exception handling, making your workflow readable, keeping it clean, Nesting workflows, Reusability of workflows, Templates, commenting techniques, State Machine, when to use Flowcharts State Machines or Sequences.

UNIT-V:

Deploying and Maintaining the Bot: Publishing using publish utility, Overview of Orchestration Server: Queues, Assets and Process, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots, License management: Activating and uploading a license to Orchestrator, Publishing and managing updates: Packages, Managing packages.

TEXT BOOKS:

1. Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing, 2018.

REFERENCES:

1. Frank Casale, Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
3. Srikanth Merianda,"Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.
5. Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes", Packt Publishing, 1st Edition 2018.

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20EC41007 - Digital Image and Video Processing
(Professional Elective - IV)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC32002-Digital Signal Processing

Course Objectives: Develop ability to

1. Understand fundamentals of digital image processing , image transforms and image segmentation techniques.
2. Understand various image enhancement techniques in spatial and frequency domains.
3. Understand various image compression algorithms.
4. Understand the representation of video signal formation models.
5. Understand the principles and methods of motion estimation with reference to video processing.

Course Outcomes: At the end of the course, student would be able to

CO1. Apply various transforms for image segmentation.
CO2. Apply various spatial domain techniques for quality enhancement of an image.
CO3. Apply and analyze various data compression techniques for an image.
CO4. Analyze various models used for video processing and methodologies for estimating 2D motion.

UNIT-I: Digital Image Fundamentals & Image Transforms

Fundamental Steps in Digital Image Processing, Image Sampling and Quantization, Relationships between Pixels, 2-D DFT and its Properties, introduction to Discrete Cosine Transform, Hadamard, Walsh and K L Transform.

Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

UNIT –II: Image Enhancement (Spatial Domain):

Introduction, Image Enhancement in Spatial Domain, Enhancement Through Point Operation, Types of Point Operation, Histogram Manipulation, Linear and Non — Linear Gray Level Transformation, Local or Neighbourhood Operation, Median Filter, Spatial Domain High-Pass Filtering.

Filtering in the Frequency Domain: Frequency Domain Filtering Fundamentals, Correspondence between Filtering in the Spatial and Frequency Domains, Image Smoothing Using Frequency Domain Filters, Image Sharpening Using Frequency Domain Filters.

UNIT III: Image Compression:

Fundamentals, Fidelity Criteria, Image Compression Models, Coding Redundancy, Some Basic Compression Methods, Huffman Coding, Arithmetic Coding, LZW Coding Run-Length Coding, Bit-Plane Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Block Transform Coding, JPEG.

UNIT IV : Basic Steps of Video Processing

Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, filtering operations in cameras and display devices.

UNIT – V: 2-D Motion Estimation

Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Application of motion estimation in Video coding.

Waveform based video coding: Block based transform coding, Predictive coding.

Text Books:

1. S. Jayaraman, S. Esakkirajan, T. Veera Kumar, "Digital Image Processing", 2nd Edition, TMH,2009
2. Gonzaleze and Woods, "Digital Image Processing", 3rd Edition,Pearson,2008
3. Yao Wang, Joem Ostermann and Ya–quin Zhang, "Video Processing and Communication",1st Edition, PH Int., 2002

Reference Books:

1. Gonzaleze and Woods, "Digital Image Processing using MATLAB", 2nd Edition, McGraw Hill Education,2010
2. Digital Video Processing – A. Murat Tekalp, 2nd Edition, Pearson,2015

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20EC41008 – Internet of Things Using Smart Sensors
(Professional Elective IV)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): NIL

Course Objectives: Develop ability to

1. Explore various components of Internet of things such as Sensors, internetworking and cyber space.
2. Design and implement IoT circuits and solutions.
3. Distinguish between the ordinary sensors and smart sensors.
4. Develop an application using smart sensors.

Course Outcomes: At the end of the course, student would be able to

CO1.**Explain** different communication models, protocols, sensor networks and software used in IoT.
CO2: **Apply** different architectural views of IoT to Home automation, industry and surveillance applications.
CO3: **Interface** various sensors to Arduino and Raspberry Pi using python language.
CO4: **Explain** MQTT, CoAP, UDP, HTTP, XMPP, gateway protocols and computing techniques used in IoT.
CO5: **Design** a smart sensor network using IoT tools for real time applications.

UNIT- I

Introduction to IoT: Sensing, Actuation and Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

UNIT- II

IoT Reference Architecture: IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment.

Domain specific applications of IoT: Home automation, Industry applications and Surveillance applications

UNIT - III

Developing IoT solutions: Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi, Implementation of IoT with Arduino and Raspberry,

UNIT - IV

IoT Protocols and Software: Basics of MQTT, UDP, HTTP, COAP, XMPP and gateway protocols, IoT Protocol Architecture, Introduction to Cloud Computing and Fog Computing.

UNIT - V

Smart sensors: Need of smart sensors, Building blocks of Smart Sensors. Block diagram of Typical Micro-instrument. Advantages of Smart Sensors and their Applications in IoT.
Case Study: TI MSP 430

Text Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1/e, VPT, 2014.
2. Jacob Fraden, Handbook of Modern sensors 4/e, Springer. 2014.

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1/e, Academic Press, 2014

2. CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1.

3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1/e, Apress Publications, 2014.

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20EC41009 - ASIC Design
(Professional Elective - IV)

B. Tech. ECE- IV Year I Sem.

L	T	P	C
3	-	-	3

Prerequisite(s): 20EC21002 - Digital Design

Course Objectives: Develop ability to
1. Understand types of ASICs and their programmability.
2. Understand low level design entry schemes and concepts of logic simulation.
3. Understand different aspects of logic synthesis for ASIC design.
4. Understand various steps involved in physical design of an ASIC.
5. Understand various Test architectures for IC design.

Course Outcomes: At the end of the course, student would be able to:

CO1: **Compare** different types of programmable ASICs.
CO2: **Apply** low level design entry schemes and concepts of logic simulation for combinational circuits.
CO3: **Realize** synthesized netlist for combinational, sequential and memory logic.
CO4: **Apply** the concepts of Floor Planning, Placement and Routing to Implement an ASIC.
CO5: **Analyze** the architectures of ASIC Test mechanisms.

Unit I: Introduction to ASICs:
Types of ASICs, Design flow, Economics of ASICs and ASIC Cell Libraries.
Programmable ASICs:
Antifuse, SRAM, EPROM, EEPROM Technology, Practical issues, Introduction to Programmable ASIC: Logic Cells, I/O Cells and Interconnects

Unit II: Low-Level Design Entry:
Schematic Entry, Low level design languages, EDIF
Logic Simulation: Types of Simulation, Comparator/MUX example, Logic Systems, How Logic Simulation works, Cell Models, Delay Models, Static Timing Analysis, Formal Verification, Switch Level Simulation and Transistor Level Simulation

Unit III: Logic Synthesis:
Introduction, A Logic Synthesis Example, Comparator/MUX example, Inside a Logic Synthesizer, Verilog and Logic Synthesis, FSM Synthesis in Verilog, Memory Synthesis in Verilog.

Unit IV: Floor Planning and Placement:
Physical Design Flow, Floor planning: Goals and Objectives, Channel definition, I/O, Power and Clock Planning; Placement: Goals and Objectives, Timing-driven placement method, A simple placement example; Information Formats.
Routing: Overview of Global Routing, Detailed Routing, Special Routing, Circuit Extraction and DRC

Unit V: Test: Importance of Test, Overview of Boundary Scan Test, Faults, Fault Simulation in ASIC design flow, Automatic Test Pattern Generation, Scan tests, Built-in-Self-Test: LFSR and Signature Analysis.

Text Book:

1. M.J.S. Smith, Application Specific Integrated Circuits, Pearson, 2006.

Reference Books:

1. H.Gerez, Algorithms for VLSI Design Automation, John Wiley, 1999.

2. Jan M. Rabaey, Digital Integrated Circuits: A Design Perspective, 2/e, Prentice Hall Electronics and VLSI Series, 2003.

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20EC41010-Adaptive Signal Processing
(Professional Elective - IV)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): Nil

Course Objectives: Develop ability to

1. focus on problems, algorithms and solutions for processing signals in an manner that is responsive to a changing environment.
2. Understand systems on recursive, model-based estimation methods taking the advantage of the statistical properties of the received signals.
3. Understand the performance of adaptive filters and the application of the theory to a variety of practical problems such as beam forming and echo cancellation signal.
4. understand innovation process, Kalman filter theory and estimation of state using the innovation process, concept of Kalman Gain and Filtering.

Course Outcomes: At the end of the course, the student would be able to

CO1. Apply the principle of wiener filter in the context of statistical estimation of an unknown signal
CO2. Analyse various optimization algorithms to track variations in the statistics of a signal with respect to time
CO3. Design adaptive filter to minimize MS error at its output.
CO4. Analyse the nonlinear nature of LMS algorithm and the role of step size on its convergence
CO5. Analyse the differences between the RLS and LMS algorithms with reference to the deterministic and stochastic nature of the respective inputs.

UNIT-I: Introduction to Adaptive Systems Definitions, Characteristics, Applications, Example of an Adaptive System. The Adaptive Linear Combiner- Description, Weight Vectors, Desired Response Performance function - Gradient & Mean Square Error.

UNIT-II: Development of Adaptive Filter Theory Introduction to Filtering - Smoothing and Prediction – Linear Optimum Filtering, Problem statement, Principle of Orthogonally- Minimum Mean Square Error, Wiener-Hopf equations, Error Performance - Minimum Mean Square Error, Estimation of phase shift between two narrow band signals using Orthogonal Decomposer.

UNIT-III: Steepest Descent Algorithms Searching the performance surface – Methods & Ideas of Gradient Search methods - Gradient Searching Algorithm & its Solution - Stability & Rate of convergence - Learning Curves Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves.

UNIT-IV: LMS Algorithm Overview - LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms - LMS Gradient & Stochastic algorithms - Convergence of LMS algorithm.

UNIT-V: Recursive Least-Square Adaptive filters & Kalman Filters Introduction to RLS Algorithm, Statement of Kalman filtering problem, The Innovation Process, Estimation of State using the Innovation Process- Filtering, variants of Kalman filter, Extended Kalman filter.

Textbooks:

1. Bernard Widrow, Samuel D.Strearns -Adaptive Signal Processing -, 2005,PE.
2. Simon Haykin-, Adaptive Filter Theory - 4 ed., 2002, PEAsia.

Reference Books:

1. Sophocles. J. Orfamadis,- Optimum signal processing: An introduction - 2 ed.,1988, McGraw-Hill, Newyork
2. S.Thomas Alexander -Adaptive signal processing-Theory and Applications, , 1986, Springer–Verlag.
3. James V. Candy, Signal Processing: A Modern Approach, McGraw-Hill, International Edition, 1988.

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20CE41071–Green Buildings
(Open Elective-II)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): None.

Course objectives: Develop ability to
1. Impart knowledge on the sustainable construction strategies.
2. Understand green building assessment and LEED certification process.
3. Understand effective energy management systems for a smart building.
4. Learn emerging building materials and their application.
5. Understand green building implementation concepts.

Course Outcomes: At the end of the course, student would be able to
CO1. Explain the scope and importance of a green building, green building movement.
CO2. Differentiate between conventional and green buildings and its rating system.
CO3. Describe the conservative use of environmental components and identify the materials for green building.
CO4. Explain green buildings implementation strategies.

UNIT– I:

Introduction to Green Buildings: Definition of green buildings and sustainable development– typical features of green building– Increased CO_2 trade – Sustainable construction – Major environmental and resource concerns –Green building movement and obstacles – Green building requirements – Perceived use of green building.

UNIT– II:

Green Building Process and Assessment: Conventional versus green building delivery systems – Execution of green building process – Integrated design process – Ecological design –Merits and demerits – Historical perspective –Green building rating systems – GRIHA, IGBC and LEED, Overview of the criteria as per these rating systems. International building assessment standards – Building rating system and its future – Case study of a green building.

UNIT– III:

Sustainable landscaping, Energy and Atmosphere: Land and landscape approaches for green buildings – Sustainable landscapes – Enhancing ecosystems – Storm water management– Heat Island mitigation–Building energy issues–Building energy design strategies Building envelope–Active mechanical systems–Electrical power systems Innovative energy optimization strategies – Smart buildings and energy management systems – Ozone depleting chemicals in HVAC&R and fire suppression.

UNIT–IV:

Building Hydrologic System and Material Loops: Energy policy act of 1992–High performance building hydrologic strategy - High performance building water supply strategy - High performance building waste water strategy–Land scaping water efficiency–Green building materials issues and priorities – Difference between green building buildings and green building materials – Waste Management–Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management.

UNIT–V:

Green Building Implementation: Site protection planning – Health and safety planning – Construction and demolition – Waste management – Reducing the footprint of construction operations–Essentials of building commissioning Costs and benefits of building commissioning – Case study for high performance green buildings – The economics of green buildings– Quantifying green building costs–Future directions in green buildings.

TEXTBOOKS:

1. Sustainable Construction: Green Building Design and Delivery, Charles. J.Kibert, JohnWiley&Sons, New Jersey, 2016
2. Green Building: Guide book for Sustainable Architecture, M.Bauer,P. Mosleand M.Schwarz, Springer, VerlagBerlin Heidelberg, 2010.

REFERENCEBOOKS:

1. Marketing Green Building Services: Strategies for success, Jerry Yudelson, Elsever,2008
2. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
3. Marketing Green Buildings: Guide for Engineering, Construction and Architecture, Jerry Yudelson, The Fairmont Press Inc., 2006.
4. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
5. Green by Design: Creating a Hom e for Sustainable Living, Angela M. Dean, Gibbs Smith Publication,2003.
6. Indian Green Building Council Website:https://igbc.in/igbc/
7. http://cpwd.gov.in/Publication/Guideleines_Sustainable_Habitat.pdf
8. For case studies:http://www.nmsarchitects.com/
9. For case studies:http://www.nmsarchitects.com/

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20EE41072- Energy Conservation and Management
(Open Elective-II)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): None.

Course Objectives: Develop ability to
1. Understand different basic terms related to Indian Energy Scenario.
2. Understand the importance of energy conservation.
3. Understand different acts and policies related to energy conservation.
4. Understand about energy management and types of audits.
5. Understand basic types of management schemes in energy conservation.

Course Outcomes (COs): At the end of the course, student would be able to
CO1: Identify the demand supply gap of energy
CO2: Interpret the importance of energy conservation and the schemes to conserve energy along with different policies
CO3: Explain the need of energy audit, prepare a report suggesting appropriate conservation scheme which include energy planning

UNIT-I

General aspects of energy: Introduction – Types of Energy – Primary and Secondary, Commercial and Non-Commercial, Renewable and Non-Renewable – Global Primary Reserves and Commercial Energy Production - Energy Scenario – Sector Wise Energy Production and Consumption in India – Energy Needs of Growing Economy – Energy Security.

UNIT-II

Energy Conservation and Its Importance: Energy Conservation – Definition – Benefits – Identification of Energy Conservation Opportunities – Technical and Economic Feasibility – Classification of Energy Conservation Measures: Low Cost-High Return, Medium Cost-Medium Return, High Cost-High Return.

UNIT-III

Energy Conservation Act and Its Policies: Introduction – Salient Features of Energy Conservation Act (EC Act),2001 – Schemes of BEE Under the EC Act-2001 – Electricity Act, 2003 – Integrated Energy Policy – National Action Plan on Climate Change (NAPCC).

UNIT-IV

Energy Management and Audit: Definition and Objectives of Energy Management – Need for Energy Audit – Types of Energy Audit and Approach – Understanding Energy Costs – Benchmarking – Energy Performance – Matching Energy Usage to Requirement – Maximizing System Efficiencies – Optimizing Input Energy Requirements – Fuel and Energy Substitution.

UNIT-V

Energy Action Planning, Management, Monitoring And Targeting: Steps Involved in Energy Action Planning – Financial Analysis Techniques – Cash Flow – Sensitivity and Risk Analysis – Financing Options – Energy Performance Contracting and Role of Energy Service Companies (ESCOs) – Developing a Typical ESCO Contract – Project Management – Project Development Cycle (PDC) – Project Planning Techniques – Monitoring and Targeting – Setting up M&T – Key Elements of M&T System.

TEXT BOOKS:

1. "Energy Management – Conservation and Audits", Anil Kumar, Om Prakash, Prashant Singh Chauhan and, Samsher Gautam, CRC Press, 2020
2. "Energy Management Handbook", Wayne C. Turner and Steve Doty, Fairmont Press; Distributed by CRC Press/Taylor & Francis.

REFERENCE BOOKS:

1. "General Aspects of Energy Management and Energy Audit", Guide Book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency.
2. "Handbook of Energy Audits", Albert Thumann, Terry Niehus, William J. Younger, Fairmont Press, Inc.

20ME41073- Digital Fabrication
(Open Elective-II)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): None.

Course Objectives: Develop ability to,

1. Introduce basics of geometric modelling of physical objects,
2. Convert digital data to obtain physical components by metal subtraction and addition processes.

Course Outcomes: Upon completion of this course, a student will be able to

CO1: prepare a geometric modelling scheme required for additive/ subtractive manufacturing
CO2: develop process codes required in subtractive manufacturing and additive manufacturing
CO3: illustrate additive manufacturing methods-SLA, SLS, FDM and their superiority over subtractive manufacturing methods
CO4: explain the robotic manipulations in cutting, bending, folding, stacking, weaving, stitching, Bio printing, and Food Printing
CO5: Select suitable polymer for additive manufacturing

Unit I: Geometric modelling-2D, 2 ½ D, 3D Modelling; Solid representations-CSG, Boundary representations, VOXEL representations; Overview of digital manufacturing processes

Unit II: Subtractive Manufacturing –Introduction to G codes and M codes; Operations on CNC Lathe- Turning and facing; operations on CNC Mill-Planing, grooving and drilling; Introduction to simple CNC Program (Demonstration only);

Unit III: Additive Manufacturing- Stereo lithography, Selective Laser Sintering, Fused Deposition Modelling; Conversion of Geometric model to .stl for 3D printing (Demonstration only)

Unit IV: Robotic manipulations: Cutting- Laser Cutting, Plasma Cutting, Water jet cutting; bending; folding; stacking; weaving; stitching, Bio printing, Food Printing;

Unit-V: Introduction to Engineering polymers- acetals (polyoxymethylenes), ABS, (Acrilonitrile-Butadiene-Suyrene), polycarbonates, polyphenylene ethers and oxides, polyamides (nylons); and thermoplastic polyesthers.

Text books:

1. Digital Fabrication, Philip F. Yuan, Neil Leach, Tonji University press
2. Digital Fabrication in Architecture, Luca Caneparo, Engineering and Construction, Springer

Reference Books:

1. Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing, Gibson, I, Rosen, D W., and Stucker, B., Springer, 2010.
2. Rapid Prototyping – Laser Based and Other Technologies, Venu vinod, PK., Ma, W., Kluwer, 2004.
3. Fundamentals of electronic materials and devices, Safa O Kasap, Mc Graw Hill, 3rd ed

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20CS41075-Knowledge Management
(Open Elective II)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisites: None

Course Objectives: Develop ability to

1. Understand Knowledge Management Systems for access and coordination of Knowledge assets.
2. Understand technologies namely intranet, group-wares, weblog, instant messaging, content management systems and email in both individual and organizational contexts.
3. Use case studies, research methods of Knowledge organization.
4. Understand and implement various knowledge capturing techniques.
5. Test the captured knowledge and to deploy the knowledge.

Course Outcomes: At the end of the course, student would be able to:

CO1. Explain fundamental concepts of Knowledge Management Systems and their life cycle.
CO2. Apply knowledge capturing and knowledge codification techniques.
CO3. Explain methods, tools and protocols for knowledge transfer and sharing.

UNIT-I:

Knowledge management: KM Myths –KM Life Cycle-Understanding Knowledge-Knowledge, Intelligence-Experience-Common Sense-Cognition and KM-Types of Knowledge-Expert Knowledge-Human Thinking and Learning.

UNIT-II:

Knowledge management system life cycle: Challenges in Building KM Systems – Conventional KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – Nonaka's Model of Knowledge Creation and Transformation. Knowledge Architecture.

UNIT-III:

Capturing knowledge: Evaluating the Expert – Developing a Relation Ship with the Experts – Fuzzy Reasoning and Quality of Knowledge – Knowledge Capturing Techniques, Brain Storming – Protocol Analysis – Consensus Decision Making – Report Grid – Concept Mapping – Black Boarding.

UNIT-IV:

Knowledge codification: Modes of Knowledge Conversion – Codification Tools and Procedures – Knowledge Developers Skill Sets – System Testing and Deployment – Knowledge Testing - Approaches to Logical Testing, User Acceptance Testing – KM Systems Deployment Issues – User Training – Post Implementation.

UNIT-V:

Knowledge transfer and sharing: Transfer Methods - and Role of the Internet – Knowledge Transfer in the e-World – KM System Tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Decision Making Architecture – Data Management – Knowledge Management Protocols – Managing Knowledge Workers.

TEXT BOOK(S)

1. Elias.M.Awad & Hassan.M.Ghaziri–"Knowledge Management" Pearson Edition.

REFERENCE BOOK(S)

1. Guus Schreiber , Hans Akkermans, AnjoAnjewierden, Robert de Hoog , Nigel Shadbolt, Walter Van de Velde and Bob Wielinga, "Knowledge Engineering and Management", Universities Press, 2001.
2. C.W.Holsapple, "Handbooks On Knowledge Management", International Handbooks on Information Systems, Vol 1and 2 , 2003.

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20MB41076- Supply Chain Management
(Open Elective II)

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisites: None

Course Objectives: Develop ability to:

1. Distinguish the different functional areas in business management; understand the cross functional integrations and map supply chains of various business sectors.
2. Identify different types of distribution/ modes of transport/ network design.
3. Analyze the operational issues in SCM.
4. Recognize the drivers of the supply chain.
5. Interpret the importance of relationships with suppliers and customers.

Course Outcomes: At the end of the course, the student would be able to

CO1: Develop and understand the role of supply chain management and logistics in business.
CO2: Identify the best practices in logistics operations and design distribution network and channel structure.
CO3:Analyse the effectiveness of functional and cross-functional operations in business.
CO4: Determine the supply chain drivers and logistics performance indicators.
CO5: Compare domestic and global supply chain management.
CO6: Evaluate the role of technologies in supply chain management.

Unit I: Introduction to Supply Chain Management

Understanding the Supply Chain, Supply Chain Performance: Achieving Strategic Fit and Scope including: Customer and Supply Chain Uncertainty, Competitive and Supply Chain Strategies, Product development strategy, Marketing and sales strategy, Supply chain strategy, Scope of strategic fit; Supply Chain Drivers and Metrics.

Unit II: Logistics Management

Designing distribution networks and applications to e-Business, Network design in the Supply Chain, Designing global supply chain, network design, 3 PL, 4 PL, Transportation in supply chain management.

Unit III: Planning and managing inventories

Managing Economies of Scale in a Supply Chain: Cycle Inventory, Managing Uncertainty in a Supply Chain: Safety Inventory, Determining the Optimal Level of Product Availability. Demand Forecasting in a Supply Chain, Aggregate Planning in a Supply Chain, Sales and Operations Planning: Planning Supply and Demand in a Supply Chain, Coordination in a Supply Chain. E- Procurement, Global alliances.

Unit IV: Managing Cross-Functional Drivers in a Supply Chain

Importance of sourcing decisions in Supply Chain Management, Price and Revenue management, role of Information Technology in a Supply Chain, Sustainability and the Supply Chain. Customer Relationship management.

Unit V: Logistics and supply chain relationships

Identifying logistics performance indicators- channel structure- economics of distribution- channel relationships- logistics service alliance. Managing global logistics and global supply chains: Logistics in a global economy- Views of global logistics- global operating levels interlinked global economy. Global supply chain, Supply chain management in Global environment Global strategy- Global purchasing- Global logistics- Global alliances- Issues and Challenges in global supply chain management.

Text Books:

1. Sunil Chopra, Peter Meindle, D.V Kalra, Supply Chain Management 6/e, Pearson.
2. Donald J. Bowersox and David J. Closs, Logistics Management: The Integrated Supply Chain Process TMH 2006.

Reference books:

1. The Toyota Way Paperback by Jeffrey Liker.

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20EC41L01-Microwave Engineering Lab

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
-	-	2/-	1

Prerequisite(s):20EC22004-Electromagnetic Theory and Transmission lines

Course Objectives: Develop ability to

1. Understand working with various microwave sources and devices.
2. Understand calculation of scattering parameters of different microwave devices.
3. Understand the parameters of various microwave passive devices.
4. Understand the procedure for measurement of impedance of a given device.

Course outcomes: At the end of the course, the student would be able to:

CO1. Verify the characteristics of microwave sources experimentally.
CO2. Measure various waveguide parameters.
CO3. Verify experimentally the scattering matrices of various microwave devices.
CO4. Measure the impedance of the given load.

List of Experiments:

1. Reflex Klystron Characteristics
2. Gunn Diode Characteristics
3. Directional Coupler Characteristics
4. VSWR Measurement
5. Measurement of Waveguide Parameters
6. Measurement of Impedance of a given Load.
7. Measurement of Scattering parameters of a E-plane and H-plane Tee
8. Measurement of Scattering parameters of a Magic Tee
9. Measurement of Scattering parameters of a Circulator
10. Measurement of Scattering parameters of a Isolator
11. Attenuation Measurement
12. Microwave Frequency Measurement.

Equipment required:

1. Microwave Bench set up with Klystron Power Supply.
2. Microwave Bench set up with Gunn Power Supply.
3. Micro Ammeter.
4. VSWR meter.
5. Microwave components
6. Cathode Ray Oscilloscope (20MHz)

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20EC41L02 – EDA Tools and Simulation Lab

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
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Prerequisite(s): Nil

Course Objectives: Develop ability to

1. Learn simulation procedures for understanding electrostatic fields and radiation pattern of antennas.
2. Study the transient response of a given system.
3. Understand the simulation concepts of frequency response of amplifiers, filters.
4. Learn the simulation methods for generating various signals using ICs 741 and 555.

Course Outcomes: At the end of the course, the student would be able to

CO1. Simulate and analyse the electrostatic fields and radiation pattern of antennas.
CO2. Verify the transient response of a given system and the effect of various controllers on it.
CO3. Design and simulate the frequency response of various electronic circuits involving active and passive elements .
CO4. Design and simulate various wave form generators using ICs 741 and 555.

List of Experiments

PART – A (Minimum 4 experiments are to be conducted)

Experiments using MATLAB/ Octave or Equivalent Software

1. Generation of 3- dimensional Radiation Pattern for a dipole antenna.
2. Generation of Radiation Pattern for linear array antenna.
3. Simulation of Electrostatic fields in free space.
4. Study the performance of First order and second order systems.
5. Study the effect of PI & PD Controller on the system performance.
6. Determination of Gain Margin, Phase Margin and hence analyze the stability of a given system using Bode Plot

PART – B

(Minimum 8 experiments are to be conducted) Experiments Using Multisim/ Pspice or Equivalent Software

1. Verify the frequency response of two stage RC coupled amplifier.
2. Verify the frequency response of voltage shunt feedback amplifier.
3. Design and Verify RC phase shift Oscillator using BJT for a given frequency of oscillations
4. Design and Verify the frequency response of a single tuned amplifier for a given resonant frequency.
5. Design and Simulation of Constant – K Low Pass filter
6. Design and Simulation of Attenuator
7. Simulation of transient response of Second Order System
8. Design and Simulate LPF, HPF Active filters (second order Butterworth)
9. Design and Simulate generation of Sine, Square and Triangular waves using IC 741.
10. Design and Simulate Monostable and Astable Multi-vibrator using IC 555 Timer.

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20EC41011 -Project Seminar

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
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Prerequisites: None

There shall be a Project seminar presentation in Fourth year First semester, for which, the student shall collect the information on the Project topic, prepare a report, submit it and present the same before a departmental committee. It shall be evaluated by the departmental committee, consisting of Head of the Department or his nominee, seminar supervisor and a senior faculty member. The Project seminar report shall be evaluated for 100 marks as CIE. There shall be no SEE for the Project seminar. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Project Seminar if the student:

i. Secures not less than 40% of the total marks allocated for the course in the evaluation by Departmental Evaluation Committee.
ii. Makes a presentation of the Project Seminar carried out before the Departmental Evaluation Committee as per schedule.
iii. Submits a report on his Project Seminar.

Course outcomes: At the end of the course, the student would be able to:

CO1. **Research** independently in collecting the required information through various resources.
CO2. **Review** and consolidate the research literature to identify and formulate the engineering problem with clear statements of problem definition and the expected deliverables
CO3. **Assess** societal, health, safety, legal and cultural issues in finding a solution for the identified engineering problem
CO4. **Formulate** a sustainable solution to the identified engineering problem taking into account the societal and environmental factors.
CO5. **Demonstrate** compliance to the prescribed standards/ safety norms in the implementation of the identified engineering problem
CO6. **Apply** knowledge of mathematics/ science/ engineering to arrive at design and development of solution(s) for the identified engineering problem
CO7. **Investigate** multiple methods of finding solutions to the identified engineering problem taking into consideration; the cost, power requirement, durability, product life, etc.
CO8. **Apply** appropriate techniques, resources, and modern engineering and IT tools in finding a solution to the identified engineering problem
CO9. **Apply** engineering and management principles in preparing time line of activities for completion of the project and the budget analysis.
CO10. **Exhibit** oral communication skills during presentations of the proposed project work, and writing skills in the preparation of the project report.

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20EC41012 –Mini Project

B. Tech. ECE- IV Year I Sem.

L	T	P/D	C
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Prerequisites: None

There shall be a Mini Project, which the student shall carryout immediately after Third year second semester examinations and pursue it during summer vacation. Mini Project shall be submitted in the form of a report, duly approved by the departmental internal evaluation committee, and presented before the examination committee in Fourth year first semester. It shall be evaluated for 100 marks as SEE. The examination committee consists of Head of the Department or his nominee, supervisor of the mini project and a senior faculty member of the department. There shall be no internal marks (CIE) for Mini Project.

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Mini-Project if the student:

i. Secures not less than 40% of the total marks allocated for the course in the evaluation by Departmental Evaluation Committee.
ii. Makes a presentation of the Mini-Project carried out before the Departmental Evaluation Committee as per schedule.
iii. Submits a report on his Mini-Project.

Course outcomes: At the end of the course, the student would be able to:

CO1. **Research** independently in collecting the required information through various resources.
CO2. **Review** research literature to identify and formulate the engineering problem with clear statements of problem definition and the expected deliverables
CO3. **Assess** societal, health, safety, legal and cultural issues in finding a solution for the identified engineering problem
CO4. **Formulate** a sustainable solution to the identified engineering problem taking into account the societal and environmental factors.
CO5. **Demonstrate** compliance to the prescribed standards/ safety norms in the implementation of the identified engineering problem
CO6. **Apply** knowledge of mathematics/ science/ engineering to arrive at design and development of solution(s)for the identified engineering problem
CO7. **Investigate** multiple methods of finding solutions to the identified engineering problem taking into consideration; the cost, power requirement, durability, product life, etc.
CO8. **Apply** appropriate techniques, resources, and modern engineering and IT tools in finding a solution to the identified engineering problem
CO9. Apply engineering and management principles in preparing time line of activities for completion of the project and the budget analysis.
CO10. **Exhibit** oral communication skills during presentations of the project work, and writing skills in the preparation of the project report.
CO11. **Function** effectively as an individual or as a member to lead the project team and expand the networking platform of professionals.
CO12. **Exhibit** the industry culture abiding by the norms of professional ethics and engineering practice.

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20MB42005- Project Management and Finance

B. Tech. ECE- IV Year II Sem.

L	T	P/D	C
3	-	-	3

Pre requisites: None

Course Objective: Develop ability

1. To understand the Fundamentals of Project Management and Financial considerations involved in it.
2. Estimate the slack-time and cost of the project.
3. Analyse the project risks.
4. Analyse the financial sources.
5. Configuring the venture capital sources.

Course outcomes: At the end of the course, the student would be able to

CO1: Define project management process, classification of costs, types of risks, and sources of finance.
CO2: Apply the concepts of PERT and capital structure theories in project management.
CO3: Integrate financial risk assessment and project risk analysis.
CO4: Assess project financing structure to ensure project success.

UNIT – I: Introduction to Project Management and Selection Criteria: Project definition, Program, Portfolio, Project life cycle cum phases. Importance of Project management. Project management process and classification. Project selection- Project Portfolio Management system, selection methods.

UNIT – II: Estimating times and cost: Factors influencing quality of estimates, estimation methods, types of cost, developing network, constructing project network, activity on node, network computation. PERT.

UNIT – III: Managing Risk: Risk management process- contingency planning, change control. Project risk management, resource allocation. Analysis of project risks, Market risk, Firm risk.

UNIT – IV: Financing of Projects: Capital structure, methods of offering, equity capital, preference capital, debenture. Methods of offering term loans, working capital advances. Project financing structure.

UNIT – V: Financing infrastructure projects and Venture capital: Typical project configuration, key project parties. Project contracts, infrastructure financing scenario in India. Venture capital investor, venture capital investment, raising venture capital.

SUGGESTED TEXT BOOKS:

1. Project management- The managerial process, Clifford F Gray, Erik W Larsom, Gautam V. Desai, 4ed, THM
2. Project- Planning, analysis, selection , financing, implementation and review, Prasanna Chandra, 6ed, TMH
3. Project Management- Achieving competitive advantage, Jeffrey K Pinto, 1st ed, PHP

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20EC42001-Radar Systems
(Professional Elective– V)

B. Tech. ECE- IV Year II Sem.

L	T	P/D	C
3	-	-/-	3

Pre-requisite(s): 20EC22004–Electromagnetic Theory and Transmission Lines

Course Objectives: Develop ability to

1. Understand the working principle of radar and its rang equation.
2. Understand the working principles of CW and FM-CW radars.
3. Understand the functioning of MTI and Pulse Doppler radars.
4. Understand the working principle of various tracking radars.
5. Understand the concepts of Matched Filter, duplexers and displays.

Course Outcomes: At the end of the course, the student would be able to

CO1: Analyze the basic radar range equation and the impact of different parameters on the equation.
CO2. Analyze the operation of Pulse, CW, FM-CW, MTI and Doppler radars.
CO3: Explain the operation of different tracking radars, Radar Receivers, Displays and Duplexers
CO4: Analyze the operation of phased array antennas
CO5: Explain the process of detection of radar signals in the presence of noise

UNIT– I: Basics of Radar

Introduction, Radar Frequencies and Applications, Simple form of Radar Equation, Radar Block Diagram and Operation, Prediction of Range Performance, Minimum Detectable Signal, False Alarm, Receiver Noise, Probability density functions, SNR, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, PRF and Range Ambiguities, System Losses (Qualitative treatment only), Modified Radar Range Equation.

UNIT–II: CW and Frequency Modulated Radars

Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, IF Receiver, Receiver Bandwidth, Applications of CW radar. FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter, Measurement errors, Multiple Frequency CW Radar.

UNIT–III: MTI and Pulse Doppler Radar

Introduction, MTI Radar with-Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers - Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

UNIT–IV: Tracking Radar and Phased Array Antennas

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one - and two- coordinates), Angular Accuracy, Tracking in Range, Acquisition, Comparison of Trackers.

UNIT–V: Radar Receivers

Phased Array Antennas: Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering, Change of Beam Width steering angle, Applications, Advantages and Limitations.

Detection of Radar Signals in Noise:

Introduction, Radar Receivers, Displays and Duplexers: Radar Receiver, Noise Figure, Mixers, Displays, Duplexers.

Text Book:

1. MerrillI.Skolnik, Introduction to Radar Systems, TMH Special Indian Edition,2nd Ed., 2007.

Reference Books:

1. M.Kulkarni, Microwave and Radar Engineering, UmeshPublications,1998.
2. PeeblesJr.,P.Z.Wiley, Radar Principles, NewYork,1998.

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20EC42002 - Mixed Signal Circuit Design
(Professional Elective - V)

B. Tech. ECE- IV Year II Sem.

L	T	P	C
3	-	-	3

Prerequisite(s): 20EC21003 - Electronic Circuit Analysis and Design
20EC22002 - Linear Integrated Circuits

Course Objectives: Develop ability to

1. Understand MOSFET Switches and switched capacitor circuits.
2. Understand models of MOS Amplifiers; Design and analysis of Comparator.
3. Understand the design concepts of PLLs and Data Converters.
4. Understand different DAC Architectures.
5. Understand different ADC Architectures.

Course Outcomes: At the end of the course, the student would be able to

CO1. **Analyze** functionality of dynamic analog circuits.
CO2. **Design** CMOS based amplifier and comparator circuits.
CO3. Explain the functionality of Digital PLL.
CO4. **Analyze** different DAC and ADC architectures based on design parameters.

UNIT - I: Dynamic Analog Circuits:

The MOSFET Switch-Charge injection, Capacitive feedthrough, Reduction of charge injection and clock feedthrough; Sample and Hold Circuits.

Switched-Capacitor Circuits: Switched–Capacitor Integrator: Parasitic Insensitive, Summing integrator and Lossy integrator Configurations; Dynamic Comparator.

UNIT - II: Operational Amplifier:

Overview of Basic Op-Amp Design.

CMOS Comparator Design: Preamplification, Decision Circuit, Output Buffer, Characterizing the Comparator.

UNIT - III: Phase-Locked Loops:

Simple PLL, Basic Charge Pump PLL, Jitter in PLLs, Delay-Locked Loops, Jitter Reduction

Digital Phase-Locked Loop: Phase Detector, Voltage-Controlled Oscillator, Loop Filter - Overview, Delay-Locked Loops

UNIT -IV: Overview of DAC Architectures:

Analog versus Discrete Time Signals, Digital-to-Analog Converter (DAC) Specifications**,** Digital input code, Resistor String; Current Steering, Charge-Scaling DACs, Cyclic DAC and Pipeline DAC.

UNIT -V: Overview of ADC Architectures:

Converting Analog Signals to Digital Signals, Sample-and-Hold Characteristics, Analog-to-Digital Converter Specifications, Mixed-Signal Layout Issues, Pipelined ADC, Oversampling ADC and First Order Sigma-Delta Modulator.

Text Book:

1. R.Jacob Baker, CMOS Circuit Design, Layout, and Simulation, Wiley India, 2nd Edition, 2005.

Reference Books:

1. Philip E. Allen and Douglas R. Holberg, CMOS Analog Circuit Design, Oxford University Press, International Third Edition / Indian Edition, 2013.
2. Behzad Razavi, Design of Analog CMOS Integrated Circuits, TMH Edition, 2002.

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20CS42014 – Computer Networks

IV Year. B. Tech. (ECE) – II Sem

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC31001 – Computer Architecture and Microprocessors

Course Objectives: Develop ability to

1. Develop an understanding of modern network architectures from a design and performance perspective.
2. Understand the protocols of data link layer and MAC sub layer and apply different techniques of error detection and error correction.
3. Distinguish and explain different network layer protocols and routing algorithms.
4. Describe the functions of TCP and UDP protocols.
5. Illustrate the application layer protocols such as HTTP, FTP, SMTP, DNS and TELNET.

Course Outcomes (COs): After completion of the course, student would be able to

CO1. Analyze different types of network topologies, various physical media in terms of their suitability for different applications, OSI and TCP/IP models.
CO2. Apply channel allocation, framing, error and flow control techniques at data link layer.
CO3. Distinguish between circuit and packet switching, logical and physical addressing and analyze various routing algorithms.
CO4. Explain different Transport Layer functions and analyse congestion control algorithms.
CO5. Explain various Application layer protocols and classical cryptographic techniques.

UNIT-I

Data communication Components: Representation of data and its flow, Networks, Various Connection Topology, Protocols and Standards, OSI model, TCP/IP Protocol Suite, Transmission Media, Switching, Circuit Switched Networks, Datagram Networks and Virtual Circuit Networks; LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

UNIT-II

Data Link Layer: Design Issues, Services provided to Network Layer, Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking. Medium Access Control Sub Layer: Random Access, Multiple Access protocols-Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.

UNIT-III

Network Layer: Network Layer Design Issues, Logical addressing – IPV4, IPV6 Protocols; Address mapping – CIDR, ARP, RARP, BOOTP and DHCP–Delivery, Forwarding, Uni-Cast Routing protocols, Multicast Routing Protocols.

UNIT-IV

Transport Layer: Process to Process Communication, Client/Server Paradigm, User Datagram Protocol (UDP),Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT-V

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

TEXT BOOK(S)

1. Data Communication and Networking, Fourth Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Computer Networks, Fifth Edition, Andrew S. Tanenbaum, Pearson New International Edition.

REFERENCES BOOK(S)

1. Data and Computer Communication, Eighth Edition, William Stallings, Pearson Prentice Hall India.
2. Internetworking with TCP/IP, Volume 1, sixth Edition Douglas E. Comer, Prentice Hall of India.
3. TCP/IP Illustrated Volume 1, Second Edition, Kevin R. Fall, W. Richard Stevens, Pearson Education.
4. Computer Networking: A Top-Down Approach Featuring the Internet, James F.Kursoe, K.W.Ross, Fifth Edition, Pearson Education.

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20EC42003- 5G Mobile Communications

(Professional Elective - V)

B. Tech. ECE- IV Year II Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): 20EC22001- Analog and Digital Communications
20EC31002 – Antennas and Wave Propagation

Course Objectives: Develop ability to

1. Understand the spectrum challenges and use cases of 5G.
2. Understand the 5G New Radio (NR) architecture, channel propagation characteristics and Hardware technologies for Millimeter Wave Communication.
3. Understand the requirements, fundamental techniques and radio resource management for machine type and D2D communication.
4. Understand the radio access technologies for efficient multiple access for V2X Communication and machine type communication.
5. Understand the advanced antenna systems and channel models for 5G networks

Course Outcomes: At the end of the course, the student would be able to

CO1: **Compare** the functional aspects of 5G with earlier generations including the spectrum challenges in 5G mobile systems.
CO2: **Explain** the 5G architecture and the deployment scenarios in millimeter wave communication.
CO3: **Explain** the use cases of Machine Type Communication (MTC) and Device to Device (D2D) communication.
CO4: **Illustrate** the design principles of radio access for Dense Deployment (DD), Vehicle to Everything (V2X) Communications and Massive Machine Type (MMT) Communication.
CO5: **Analyze** different types of Massive Multi-Input-Multi-Output (MIMO) systems.

UNIT – I: Drivers of 5G:

Historical Trend for Wireless Communication - Mobile Communications Generations: 1G to 4G – Evolution of LTE Technology to Beyond 4G – Pillars of 5G – Standardization Activities - Use cases and Requirements – System Concept – Spectrum: Spectrum for 4G – Spectrum Challenges in 5G – Spectrum Landscape and Requirements – Spectrum Access Modes and Sharing Scenarios.

UNIT – II: 5G Architecture and Millimetre wave communication:

5G Architecture: Software Defined Networking – Network Function Virtualization – Basics about RAN Architecture –High-Level Requirements for 5G Architecture – Functional Architecture and 5G Flexibility – Physical Architecture and 5G Deployment

Millimetre Wave Communication: Channel Propagation – Hardware Technologies for mmW Systems– Deployment Scenarios – Architecture and Mobility – Beamforming – Physical layer Techniques

UNIT – III: Machine Type and D2D Communication:

Machine Type Communication (MTC): Use cases and Categorization – MTC Requirements – Fundamental Techniques for MTC – Massive MTC – Ultra-reliable Low-latency MTC Device to Device (D2D): from 4G to 5G – Radio Resource Management for Mobile Broadband D2D – Multi-hop D2D Communications for Proximity and Emergency Services – Multi-operator D2D Communication

UNIT – IV: 5G Radio Access Technologies:

Access Design Principles for Multi-user Communications – Multi-carrier with Filtering – Non-orthogonal Schemes for Efficient Multiple Access – Radio Access for Dense Deployments – Radio Access for V2X Communication – Radio Access for Massive Machine-type Communication.

UNIT –V: Massive Multiple-Input Multiple –Output Systems:

MIMO in LTE – Single-user MIMO – Multi-user MIMO – Capacity of Massive MIMO – Pilot Design of Massive MIMO – Resource Allocation and Transceiver Algorithms for Massive MIMO – Fundamentals of Baseband and RF Implementation in Massive MIMO – Channel Models

Text Books

1. Asif Oseiran, Jose F.Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.
2. Jonathan Rodriquez, "Fundamentals of 5G Mobile Networks", Wiley, 2015

Reference Books

1. Ali Zaidi, Fredrik Athley, Jonas Medbo, Ulf Gustavsson, Giuseppe Durisi, Xiaoming Chen, '5G Physical layer: Principles, Models and Technology components', Elsevier Academic Press, 2018.
2. Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, "5G System Design – Architectural and Functional Considerations and Long-Term Research", Wiley, 2018.

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20CE42081 – Disaster Management
(Open Elective-III)

B. Tech. ECE- IV Year II Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): None.

Course objectives: Develop ability to

1. Acquire knowledge on disaster and assess their impact.
2. Comprehend the monitoring techniques of disasters.
3. Understand the issues and policies involved in the disaster management.
4. Evaluate the pre-disaster risk and vulnerability reduction strategies.
5. Assess the role of NGO's, Government bodies and Public in the disaster mitigation and management.

Course Outcomes: At the end of the course, student would be able to

CO1. Explain Environmental and Man-made Hazards happening in India and globally.
CO2. Differentiate between Hazards & Disasters, such as endogenous, exogenous, planetary hazards.
CO3. Describe the causes and effects of hazards, identify safety measures.
CO4. Apply special measures to rebuild the environment using disaster management techniques.

UNIT–I:

Introduction: Meaning and Concept of Environmental hazards, Environmental Disasters and Environmental stress. Different approaches and relation with human Ecology – Landscape Approach – Ecosystem Approach – Perception approach – Human ecology and its application in geographical researches.

UNIT–II:

Types of Environmental Hazards & Disasters: Natural and Man induced. Natural Hazards – Planetary Hazards/Disasters – Extra Planetary Hazards/ Disasters – Planetary Hazards – Endogenous Hazards – Exogenous Hazards.

UNIT–III:

Endogenous Hazards/ Disasters: Volcanoes – Earthquakes – Landslides – Earthquake Hazards/ Disasters – Causes of Earthquakes – Distribution of Earthquakes – Hazardous effects of Earthquakes – Earthquake Hazards in India - Human adjustment, perception & mitigation of earthquake.

UNIT–IV:

Exogenous Hazards/ Disasters: Infrequent events – Cumulative atmospheric hazards/ disasters.
Infrequent events: Cyclones – Lightening – Hailstorms.
Cyclones: Tropical cyclones & Local storms – Destruction by tropical cyclones & local storms (causes, distribution, human adjustment, perception & mitigation)
Cumulative Atmospheric Hazards/ Disasters: Floods – Droughts – Cold waves – Heat waves.
Floods: Causes of floods – Flood hazards – Flood control measures (Human adjustment, perception & mitigation).

Droughts: Impact of droughts – Drought hazards in India – Drought control measures.
Extra Planetary Hazards/ Disasters: Man induced hazards/ Disasters – Physical Hazards/ Disasters – Soil Erosion.
Soil Erosion: Mechanics & forms of soil erosion – Factors & causes of soil erosion – conservation measures of soil erosion.
Chemical Hazards/ Disasters: Release of toxic chemicals, nuclear explosion – Sedimentation processes: Global sedimentation problems – Regional sedimentation problems – Sedimentation & Environmental problems – Corrective measures of Erosion & Sedimentation.
Biological Hazards/ Disaster: Population Explosion.

UNIT–V:

Emerging approaches in Disaster Management – Three Stages

1) Pre- Disaster Stage (Preparedness)
2) Emergency Stage
3) Post Disaster Stage – Rehabilitation

TEXT BOOKS:

1. Manual on National Disaster Management Plan, National Disaster Management Authority Ministry of Home Affairs, Government of India.
(http://ndma.gov.in/images/policyplan/dmplan/National%20Disaster%20Management%20Plan%20May%202016.pdf)
2. Disaster Management, Dr. Mrinalini Pandey, Wiley India Pvt Ltd., 2014.
3. Disaster Science and Management, Tushar Bhattacharya, McGraw Hill Education, 2015.

REFERENCE BOOKS:

1. Disaster Mitigation: Experiences and Reflections, Pardeep Sahni, PHI Learning, 2010.
2. Natural Hazards and Disasters, Donald Hyndman and David Hyndman, Cengage Learning, 2013.
3. Disaster Management Global Challenges and Local Solutions, Rajib, S and Krishna Murthy, R.R, University Press Hyderabad, 2009.
4. Earth and Atmospheric Disaster Management: Nature and Manmade, Navale Pandharinath & C.K.Rajan, B.S. Publications, Hyderabad, 2009.
5. Disaster Risk Reduction in South Asia, Sahni and Pardeep, PHI learning Pvt Ltd, 2003.

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Cheeryal (V), Keesara (M), Medchal Dist., Telangana - 501 301

20EE42082 - Micro-Electro-Mechanical Systems
(Open Elective-III)

B. Tech. ECE- IV Year II Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): None

Course Objectives:
1. To introduce to basics of Micro-electro-mechanical systems
2. To understand properties of materials involved in MEMS
3. To pertain fabrication methods involved in MEMS manufacturing
4. To apply the concepts for various applications

Course Outcomes: Upon completion of the course, the student will be able to
CO1: Explain the basic concepts involved in MEMS technologies
CO2: Describe the properties of various materials involved in MEMS technologies
CO3: Apply the concepts and technologies involved in designing of MEMS
CO4: Explain different manufacturing processes involved in the fabrication of MEMS
CO5: Explain the functional aspects of various MEMS structures and devices.

UNIT I
Introduction to MEMS: What is MEMS, Historical Background, classification, Micro-engineering, importance of micro-engineering. Technological advancements in MEMS, advantages and disadvantages of MEMS.

UNIT II
MEMS materials: Materials used in MEMS. Material properties: electrical, mechanical, thermal, chemical, biological, optical and processing. Reliability issues of materials

UNIT III
Designing of MEMS: Design and analysis process for MEMS. Initial design process, structured design process. Commonly used design flow, structured design flow. Design flow for MEMS cad design. Design and verification flow for integrated MEMS.

UNIT IV
MEMS fabrication Techniques: Photolithography, materials for micromachining, bulk micromachining Surface micromachining, High aspect-ration-micromachining, assembly and system integration.

UNIT V
MEMS structures and devices: Mechanical sensors, mechanical actuators, micro-fluidic devices, optical/photonic micro-systems, biological transducers.

TEXT BOOKS:

1. Adams TM, Layton RA., *"Introductory MEMS: Fabrication and applications",* 2010.
2. Tobergte DR, Curtis S., *"An Introduction to Micro-electro-mechanical Systems Engineering"* Second Edition. vol. 53. 2013.

REFERENCE BOOKS:

1. Kreith F, Kreider JF., *"The MEMS Handbook*‖ CRC Press 2002.
2. Reza Ghodssi, Pinyen Lin, *"MEMS Materials and Processes Handbook"* Springer 2013
3. Gad-el-Hak M, *"MEMS applications"* 2nd edition, CRC press 2006.

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20ME42083 - Principles of Automobile Engineering
(Open Elective-III)

B. Tech. ECE- IV Year II Sem.

L	T	P/D	C
3	-	-/-	3

Pre-requisites: None

Course Objectives: Develop ability to,

1. Introduction to Engineering analysis of the automobiles and their sub systems.
2. Applications of engineering principles to automotive design.
3. Improves ability to understand the different types of engines and automobile bodies.
4. Familiarization with the automotive industry and its terminology.
5. Develops an idea of utilization of resources duly reducing emission levels for achieving eco-friendly environment.

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

CO1: explain evolution and terminology of automobiles.
CO2: describe fuel supply systems, ignition systems and cooling systems of an automobile.
CO3: illustrate transmission system, lubrication system, braking system, and steering system of an automobile.

UNIT – I:
Introduction: History of Automobiles, Classification of Automobiles. Chassis and body building, Engine Terminology, Classification of Engines

UNIT-II:
Fuel System: spark Ignition engines-Fuel tank, fuel filter, fuel pump, air cleaner/filter, carburetor types, injection of petrol engines. Compression Ignition engines, Fuel Injection System- air & solid injection system, Pressure charging of engines, super charging and turbo charging
Cooling System : Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System, Radiators, Cooling Fan - water pump, thermostat, evaporating cooling, pressure sealed cooling, antifreeze solutions.

UNIT-III:
Ignition System: Function of an ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, Battery ignition system

UNIT-IV:
Transmission System: Clutch principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, gear boxes, types. Propeller shaft, Hotch Kiss drive, Torque tube drive, universal joint, differential, live and dead axles, wheels and tyres.
Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder, tandem master cylinder, Requirement of brake fluid, Pneumatic and vacuum brakes.

UNIT-V:

Steering System: Types of steering mechanism, Ackerman steering mechanism, Davis steering mechanism.

Text Books:

1. Kirpal Singh, Automobile Engineering, Vol.1 and 2, Standard Publishers, New Delhi, 2003.
2. A Text Book of Automobile Engineering by R K Rajput. Laxmi Publications.

Reference books:

1. Automotive Engines / Srinivasan
2. A Text Book of Automobile Engineering By Khalil U Siddiqui New Age International
3. Automobile Engineering / William H Crouse
4. A Text Book Automobile Engineering–Manzoor,. Nawazish Mehdi & .Yosuf Ali, Frontline Publications.

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20CS42085-DATABASE SYSTEMS

(Open Elective-III)

B. Tech. ECE- IV Year II Sem.

Prerequisites: None

L	T	P/D	C
3	-	-/-	3

Course Objectives: Develop ability to

1. Understand the basic concepts and the applications of database systems.
2. Master the basics of SQL and construct queries using SQL.
3. Apply relational database design principles.
4. Understands the basic issues of transaction processing and concurrency control.
5. Know the needs of database storage structures and access techniques.

Course Outcomes: At the end of the course, student would be able to

CO1. Design simple database using ER modelling and analyse the RDBMS approach towards database design.
CO2. Apply theoretical and practical database querying languages to efficiently retrieve data stored in the database.
CO3. Apply functional dependency and normalization techniques to arrive at a minimally redundant database.
CO4. Apply concepts of concurrency control and data recovery in database transactions.
CO5. Apply indexing techniques to organize the data on the secondary storage devices enabling efficient data retrieval.

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages – DDL, DML, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Database Users and Administrators, History of Database Systems.

Introduction to Data base design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model.

UNIT - II

Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design: ER to Relational, Introduction to Views, Destroying /Altering Tables and Views.

Relational Algebra: Express Preliminaries, Relational Algebra.

Basic Structure of SQL Queries, Set Operations, Null Values, Additional Basic Operations, Aggregate Functions, Nested Sub Queries, Views, Joins.

UNIT - III

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies.

Normal Forms – INF, 2NF, 3NF, BCNF, Multi valued dependencies – 4NF,5NF.

UNIT - IV

Transaction Management: Transactions, Transaction Concept, A Simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation and consistency, Serializability.
Concurrency Control: Lock–Based Protocols, Multiple Granularity, deadlock handling Timestamp-Based Protocols, Validation-Based Protocols, Recovery Systems.

UNIT - V

Indexing and Hashing: Basic Concepts, Ordered Indices, B+ Tree Index Files, B Tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.
Special Data bases: Data analysis, data mining, data warehousing, spatial and geographical, multimedia database, mobility and personal database, distributed information system. World Wide Web, OLAP

TEXT BOOK(S)

1. Database System Concepts, Abraham Silberschatz, Henry. F. Korth, S. Sudarshan, McGraw Hill Education(India) Private Limited , 6th edition.

REFERENCE BOOK(S)

1. Database Systems, 6th edition, R Elmasri, Shamkant B.Navathe, Pearson Education.
2. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning.
3. Introduction to Database Management, M. L. Gillenson and others, Wiley Student Edition.
4. Database Development and Management, Lee Chao, Auerbach publications, Taylor & Francis Group.
5. Introduction to Database Systems, C. J. Date, Pearson Education.

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20MB42086- Entrepreneurship
(Open Elective-III)

B. Tech. ECE- IV Year II Sem.

L	T	P/D	C
3	-	-/-	3

Prerequisite(s): None

Course Objectives: Develop ability to

1. Understand the mindset of the entrepreneurs.
2. Analyze the financial aspects of establishing an enterprise.
3. Learn entrepreneurial activities and determine strategies for launching.
4. Identify the challenges of entrepreneurship and develop an idea on the entrepreneurial framework.
5. Apply strategic perspectives in entrepreneurship.

Course Outcomes (COs): At the end of the course, the student would be able to

CO1: Identify and apply the concepts of entrepreneurship.
CO2: Evaluate and use the concepts of IPR and opportunities to launch new ventures.
CO3:.Justify the nature of the creativity process and innovation as an entrepreneur.
CO4: Evaluate entrepreneurial challenges and analyze new ventures.
CO5: Develop strategic plans for business and entrepreneurship.
CO6: Design and develop strategies for entrepreneurial sustainability.

UNIT-I

Introduction to entrepreneurship: meaning, importance, entrepreneurship characteristics, women entrepreneurs, classifications of entrepreneurs, myths of entrepreneurship, qualities of entrepreneurship, competencies, attitude function and nature of forms of entrepreneurship.

UNIT-II

Promotion and financial aspects of entrepreneurship: Idea generation- opportunities- SWOT analysis, patents and trademark, intellectual property rights, source of capital, debt capital, seed capital, venture capital- informal agencies in financing entrepreneurs. Government grants and subsidies, types of investors and private offerings.

UNIT-III

Launching entrepreneurial ventures: opportunities identification- entrepreneurial imagination and creativities – the nature of the creativity process innovation and entrepreneurial- methods to initiate venture creating, new ventures-acquiring and established entrepreneurial venture, franchising hybrid-disadvantage of franchising.

UNIT-IV

Legal challenges of entrepreneurship: Intellectual property protection patents, copy rights-trademarks and trade secret. Avoiding pitfalls-formulation of the entrepreneurial plan-the challenges of new venture startups-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 adoptive 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, 1/e, 2012.
2. Vasanth Desai "Small Scale industries and entrepreneurship" Himalaya Publishing 2012.

Reference Books

1. Stuart Read, Effectual Entrepreneurship, Routledge, 2013.
2. Nandan H, Fundamentals of Entrepreneurship, PHI, 2013.

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20EC42004 - Technical Seminar

B. Tech. ECE- IV Year II Sem.

L	T	P/D	C
-	-	2	1

Prerequisites: None

There shall be a technical seminar presentation in Fourth year second semester, for which, the student shall collect the information on a specialized topic, prepare a technical report, submit it and present the same before a departmental committee. It shall be evaluated by the departmental committee, consisting of Head of the Department or his nominee, seminar supervisor and a senior faculty member. The technical seminar report shall be evaluated for 100 marks as CIE. There shall be no SEE for the technical seminar. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Technical Seminar if the student:

i. Secures not less than 40% of the total marks allocated for the course in the evaluation by Departmental Evaluation Committee.
ii. Makes a presentation of the Technical Seminar carried out before the Departmental Evaluation Committee as per schedule.
iii. Submits a report on his Technical Seminar.

Course outcomes: At the end of the course, the student would be able to:

CO1. **Research** independently in collecting the required information through various resources.
CO2. **Review** the research literature and identify a specialized topic in an emerging area with clear description of the title.
CO3. **Apply** the knowledge of basic sciences, mathematics and engineering concepts in the preparation and presentation of the technical seminar.
CO4. **Make** an effective presentation within the stipulated time.
CO5. **Demonstrate** writing skills in the preparation of seminar report, adhering to the stipulated format.

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20EC42005 – Project

B. Tech. ECE- IV Year II Sem.
Prerequisites: None

L	T	P	C
-	-	20	10

The student shall carryout the Project in final year second semester. There shall be three reviews, one at the end of the fourth week, another at the end of the ninth week and third at the end of the fourteenth week. The reviews shall be conducted and evaluated by an internal project review committee. The committee shall consist of Head of the Department or his nominee, the supervisor allocated for the Project, and two Professors /Assoc-Professors of the department. Each review shall be evaluated for forty (40) marks and average of all three reviews shall constitute CIE of forty (40) marks. Project carried out shall be submitted in a dissertation form, and a presentation of the same shall be made before a final examination committee consisting of Head of the Department or his nominee, the supervisor and an external examiner, appointed by the chief superintendent of examinations, selected from a panel of examiners suggested by the chairperson, BoS, which evaluates it for sixty (60) marks.

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Project if the student:

i. Secures not less than 40% of the total marks allocated for the course, in the project evaluation.
ii. Makes a presentation of the Project carried out before the Internal Project Review Committee as per schedule.
iii. Submits a report on his Project.

Course outcomes: At the end of the course, the student would be able to:

CO1. **Research** independently in collecting the required information through various resources.
CO2. **Review** research literature to identify and formulate the engineering problem with clear statements of problem definition and the expected deliverables
CO3. **Assess** societal, health, safety, legal and cultural issues in finding a solution for the identified engineering problem
CO4. **Formulate** a sustainable solution to the identified engineering problem taking into account the societal and environmental factors.
CO5. **Demonstrate** compliance to the prescribed standards/ safety norms in the implementation of the identified engineering problem
CO6. **Apply** knowledge of mathematics/ science/ engineering to arrive at design and development of solution(s) for the identified engineering problem
CO7. **Investigate** multiple methods of finding solutions to the identified engineering problem taking into consideration; the cost, power requirement, durability, product life, etc.
CO8. **Apply** appropriate techniques, resources, and modern engineering and IT tools in finding a solution to the identified engineering problem
CO9. Apply engineering and management principles in preparing time line of activities for completion of the project and the budget analysis.
CO10. **Exhibit** oral communication skills during presentations of the project work, and writing skills in the preparation of the project report.
CO11. **Function** effectively as an individual or as a member to lead the project team and expand the networking platform of professionals.
CO12. **Exhibit** the industry culture abiding by the norms of professional ethics and engineering practice.