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PROGRAM STRUCTURE

AND

DETAILED SYLLABUS

for

CBCS BASED B.Tech. FOUR YEAR DEGREE PROGRAM

(Applicable for the batches admitted from AY 2020-21)

ELECTRICAL AND ELECTRONICS ENGINEERING

. . . Striving Towards Perfection

Department of Electrical and Electronics Engineering
(Accredited by NBA)

Geethanjali College of Engineering and Technology

(Approved by AICTE, Permanently Affiliated to JNTUH, Accredited by NAAC with 'A' Grade)
Cheeryal (V), Keesara (M), Medchal (Dist.), Telangana - 501 301

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ACADEMIC REGULATIONS 2020
For CBCS Based B. Tech PROGRAMMES

(Effective for the students admitted into FIRST year from the Academic Year **2020-2021**

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 2020-2021, 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.	Computer Science and Engineering (Internet of Things)
7.	Electrical and Electronics Engineering
8.	Electronics and Communication Engineering
9.	Information Technology
10.	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 the JNTUH, or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government of Telangana from time to time.

2.2 The medium of instruction for all the B. Tech programme 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 denoted 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 Work	Project/ Internship/Mini- Project / Design Thinking/ Project Seminar/Technical Seminar
8	Mandatory Courses (MC)		Mandatory courses (Non-Credit)

4. Course Registration

4.1 A 'Faculty Advisor or Counselor' shall be assigned to a group of 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 subjects/ courses in a semester as specified in the course structure with maximum extra/ additional course(s) limited to 4 credits, based on progress and SGPA/ CGPA, and completion of the 'pre- requisites' as indicated for various subjects/ courses, in the department course structure and syllabus content.

4.4 If any theory course(s) has an associated laboratory / practical course, while registering for such course(s), the student shall register for laboratory / practical course(s) along with the corresponding theory course(s) in the same semester.

4.5 Student's choice for 'extra/additional course(s) ' must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/ Counselor.

4.6 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).

4.7 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 will rectify such errors and advise the student accordingly.

4.8 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.

4.9 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.

4.10 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.

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

5. Courses to be offered

5.1 A typical section (or class) strength for each semester shall be 60.

5.2 A Course may be offered to the students, ONLY IF a Minimum of 20 students (1/3 of the Section Strength) opt for the same. The maximum strength of a section is limited to 80 (60 + 1/3 of the section strength).

5.3 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 on-line registration from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student)

5.4 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.

5.5 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, Induction Program, Sports/NCC/NSS etc.,) for that semester

6.1.1 Shortage of attendance in aggregate up to 10% in each semester may be condoned by the college academic committee on genuine medical grounds, based on the student's representation with supporting evidence.

6.2 A stipulated fee shall be payable towards condoning of shortage of attendance.

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

6.4 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.

6.5 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 course, if the student secures not less than 35% marks (e.g. 25 out of 70 marks in theory/laboratory/practical/drawing course(s)) in the Semester End Examination, and a minimum of 40% of 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 Pass (C) Grade or above in that 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. 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 Internship carried out before the Departmental Evaluation Committee as per schedule iii. Submits a report on his Internship.
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.
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.
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.
Project	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.
Activity Oriented (Non –Laboratory) courses 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 evaluation 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 shall register for all course(s) covering 160 credits as specified and listed in the Programme Structure, fulfills the Attendance and Academic requirements for 160 Credits securing a minimum of "C Grade" (Pass Grade) or above in each course(s), and 'earns ALL 160 Credits securing an SGPA $\geq$ 5.0 (in each Semester), and CGPA (at the end of each successive Semester) $\geq$ 5.0, in addition to fulfilling the academic requirements of mandatory course(s), to successfully complete the B.Tech Programme. The performance of the student in these 160 credits shall be taken into account for the calculation of "the final CGPA" (at the end of undergraduate programme), and shall be indicated in the grade card issued at the end of IV-year II semester.

7.5 A student eligible to appear in the Semester End Examination in any course(s), but absent for it or failed (thereby failing to secure '**C**' Grade or above), may reappear for that course(s) at the supplementary examination as and when conducted. In such cases, his Internal Marks (CIE) assessed earlier for that course(s) shall be carried over, and added to the marks he obtains in the supplementary examination, for evaluating his performance in that course(s).

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

7.7 A student detained due to lack of credits, shall be promoted to the next academic year only after acquiring the required credits as per the regulations last studied under. Upon readmission 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:

8.1.1 Theory, practical, drawing and Project course(s) shall be evaluated based on 30% CIE (Continuous Internal Evaluation) and 70% SEE (Semester End Examination)

8.1.2 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.

8.2 For theory course(s), during the semester, there shall be TWO (2) mid-term examinations for 25 marks each. Each mid-term examination consists of one objective paper for TEN (10) marks, plus one subjective paper for FIFTEEN (15) marks, with duration of 120 minutes (20 minutes for objective and 100 minutes for subjective papers). Further, there shall be an allocation of five (5) marks for assignment. The objective paper is set with multiple choice questions, and / or True / False, and /or fill-in the blanks, and / or matching type questions. Subjective paper shall contain 3 questions, one from each unit or part thereof, with internal choice, each for 5 marks. All three questions are to be answered.

8.2.1 The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.

8.2.2 The first set of assignments should be submitted before the conduct of the first mid-term examinations, and the second set of assignments should be submitted before the conduct of the second mid-term examinations. The assignments shall be as specified by the course instructor concerned.

8.2.3 The first mid-term examination marks and average of the marks of the first set of assignment shall make one set of CIE marks, and the second mid-term examination marks and the average of the marks of the second set of assignment shall make second set of CIE Marks; and the average of these two sets of marks shall be taken as the final marks secured by the student in the Continuous Internal Evaluation in that course.

8.2.4 The details of the question paper pattern for Semester End Examination (SEE) shall be as follows:

- The examination shall be conducted for 70 marks. The question paper consists of two parts:
  - Part – A for 20 marks (Compulsory);
  - Part – B for 50 marks (Questions with Internal Choice);
- Part – A: Part A shall consist of ten questions, two from each unit of the prescribed syllabus of the course. Each question carries 2 marks. All questions are compulsory.

- Part – B: Part B shall consist of five questions, one each from the five units of the prescribed syllabus of the course. Each question carries 10 marks and may contain sub-questions. For each question, there shall be an internal choice (it means, there shall be two questions from each unit, and the student shall answer either of the questions). The student shall answer all the five questions.

8.2.5. For laboratory / practicals / drawing course(s), there shall be a Continuous Internal Evaluation (CIE) during the semester for 30 marks, and Semester End Examination (SEE) for 70 marks. Out of the 30 marks for CIE, day-to-day work in the laboratory / practical shall be evaluated for 15 marks; and for the remaining 15 marks - two internal practical tests (each of 15 marks) shall be conducted by the concerned laboratory instructor, one at the end of 8 weeks and the other in the last week of the semester. The average of these two tests is taken into account. The SEE for practicals shall be conducted at the end of the semester by two examiners, namely, an external examiner and laboratory faculty as internal examiner.

8.2.6. Makeup test in theory/ laboratory internal examination(s):

For the benefit of students who are absent or desirous of improvement in mid-term examination(s) in any course(s) concerned, one Makeup test shall be conducted (15 marks for laboratory course and 25 marks for theory) covering all units/experiments (as applicable) in that course at the end of the semester.

- In the case of the student seeking to improve performance and had appeared for both Mid-I and Mid-II examinations, the lower of the marks obtained in the two mid term examinations shall be annulled and replaced with the marks secured in the makeup test.
- In the case of students who are absent in both mid-term examinations for any course(s), marks secured in the makeup test shall be halved and awarded against the said mid-term examinations for that course.
- A prescribed fee shall be payable by the student for appearing in the above mentioned Makeup test.

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

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.

8.2.6.2. 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 and a senior faculty member of the department. There shall be no internal marks (CIE) for Mini Project.

8.2.6.3. 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. There shall be no SEE for the technical seminar.

8.2.6.4. 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 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.

8.2.6.5. 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 thirty (30) marks and average of all three reviews shall constitute CIE of thirty (30) 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 seventy (70) marks.

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

8.2.7. 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 passing the course(s)

8.2.7.1. No marks / letter grades shall be allotted for mandatory/non-credit course(s). Only Pass / Fail shall be indicated in Grade Card.

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

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

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

$$\text{CGPA} = \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \} \text{ ... for all S Semesters registered}$$

(ie., upto and inclusive of S Semesters, $S \geq 2$),

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 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 a 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.

11. Declaration of Results

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

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 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 have secured a CGPA ≥ 8.00, at the end of each of the eight (8) sequential semesters, starting from the FIRST year FIRST semester onwards,

iii. 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) ≥ 6.50 but < 8.00, shall be placed in 'FIRST CLASS'.

12.2.4 Students with final CGPA (at the end of the B.Tech. Programme) ≥ 5.50 but < 6.50, 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 < 5.50, 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 section (iii) of 12.2.1 alone shall be eligible for the award of 'college rank' and / or 'gold / silver / bronze medal'.

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

14.1 The student readmitted under changed regulations, shall pass all the courses in the curriculum prescribed for the batch of students which the readmitted student joins subsequently. To fulfill this requirement, the student may have to pass additional courses. The student shall apply to Dean Academics, through HoD, at the beginning of the semester of readmission, for allotment of additional courses to be studied, if any. The BoS of the department will thereupon:

i. examine and establish the equivalence of courses studied in the previous curriculum and the courses prescribed in the curriculum in force

ii. verify the equivalent courses already passed by the student in the previous semesters, and the credits secured thereby, as per the new curriculum

iii. determine and prescribe the additional courses, if any, the student has to pass to fulfill the academic requirements under the new curriculum.

The student must register for additional course(s) at the beginning of the semester during which he desires to study with the approval of the faculty advisor.

14.1.1. The college shall conduct one internal Test in each of the additional courses, at the end of the semester, covering the entire syllabus, for a maximum of 30 marks. The marks obtained in the test shall be considered as the internal marks for the course.

14.1.2. If a student readmitted into AR20 Regulations has any course(s) to be studied in the semester of his re-admission or succeeding semesters with about 80% of the syllabus in common as certified by the BoS with course(s) he has studied under his previous regulations, that particular course(s) shall be substituted for by another course(s) from the list of additional courses the student is required to pass as mentioned in 14.1(iii).

15. Student Transfers

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

15.2 The student seeking transfer to this college from other University/institutions should obtain N.O.C. from the college and apply to Department of Technical Education, Government of Telangana, Telangana State. The student, on transfer, shall pass additional courses, from the courses prescribed in the curriculum of AR20, up to 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.

The rules governing the registration of the additional courses, and award of internal marks, shall be the same as specified in section 14.1

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 thereof inside or outside the examination hall with the mala fide intention of destroying any evidence of use of unfair means.	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.

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 college's 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 subjects 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.

18. Eligibility for award of B. Tech. Degree (LES)

18.1 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.

18.2 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.

18.3 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

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

18.5 Promotion rule

S. No.	Promotion	Conditions to be fulfilled
i	Second year first semester to Second year second semester	Regular course of study of Second year first semester.
ii	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 50% 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.
iii	Third year first semester to Third year second semester	Regular course of study of Third year first semester.
iv	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.
v	Fourth year first semester to Fourth year second semester	Regular course of study of Fourth year first semester.

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

18.7 Punishment for Malpractice

S. No.	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 destroying any evidence of use of unfair means.	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 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 college's 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 subjects 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.

Vision and Mission of the Institution

Vision:

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:

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

Vision and Mission of the Department

Vision:

To provide excellent Electrical and Electronics education by building strong teaching and research environment

Mission:

- To offer high quality graduate program in Electrical and Electronics education and to prepare students for professional career or higher studies.
- The department promotes excellence in teaching, research, collaborative activities and positive contributions to society

Program Educational Objectives

- To prepare students with excellent comprehension of mathematics, basic sciences and engineering subjects facilitating them to find gainful employment or pursue postgraduate program with an appreciation for lifelong learning.
- To inculcate problem solving capabilities in students with analysis, design and practical skills that are Program Specific which would facilitate them to exhibit creativity and innovation that would enable them to develop modern equipment with emerging technologies of multidisciplinary nature for societal development.
- To inculcate positive attitude, professional ethics, effective communication and interpersonal skills which would facilitate them to succeed in the chosen profession through research and development both as team member and as well as leader.

Programme Outcomes

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. 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.

PO3. 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.

PO4. 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.

PO5. 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.

PO6. 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.

PO7. 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.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. 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.

PO11. 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.

PO12. 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:

PSO1: Ability to apply fundamental knowledge to identify, interpret, formulate, design, analyze and investigate various problems of electrical and electronic systems/components and integrate them into generation, transmission, distribution and utilization of electrical energy through conventional and non-conventional energy sources.

PSO2: Ability to apply emerging technologies in the design, simulation and analysis of electrical and electronic systems and demonstrate capabilities of scientific and innovative thinking to meet the technical challenges of the society and industry

SCHEME OF INSTRUCTIONS AND EXAMINATION

B. Tech. (ELECTRICAL AND ELECTRONICS ENGINEERING)

Academic Regulations: AR20 **Academic Year 2020-21**

PROGRAMME STRUCTURE

FIRST YEAR SEMESTER-I

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	20EN11001	English	HSMC	3	-	-	30	70	100	3
2	20MA11001	Basic Engineering Mathematics	BSC	3	1	-	30	70	100	4
3	20PH11001	Solid State Physics	BSC	3	1	-	30	70	100	4
4	20CS11001	Programming for Problem Solving - I	ESC	2	-	-	30	70	100	2
5	20ME11002	Engineering Graphics	ESC	2	-	2	30	70	100	3
6	20EN11L01	English Language Communication skills Lab	HSMC	-	-	2	30	70	100	1
7	20PH11L01	Solid State Physics Lab	BSC	-	-	2	30	70	100	1
8	20CS11L01	Programming for Problem Solving – I Lab	ESC	-	-	2	30	70	100	1
9	20ME11L01	Engineering Workshop	ESC	-	-	2	30	70	100	1
10		Induction Program	MC	-	-	-	-	-	-	-
Total				**13**	**2**	**10**	**270**	**630**	**900**	**20**
Total Periods Per Week				**25**						

Code	Definitions
HSMC	Humanities and Social Sciences including Management courses
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
MC	Mandatory course
PROJ	Project, Internship, Mini Project and Technical Seminar
L	Lecture
T	Tutorial
P/D	Practical/Drawing
CIE	Continuous Internal Evaluation
SEE	Semester End Examination
C	Credits

FIRST YEAR SEMESTER-II

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	20MA12001	Multi Variable Calculus	BSC	3	1	-	30	70	100	4
2	20MA12002	Computational Mathematics	BSC	3	-	-	30	70	100	3
3	20CH12001	Engineering Chemistry	BSC	3	-	-	30	70	100	3
4	20CS12001	Programming for Problem Solving - II	ESC	2	-	-	30	70	100	2
5	20EC12001	Semiconductor Devices and Circuits	ESC	3	1	-	30	70	100	4
6	20MA12L01	Computational Mathematics Lab	BSC	-	-	2	30	70	100	1
7	20CH12L01	Engineering Chemistry Lab	BSC	-	-	2	30	70	100	1
8	20CS12L01	Programming for Problem Solving – II Lab	ESC	-	-	2	30	70	100	1
9	20EC12L01	Semiconductor Devices and Circuits Lab	ESC	-	-	2	30	70	100	1
Total				**14**	**2**	**8**	**270**	**630**	**900**	**20**
Total Periods Per Week				**24**						

SECOND YEAR SEMESTER-I

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	-	-	30	70	100	3
2	20EC21002	Digital Design	ESC	3	-	-	30	70	100	3
3	20EE21002	Electromagnetic Fields	PCC	3	-	-	30	70	100	3
4	20EE21003	Electrical Circuit Analysis	PCC	3	-	-	30	70	100	3
5	20EE21004	Power Electronics	PCC	3	-	-	30	70	100	3
6	20EC21L02	Digital Design Lab	ESC	-	-	2	30	70	100	1
7	20EE21L02	Electrical Circuit Analysis Lab	PCC	-	-	2	30	70	100	1
8	20EE21L03	Power Electronics Lab	PCC	-	-	2	30	70	100	1
9	20EE21P01	Design Thinking*	PROJ	-	-	4	100	-	100	2
10	20EN21P01	English for Effective Communication*	HSMC	-	-	2	100	-	100	1
11	20CH21M01	Environmental Science	MC	2	-	-	-	-	-	-
		Total		**17**	**-**	**12**	**440**	**560**	**1000**	**21**
		Total Periods Per Week		**29**						

*** ACTIVITY ORIENTED NON-LABORATORY COURSE.**

SECOND YEAR SEMESTER-II

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	20MB22004	Engineering Economics and Accounting	HSMC	3	-	-	30	70	100	3
2	20EC22005	Analog Circuits	ESC	3	-	-	30	70	100	3
3	20EE22001	Generation and Utilization of Electrical Energy	PCC	3	-	-	30	70	100	3
4	20EE22002	Electrical Machines – I	PCC	3	-	-	30	70	100	3
5	20EE22003	Signals, Systems and Transform Techniques	PCC	3		-	30	70	100	3
6	20EC22L04	Analog Circuits Lab	ESC	-	-	2	30	70	100	1
7	20EE22L01	Electrical Machines – I Lab	PCC	-	-	2	30	70	100	1
8	20EE22L02	Signals, Systems and Transform Techniques Lab	PCC	-	-	2	30	70	100	1
9	20EN22P01	English for Career Development*	HSMC	-	-	2	100	-	100	1
		Total		**15**	**-**	**8**	**340**	**560**	**900**	**19**
		Total Periods Per Week		**23**						

*** ACTIVITY ORIENTED NON-LABORATORY COURSE.**

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.

THIRD YEAR SEMESTER-I

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	20MA31001	Statistics for Machine Learning	BSC	3	-	-	30	70	100	3
2	20EE31001	Electrical Power Transmission Systems	PCC	3	-	-	30	70	100	3
3	20EE31002	Electrical Machines – II	PCC	3	-	-	30	70	100	3
4	**Professional Elective – I**									
	20EE31003	Power System Protection	PEC	3	-	-	30	70	100	3
	20EE31004	Renewable Energy Systems								
	20EE31005	Electrical Estimation and Costing								
	20EE31006	Special Machines								
5	**Open Elective – I**									
	20CE31061	Building Technology	OEC	3	-	-	30	70	100	3
	20ME31063	Nano Materials and Technology								
	20EC31064	Electronic Measuring Instruments								
	20CS31065	Web Programming								
	20MB31066	Intellectual Property Rights								
6	20EN31L01	Professional Communication Skills (PCS) Lab	HS MC	-	-	2	30	70	100	1
7	20MA31L01	Statistics for Machine Learning Lab	BSC	-	-	2	30	70	100	1
8	20EE31L01	Electrical Machines – II Lab	PCC	-	-	2	30	70	100	1
9	20EE31007	Internship	PROJ	-	-	-	100	-	100	2
10	20MA31P01	Logical Reasoning – I*	BSC	-	-	4	100	-	100	2
11	20CS31M03	Introduction to Cyber Security	MC	3	-	-	-	-	-	-
			Total	**18**	**-**	**10**	**440**	**560**	**1000**	**22**
			Total Periods Per Week	**28**						

*** ACTIVITY ORIENTED NON-LABORATORY COURSE.**

THIRD YEAR SEMESTER-II

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	20EC32007	Computer Architecture and Microprocessors	ESC	3	-	-	30	70	100	3
2	20EE32001	Power System Analysis	PCC	3	-	-	30	70	100	3
3	20EE32002	Control Systems	PCC	3	-	-	30	70	100	3
4	**Professional Elective – II**									
	20EE32003	Smart Grid Technologies	PEC	3	-	-	30	70	100	3
	20EE32004	Energy Conservation and Audit								
	20EE32005	Advanced Power Electronics								
	20EE32006	Electrical Distribution Systems								
5	20EC32L04	Microprocessors and Assembly Language Programming Lab	ESC	-	-	2	30	70	100	1
6	20EE32L01	Power System Simulation Lab	PCC	-	-	2	30	70	100	1
7	20EE32L02	Control Systems Lab	PCC	-	-	2	30	70	100	1
8	20EN32P01	English for Professional Success*	HSMC	-	-	2	100	-	100	1
9	20MA32P01	Logical Reasoning – II*	BSC	-	-	4	100	-	100	2
10	20MB32M04	Professional Ethics	MC	3	-	-	-	-	-	-
			Total	**15**	**-**	**12**	**410**	**490**	**900**	**18**
			Total Periods Per Week	**27**						

*** ACTIVITY ORIENTED NON-LABORATORY COURSE.**

Note: Students have to do Mini Project during the summer vacation which shall be evaluated internally during fourth year first semester.

FOURTH YEAR SEMESTER-I

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	20EE41001	Introduction to AI in Electrical Engineering	PCC	3		-	30	70	100	3
2	20EE41002	Instrumentation and Measurement Techniques	PCC	3	-	-	30	70	100	3
3	**Professional Elective – III**									
	20EE41003	HVDC and FACTS	PEC	3	-	-	30	70	100	3
	20EC41013	Digital Signal Processing								
	20EE41004	Design for Internet of Things								
	20EE41005	Electrical Drives								
4	**Professional Elective – IV**									
	20EE41006	Restructured Power System	PEC	3	-	-	30	70	100	3
	20EE41007	Power System Operation and Control								
	20EC41014	Microcontrollers and Embedded Systems								
	20EE41008	Control Systems Design								
5	**Open Elective – II**									
	20CE41071	Green Buildings	OEC	3	-	-	30	70	100	3
	20ME41073	Digital Fabrication								
	20EC41074	Principles of Communication Systems								
	20CS41075	Knowledge Management								
	20MB41076	Supply Chain Management								
6	20EC41L03	Electronic Design Lab	ESC	-	-	2	30	70	100	1
7	20EE41L01	Instrumentation and Measurement Techniques Lab	PCC	-	-	2	30	70	100	1
8	20EE41009	Project Seminar	PROJ	-	-	2	100	-	100	1
9	20EE41010	Mini Project	PROJ	-	-	-	-	100	100	2
			Total	**15**	**-**	**6**	**340**	**560**	**900**	**20**
			Total Periods Per Week	**21**						

FOURTH YEAR SEMESTER – II

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	-	-	30	70	100	3
2	**Professional Elective –V**									
	20EE42001	Power Quality	PEC	3	-	-	30	70	100	3
	20EE42002	Design of Photovoltaic Systems								
	20EE42003	Distribution System Planning and Automation								
	20EE42004	Hybrid Electric Vehicles								
3	**Open Elective – III**									
	20CE42081	Disaster Management	OEC	3	-	-	30	70	100	3
	20ME42083	Principles of Automobile Engineering								
	20EC42084	Biomedical Instrumentation								
	20CS42085	Data Base Systems								
	20MB42086	Entrepreneurship								
4	20EE42005	Technical Seminar	PROJ	-	-	2	100	-	100	1
5	20EE42006	Project	PROJ	-	-	20	30	70	100	10
		Total		**9**	**-**	**22**	**220**	**280**	**500**	**20**
		Total Periods Per Week		**31**						

Comparison of Credit allocation:

S. No.	Category	Breakup of Credits by GCET	Suggested Breakup of Credits by AICTE
1.	Humanities and Social Sciences including Management courses	14	12
2.	Basic Science Courses	32	26
3.	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computers etc.	28	20
4.	Professional Core courses	44	53
5.	Professional Elective courses relevant to chosen specialization/branch	15	18
6.	Open subjects - Electives from other technical and/or elsewhere	9	18
7.	Project work, seminar and internship in industry or elsewhere	18	11
8.	Mandatory Courses (Environmental Sciences, Induction Program, Indian Constitution, Human Values and Professional Ethics	Non-credit	Non-credit
	Total	**160**	**158**

OPEN ELECTIVES

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

S. No.	Name of the Course	Course Code
1	Building Technology (CE)	20CE22061/20CE31061/20CE32062
2	Industrial Safety and Hazards (EEE)	20EE22062/20EE31062/20EE32062
3	Nano Materials and Technology (ME)	20ME22063/20ME31063/20ME32063
4	Electronic Measuring Instruments (ECE)	20EC22064/20EC31064
5	Web Programming (CSE)	20CS22065/20CS31065/20CS32065
6	Intellectual Property Rights (MBA)	20MB22066/20MB31066/20MB32066

S. No.	Name of the Course	Course Code
1	Green Buildings (CE)	20CE31071/20CE32071/20CE41071
2	Energy Conservation and Management (EEE)	20EE31072/20EE32072/20EE41072
3	Digital Fabrication (ME)	20ME31073/20ME32073/20ME41073
4	Principles of Communication Systems (ECE)	20EC31074/20EC32074/20EC41074
5	Knowledge Management (CSE)	20CS31075/20CS32075/20CS41075
6	Supply Chain Management (MBA)	20MB31076/20MB32076/20MB41076

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

B.Tech. (EEE)
I Year I Sem.
Detailed Syllabus

20EN11001 - ENGLISH

B.Tech. EEE - I Year, I Sem.

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

Prerequisite(s): None.

Course Objectives: The students would develop ability to

1. Improve the language proficiency in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Comprehend any critical aspect effectively using theoretical and practical components of English.
3. Develop Study Skills and Communication Skills in formal and informal situations.
4. Speak proficiently and listen effectively.

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

CO1. Infer /use the vocabulary appropriately in any situation
CO2. Construct meaningful and explicit sentences in written form.
CO3. Acquire basic proficiency in English including reading comprehension and writing skills.
CO4. Communicate confidently in various contexts and different cultures
CO5. Comprehend the given text and respond appropriately.
CO6. Speak proficiently and listen effectively.

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 BOOK(S):

1. English for Engineers, Sudarshana, N.P. and Savitha, C. 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. Practical English Usage, Swan, M. Oxford University Press.
2. Mikulecky Beatrice S & Linda Jeffries, Pearson Publications, 2007

20MA11001 – BASIC ENGINEERING MATHEMATICS

B.Tech. EEE - I Year, I Sem.

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

Prerequisite(s): None.

Course Objectives: The students would 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 from quadratic form into a canonical form through linear transformation.
3. Solve first and higher order differential equations of various types.
4. Analyse 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: At the end of course, the student would be able to

CO1. Write the matrix representation of a set of linear equations and analyze solution of a system of equations using rank of a matrix.
CO2. Deduce eigenvalues and eigenvectors of a matrix and apply the same to reduce quadratic form into a canonical form through linear transformation.
CO3. Identify the type of differential equation and use the appropriate method to solve the same.
CO4. Evaluate various problems using Laplace Transform, Inverse Laplace Transform and apply the convolution theorem to obtain inverse Laplace transforms.
CO5. Apply first and higher order differential equations to solve problems like Newton's law of cooling, Natural growth and decay, Electrical circuits, Simple harmonic motion and Bending of Beams.

UNIT- I

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

Eigen values and Eigenvectors: Linear Transformation and Orthogonal Transformation: *Eigenvalues 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 transforms, 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.

***** - indicates 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.
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 Limited, 4th Edition, 2013.

20PH11001 – SOLID STATE PHYSICS

B.Tech. EEE - I Year, I Sem.

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

Prerequisite(s): None

Course Objectives: The students would develop ability to

1. Understand the fundamental concepts of quantum behavior of matter in its micro state and experimental evidence to dual nature of matter, and physical significance and applications of wave function.
2. Understand the characteristics of intrinsic semiconductor, extrinsic semiconductor, p-n junction diode and Zener diode, and applications of Hall effect.
3. Understand radiative and non-radiative recombination process in semiconductors and working of optoelectronic devices: LED, semiconductor laser, solar cell, PIN, Avalanche Photodiodes and their applications.
4. Understand the basic principles, construction, working and applications of various lasers and optical fibers, and causes for attenuation in optical fibers.
5. Understand different types of dielectric polarization mechanisms, properties and applications of different dielectric and magnetic materials. Understand properties and applications of superconductors,

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

CO1. Explain fundamental concepts of quantum behavior of matter in its microstate and experimental evidence to dual nature of matter, physical significance and application of wave function. BTL 2,3.

CO2. Explain characteristics of intrinsic semiconductor, extrinsic semiconductors, p-n junction diode and Zener diode, and applications of Hall effect. BTL 2, 3

CO3. Distinguish radiative and non-radiative recombination process in semiconductors. Explain the working and applications of optoelectronic devices: LED, semiconductor laser, solar cell, PIN, Avalanche photodiodes. BTL 2, 3.

CO4. Explain the basic principles, construction, working and applications of various lasers and optical fibers, and causes for attenuation in optical fibers. BTL 2, 3

CO5. Explain different types of dielectric polarization mechanisms, properties and applications of different dielectric and magnetic materials. Explain properties and applications of superconductors. BTL 2, 3

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: 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 laser.

Fiber Optics: Introduction, optical fiber as a dielectric wave guide, total internal reflection, acceptance angle, acceptance cone and numerical aperture, step and graded index fibers, losses associated with optical fibers, applications of optical fibers

UNIT-V

Dielectric and Magnetic Properties of Materials: 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 BOOK (S):

1. Engineering Physics, B.K. Pandey, S. Chaturvedi – Cengage Learning.
2. A Textbook of Engineering Physics, Dr. M.N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand Publications.

REFERENCE BOOKS:

1. Fundamentals of Physics, Halliday and Resnick - Wiley Publications
2. Semiconductor Optoelectronics: Physics and Technology, J. Singh, Mc Graw - Hill inc. 1995.
3. A Textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand publications, revised edition.
4. Online Course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptha on NPTEL.
5. Introduction to Solid State Physics, C Kittel, Wiley Publications, 8^{th} edition.

20CS11001- PROGRAMMING FOR PROBLEM SOLVING - I

B.Tech. EEE - I Year, I Sem.

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

Pre-requisite(s): None.

Course Objectives: The students would 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: After completion of the course, student would be able to

CO1. Demonstrate problem solving skills by developing algorithms to solve problems. Incorporate the concept of variables, constants, basic data types and input and output statement in a C language program.

CO2. Incorporate the use of sequential, selection and repetition control statements into the algorithms implemented as computer programs using C language.

CO3. Demonstrate an understanding of structured design by implementing programs with functions and passing of parameters to solve more complex problems.

CO4. Write C programs using 1D and 2D arrays.

CO5. Write C programs using pointers and also with 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 BOOK (S):

1. Computer Science: A Structured Programming Approach Using C, B.A. Forouzan and R.F. Gilberg, Third Edition, Thompson Learning, 2007 Reprint.

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.

20ME1102 - ENGINEERING GRAPHICS

B Tech. EEE - I Year, I Sem.

L	T	P/D	C
2	-	-/2	3

Pre-requisite(s): **None.**

Course objectives: The students would 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: At the end of the course, the student will be able to

CO1: Explain the basic principles of graphics and draw various curves in engineering drawing practice. (BTL 2)
CO2: Construct the engineering scales and orthographic projections of points. (BTL 3)
CO3: Show the orthographic projections of lines and planes. (BTL 2)
CO4: Visualize the projections of solids and its sectional views.(BTL 1)
CO5: Construct the Isometric views and orthographic views of various solids and explain basic AutoCAD commands for engineering drawings. (BTL 6)

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 Solids: 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.

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 BOOK (S):

1. Engineering Drawing N.D. Bhatt / Charotar,53rd Edition, 2016.
2. Engineering Drawing / Basant Agrawal and Mc Agrawal / Mc Graw Hill, 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

20EN11L01- ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

B.Tech. EEE - I Year, I Sem.

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

Prerequisite(s): None.

Course Objectives: The students would develop ability to

1. Facilitate computer-assisted multimedia instruction enabling individualized and independent language learning.
2. Sensitize students to the nuances of English speech sounds, word accent, intonation and rhythm.
3. Bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
4. Improve the fluency of students in spoken English and neutralize their Mother Tongue Influence.
5. Train students to use language appropriately for public speaking and interviews.

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

CO1. Listen actively, speak fluently and write accurately.

CO2. Speak with clarity and confidence reducing MTI and enhance Employability Skills.

CO3. Demonstrate better understanding of nuances of English Language.

CO4. Communicate intelligibly at work place.

CO5. Perform effectively in Interviews.

CO6. Plan and present ideas explicitly.

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 BOOK (S):

1. Speaking English Effectively 2nd Edition by Krishna Mohan & N. P Singh, Mac Millan Publishers, 2011.
2. ELCS Lab Manual 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.

20PH11L01 – SOLID STATE PHYSICS LAB

B. Tech. EEE - I Year, I Sem.

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

Prerequisite(s): None.

Course Objectives: The students would develop ability to

1. Plot the V-I characteristics of LASER.
2. Determine time constant of a RC circuit, energy gap of a given semiconductor, Hall coefficient, work function of a given material and resonant frequency of LCR circuit.
3. Plot V-I characteristics of LED, p-n junction diode and understand the conversion of light into electrical energy.
4. Determine magnetic induction at several points on the axis of coil carrying current.
5. Determine the bending losses of an optical fibre.

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

CO1. Explain the characteristics of a laser.
CO2. Compute time constant of RC circuit and energy gap of semiconductor, identify type of semiconductor, estimate work function of a given material and resonant frequency of LCR circuit.
CO3. Demonstrate the V-I characteristics of LED and p-n junction diode, exhibit knowledge in developing various applications of solar cells.
CO4. Summarize working principle of electromagnetic induction.
CO5. Explain the causes for loss of optical signal in optical fiber.

LIST OF EXPERIMENTS:

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 fibers.

20CS11L01 - PROGRAMMING FOR PROBLEM SOLVING - I LAB

B.Tech. EEE - I Year, I Sem.

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

Pre-requisite(s): None.

Course Objectives: The students would 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: At the end of course, the student would be able to

CO1. Demonstrate problem solving skills by developing algorithms to solve problems. Incorporate the concept of variables, constants, basic data types and input and output statement in a C language program.

CO2. Incorporate the use of sequential, selection and repetition control statements into the algorithms implemented as computer programs using C language.

CO3. Demonstrate an understanding of structured design by implementing programs with functions and passing of parameters to solve more complex problems.

CO4. Write C programs using 1D and 2D arrays.

CO5. Write C programs using pointers and also with dynamic memory allocation.

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
    i. < 30 % - Fail
    ii. Between 31 and 50 – C grade
    iii. Between 51 to 60 – B grade
    iv. Between 61 to 75 – A grade
    v. 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
a. 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

20ME11L01– ENGINEERING WORKSHOP

B. Tech. EEE - I Year, I Sem.

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

Prerequisite(s): None.

Course Objectives: The students would develop ability to

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

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

CO1. Identify and apply suitable tools for manufacturing a engineering components using different trades of engineering processes. – BTL3
CO2. Explain basic operations of welding, fitting, smithy and carpentry work. – BTL2
CO3. Analyse of the various electrical equipment connections and their operation – BTL4
CO4. Demonstrate an understanding of and comply with workshop safety regulations. – BTL2
CO5. Demonstrate and practice on machine tools and their operations – BTL2

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

I. TRADES FOR EXERCISES:

A. Carpentry exercises:

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

B. Fitting exercises:

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

C. Tin-Smithy exercises:

a. Make an Open scoop with soldering from given G.I. sheet as for the job drawing

b. Make a Rectangular tray with soldering from given G.I. sheet as for the job drawing

c. Make a Cylinder with soldering from given G.I. sheet as for the job drawing

d. Make a 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. Make an "S-Hook" from given piece of mild steel rod by hand forging.

b. Make a "U-Hook" from given piece of mild steel rod by hand forging.

c. Make a "C-Hook" from given piece of mild steel rod by hand forging.

d. Make a "Flat chisel" from given piece of mild steel rod by hand forging.

E. House-wiring exercises:

a. Wiring of simple light circuit for controlling light/fan point (PVC conduit wiring)

b. Wiring of 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. Wiring for a water pump with single phase starter.

F. Foundry exercises:

a. Prepare a mould for the given single piece pattern in green sand.

b. Prepare a mould for the given split piece pattern in green sand.

G. Welding Practice exercises:

a. Prepare simple butt joint by electric arc welding from given pieces of mild steel.
b. Prepare lap joint by electric arc welding from given pieces of mild steel.
c. Prepare corner joint by electric arc welding from given pieces of mild steel.

II. TRADES FOR DEMONSTRATION AND EXPOSURE:

a. **Machine Shop:** Demonstration and applications of drilling machine, grinding machine and lathe.

b. **Plumbing:** Various plumbing tools and its functions

c. **Disassembling and reassembling:** Tailstock of a lathe, cylinder piston of an engine and Bicycle or any machine.

B.Tech. (EEE)
I Year II Sem
Detailed Syllabus

20MA12001 – MULTI VARIABLE CALCULUS

B.Tech. EEE - I Year, II Sem.

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

Prerequisite(s): 20MA11001 – Basic Engineering Mathematics

Course Objectives: The students would 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/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. Solve partial differential equations using method of separation of variables and their applications to solve heat and wave equations.

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

CO1. Apply the method of Lagrange Multipliers to solve such constrained optimization problems, evaluate improper integrals,

CO2. Compute surface areas and volumes of revolutions of curves using definite integrals, multiple (Double and Triple) integrals and apply the concepts of same to find the areas and volumes

CO3. Calculate scalar potential for a vector and directional derivative of a scalar point function.

CO4. **C**ompute length of a curve, area between the surfaces and volumes of solids using vector integrations.

CO5. Apply method of separation of variables to solve problems like one dimensional wave and heat equations that arise in engineering branches.

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

TEXT BOOK (S):

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.
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 Limited, 4th Edition, 2013.

20MA12002 - COMPUTATIONAL MATHEMATICS

B.Tech. EEE - I Year, II Sem.

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

Prerequisite(s): 20MA11001-Basic Engineering Mathematics

Course Objectives: The students would develop ability to

1. Construct a polynomial to satisfy the given set of data.
2. Calculate differentiation and integration for a given set of data/function using various numerical techniques.
3. Apply various numerical techniques to compute approximate solution of a given first order ordinary differential equation with initial condition.
4. Apply the method of least squares to find the best fit curve for the given set of data and calculate approximate zeros of an algebraic/transcendental equations.
5. Calculate solution of system of equations using various numerical methods

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

CO1. Construct a polynomial to satisfy the given tabulated (equally/unequally spaced) data and explore it.

CO2. Apply various numerical techniques to find the approximate differentiation and integration for a given set of data/function.

CO3. Estimate a solution of first order ordinary differential equation with initial condition using various numerical techniques.

CO4. Apply the method of least squares to find the best fit curve for the given set of data and estimate roots of given algebraic /transcendental equations by various numerical methods.

CO5. Apply various numerical methods to find the approximate solution of system of equations

UNIT-I

Interpolation: Introduction, Errors in polynomial Interpolation, Finite Differences: Forward Differences, Backward Differences, Central Differences, Symbolic relations and separation of symbols, Difference Equation: Formation and Complimentary function.

Interpolation with equal and unequal intervals: Newton's forward and backward difference formulae, Lagrange's interpolation formula.

UNIT-II

Numerical Differentiation, Integration: Numerical differentiation: Derivatives using Newton's forward and backward interpolation formula.

Numerical integration: General quadrature formula for equidistant ordinates, Trapezoidal rule, Simpson's $1/3^{rd}$and $3/8^{th}$Rule.

UNIT-III

Numerical Solutions of First Order Differential Equations: Numerical Solution of Ordinary Differential Equations: Taylor's series method, Picard's method of successive Approximation, Single Step Methods for Linear Differential Equations: Euler's method, Euler's modified method, Runge-Kutta fourth order method.

UNIT-IV

Curve Fitting and Root Finding Methods: Fit a straight line, Second degree polynomial, Exponential curve and Power curve by method of least squares.

Solution of Algebraic and Transcendental Equations: Bisection Method, Regula-Falsi Method, Iteration Method, Newton-Raphson Method.

UNIT-V

Numerical Methods for System of Equations, Eigenvalue Problems: Solving system of linear non-homogeneous equations: L-U Decomposition method (Crout's Method), Jacobi's and Gauss-Seidel Iteration methods.

Numerical computation of Eigenvalues and Eigenvectors using Power method

TEXT BOOK (S):

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. Introductory methods of Numerical Analysis by S.S. Sastry, PHI learning.
2. Advanced Engineering Mathematics, Michael Greenberg, Second Edition. Pearson Education.
3. Numerical Methods in Engineering & Science with Programs in C, C++ & MATLAB, B. S. Grewal, Khanna Publishers, 10th Edition, 2012.

20CH12001– ENGINEERING CHEMISTRY

B. Tech. EEE - I Year, II Sem.

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

Prerequisite(s): None.

Course Objectives: The students would develop ability to

1. Impart the knowledge of atomic, molecular and electronic modifications for understanding properties of complexes.
2. Acquire the knowledge of various water treatment methods to resolve the problem of water hardness.
3. Understand the essential concepts of electro chemistry and corrosion with a perspective of their industrial applications.
4. Learn the synthetic aspects of drugs and polymers through organic reaction mechanisms.
5. Understand the significance of various spectroscopic techniques and their application in medical and other fields.

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

CO1. Apply the concepts of atomic, molecular and electronic changes for the calculation of CFSE and magnetic moments in complexes.
CO2. Analyse ground water and choose an appropriate treatment method for domestic and industrial applications.
CO3. Interpret the concepts of electrochemistry for the construction of batteries and understanding corrosion for its prevention.
CO4. Explain various reaction mechanisms and apply them in the synthesis of organic compounds of industrial significance.
CO5. Use the principles of various spectroscopic techniques in medicine and other fields.

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 ionization. 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: 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).

Corrosion: 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: 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 alkyl halides, Saytzeff's rule. 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 BOOK (S):

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. Thirumala Chary, 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.

20CS12001 – PROGRAMMING FOR PROBLEM SOLVING - II

B.Tech. EEE - I Year, II Sem.

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

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

Course Objectives: The students would 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: At the end of the course, student would be able to

CO1. Implement string functions and use the type definition, enumerated types, define and use structures, unions in programs using C language.
CO2. Ability to implement linear lists in programs using C language.
CO3. Write programs that sort data using selection, quick, insertion sort techniques and perform search mechanisms either by sequential or binary search techniques using C language program.
CO4. Demonstrate the basic operations of stacks and queues using C program.
CO5. Write programs that read and write text, binary files using the formatting and character I/O functions.

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 BOOK(S):

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.

20EC12001 - SEMICONDUCTOR DEVICES AND CIRCUITS

B.Tech. EEE - I Year, II Sem.

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

Pre-requisite(s): 20**PH11001 – Solid State Physics**

Course objectives: The students would 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, student would be able to

CO1. Explain the working principles of various diodes
CO2. Explain diode as a rectifier and the operation of BJT
CO3. Design various biasing circuits for BJT
CO4. Explain the operation of Field Effect Transistors
CO5. 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 BOOK(S):

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.

20MA12L01 - COMPUTATIONAL MATHEMATICS LAB

B.Tech. EEE - I Year, II Sem.

L	T	P/D	C
0	0	2/-	1

Prerequisite(s): 20CS11L01-Programming for Problem Solving–I Lab

Course Objectives: The students would develop ability to

1. Estimating the value of a function for any intermediate value of the independent variable.
2. Evaluate the solution of definite integrals for a given set of data using numerical integration methods.
3. Apply various numerical techniques to compute approximate solution of a given first order ordinary differential equation with initial condition.
4. Estimate zeros of an algebraic/transcendental equations using Bisection, Newton-Raphson method and Regula-Falsi Method.
5. Calculate the solution of a system of linear equations using L-U decomposition, Gauss-Seidel method, power method and Gauss Jordan method.

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

CO1. Determine the values of y corresponding to any value of $x = x_i$ between x_0 and x_n.
CO2. Calculate approximate area by applying various Numerical integration techniques.
CO3. Determine a solution of a first order ordinary differential equation with the initial condition using various numerical techniques.
CO4. Apply suitable numerical methods to find the approximate root / solution of algebraic / transcendental equations.
CO5. Estimate the solution of system of linear equations using various methods.

LIST OF PROGRAMS:

1. Program to determine y for a given x, if two arrays of x and y of same size are given (using Newton's forward interpolation method).
2. Program to determine y for a given x, if two arrays of x and y of same size are given (using Newton's backward interpolation method).
3. Program to determine y for a given x, if two arrays of x and y of same size are given (using Lagrange's interpolation).
4. Program to evaluate definite integral using trapezoidal rule, Simpson's $1/3^{rd}$ rule and $3/8^{th}$ rule.
5. Program to solve a given first order ordinary differential equation with initial condition using Runge-Kutta fourth order method.
6. Program to find the root of algebraic / transcendental equation by using Program to solve a given first order ordinary differential equation with initial condition using Modified Euler's method.
7. Program to find the root of algebraic / transcendental equation by using Bisection method and Newton-Raphson method.

8. Program to find the solution of given system of linear non-homogeneous equations using L-U decomposition method.
9. Program to find the solution of given system of linear non-homogeneous equations using Gauss-Seidel iteration method.
10. Program to compute largest eigenvalue and eigenvectors of a given matrix using Power method.

Additional Programs:

1. Program to find the solution of given system of linear non-homogeneous equations using Gauss Jordan elimination method.
2. Program to find the best fit of straight-line ($y = a + bx$) for the given data by the Method of Least squares.
3. Program to find the root of algebraic/transcendental equation by using Regula-Falsi Method.

20CH12L01 - ENGINEERING CHEMISTRY LAB

B. Tech. EEE - I Year, II Sem.

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

Prerequisite(s): None.

Course objectives: The students would 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 parameters like hardness content in water and validate water for its potability.
CO2. Find the concentration of given solution using instrumental techniques such as Potentiometry and Conductometry.
CO3. Determine physical properties like surface tension, adsorption, acid value and viscosity.
CO4. Use preparatory techniques which are fundamental in the synthesis of 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

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

B. Conductometry

5. Estimation of HCl by Conductometric titrations.
6. Estimation of Acetic acid by Conductometric titrations.

III. Physical Constants

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

III. Synthesis

9. Synthesis of Aspirin.

V. Kinetics

10. Determination of rate constant of acid catalysed hydrolysis of methyl acetate.

VI. Additional Experiments

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

20CS12L01 – PROGRAMMING FOR PROBLEM SOLVING - II LAB

B.Tech. EEE - I Year, II Sem.

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

Pre-requisite(s): 20CS11L01 – Programming for Problem Solving – I lab

Course Objectives: The students would 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: At the end of the course, student would be able to

CO1. Implement string functions and use the type definition, enumerated types, define and use structures, unions in programs using C language.
CO2. Ability to implement linear lists in programs using C language.
CO3. Write programs that sort data using selection, quick, insertion sort techniques and perform search mechanisms either by sequential or binary search techniques using C language program.
CO4. Demonstrate the basic operations of stacks and queues using C program.
CO5. Write programs that read and write text, binary files using the formatting and character I/O functions.

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

18PH12L1 - SEMICONDUCTOR DEVICES AND CIRCUITS LAB

B.Tech. EEE - I Year, II Sem.

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

Pre-requisite(s): None

Course Objectives: The students would 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.

B.Tech. (EEE)
II Year I Sem.
Detailed Syllabus

20MA21001– THEORY OF COMPLEX VARIABLES

B.Tech. EEE - II Year, I Sem.

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

Prerequisite(s): 20MA12001- Multi Variable Calculus

Course Objectives: The students would 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. Test analyticity of a given function using Cauchy-Riemann equations and find complex function for given real or imaginary parts.

CO2. Evaluate integrals of complex valued functions by applying Cauchy's theorem, Cauchy's integral formula including Generalized one.

CO3. Express analytic functions as infinite power series which leads to Taylor's and Laurent series and test its convergence and also able to identify the singularity.

CO4. Compute several kinds of real definite integrals using residue theorem.

CO5. Apply conformal, standard and bilinear transformations to transform a given complex valued function from Z-plane to W-Plane.

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 integrals of the type 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 BOOK (S):

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. 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.

20EC21002 – DIGITAL DESIGN

B.Tech. EEE - II Year, I Sem.

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

Prerequisite(s): None.

Course Objectives: The students would 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, student would be able to

CO 1. Perform conversions from one number system to another.
CO 2. Simplify switching functions using Boolean minimization theorems, map method and tabulation method.
CO 3. Analyze and design combinational logic circuits and the effect of Static Hazards on these circuits.
CO 4. Synthesize symmetric functions using relay contact networks.
CO 5. Design switching circuits using threshold elements.
CO 6. Analyze and design Sequential logic Circuits.

UNIT-I

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 BOOK (S):

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

20EE21002 – ELECTROMAGNETIC FIELDS

B.Tech. EEE - II Year, I Sem.

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

Prerequisite(s): 20PH11001 - Solid State Physics
20MA12001 - Multivariable Calculus

Course Objectives: The students would develop ability to

1. Calculate electric fields in different coordinates for various charge configurations using Coulomb's law and Gauss's law.
2. Understand electric polarization and estimate the torque on an electric dipole in an external electric field.
3. Calculate magnetic fields in different coordinates for various current configurations using Biot-Savart's law and Ampere's law.
4. Estimate the force on a current carrying conductor in electric and magnetic fields.
5. Understand the modifications in Maxwell's equations for time varying Electric and Magnetic fields.

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

CO1. Calculate the field intensity for distribution of charges namely, point, line and surface.
CO2. Determine the torque on an electric dipole and understand the difference between conductors and insulators.
CO3. Compute magnetic field intensity due to different current distributions by applying Biot-Savart's law and Ampere's circuital law.
CO4. Calculate magnetic forces for circular, square and solenoid current distributions.
CO5. Determine the relation between time varying Electric and Magnetic fields and hence deduce Maxwell's equations for time varying electromagnetic fields

UNIT-I

Electrostatic Fields: Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge – Work done in moving a point charge in an electrostatic field – Electric Potential – Properties of potential function – Potential gradient – Gauss law in point and integral form – Application of Gauss Law.

UNIT-II

Electric Dipole: Electric dipole – Dipole moment – Potential and EFI due to an electric dipole – Torque on an Electric dipole in an electric field. Conductors and insulators, electric field inside a dielectric material - polarization, capacitance. Energy stored and energy density in a static electric field – Current density – conduction and Convection current densities – Ohm's law in point form – Equation of continuity.

UNIT-III

Magneto Statics: Static magnetic fields – Biot - Savart's law – Magnetic field intensity (MFI) – MFI due to a straight current carrying filament – MFI due to circular, square and solenoid current – Carrying wire – Relation between magnetic flux, magnetic flux density and MFI – div(B)=0. Magnetic circuits - concept of self and mutual inductance-dot convention - coefficient of coupling-composite magnetic circuit-analysis of series and parallel magnetic circuits.

UNIT-IV

Ampere's Circuital Law and its Applications: Ampere's circuital law and its applications viz. MFI due to an infinite sheet of current and a long current carrying filament – Point form of Ampere's circuital law Curl (H)=Jc, Field due to a circular loop, rectangular and square loops. Magnetic force - Moving charges in a Magnetic field – Lorentz force equation – force on a current element in a magnetic Field. Force between two current carrying conductors. Magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field. Energy stored and density in a magnetic field.

UNIT-V

Time Varying Fields: Time varying fields – Faraday's laws of electromagnetic induction – Its integral and point forms, Curl (E)=-dB/dt – Statically and Dynamically induced EMFs – Simple problems -Modification of Maxwell's equations for time varying fields – Displacement current.

TEXT BOOK (S):

1. "Engineering Electromagnetics" by William H. Hayt and John. A. Buck Mc. Graw-Hill Companies, 7th Edition 2009.
2. "Electromagnetic Fields" by Sadiku, Oxford Publications

REFERENCE BOOKS:

1. "Introduction to Electro Dynamics", D J Griffiths, Printice hall of ndiapvt.Ltd.
2. "Electromagnetics-Problems and solutions", William H.Hayt&John.A. Buck McGraw Hill Companies.
3. "Electromagnetic Fields", Y.Mallikarjuna Reddy, Universities Press.

20EE21003 - ELECTRICAL CIRCUIT ANALYSIS

B.Tech. EEE - II Year, I Sem.

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

Pre-requisite(s): 20MA11001 – Basic Engineering Mathematics

Course Objectives: The students would develop ability to

1. Understand basic concepts of electrical circuits and different analysis techniques with DC and AC excitations.
2. Apply theorems to electrical circuits with DC and AC excitations.
3. Plot Locus diagrams of admittance and Impedance of R. L and C circuits.
4. Analyse different resonance conditions.
5. Plot and analyse network graphs for any Electrical Network.
6. Estimate Network Parameters of Two port Networks.
7. Analyse the transients of R, L and C circuits with DC and AC excitations.
8. Design a Filter Circuit.

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

CO1. Know the basic concepts of electrical circuits and solve different electrical circuits with DC and AC excitations
CO2. Solve Electrical networks using theorems
CO3. Obtain Locus of Impedance and Admittance of R. L and C circuits.
CO4. Calculate different resonance parameters.
CO5. Obtain network graphs for any Electrical Network
CO6. Calculate Two Port network parameters.
CO7. Perform Transient analysis of R. L and C circuits.
CO8. Calculate design parameters of a filter circuit.

UNIT-I

Basic Circuit Concepts: Types of Network Elements, V & I relationships. Network reduction techniques and Network analysis.

Single phase AC circuits: Basic parameters and calculations, steady state analysis of R, L and C combinational circuits. Concept of Power and Power Factor.

UNIT-II

Introduction to Three phase circuits: Basic concepts: Phase sequence, Line and Phase values and their relationship.

Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer Theorems

UNIT-III

Locus Diagrams: Locus of Impedance and Admittance with R, L and C Series and Parallel Combinations with variation of various parameters.

Resonance: In Series and Parallel circuits with R, L and C Series and Parallel Combinations.

UNIT-IV

Network topology: Basic Definitions, Network analysis using Cut set and Tie set. Dual Networks.

Two port Networks and Network functions: Calculation of Z, Y, ABCD and Hybrid Parameters. Network functions for one port and two port networks.

UNIT-V

Transient Analysis: Transient response of R, L and C combinational circuits using DC and Sinusoidal excitations.

Filter Circuits: Low pass, High Pass, Band Pass and Band elimination filter design. Constant k-Type and m-type filters

TEXT BOOK(S):

1. Engineering Circuit Analysis - William Hayt, Jack E. Kemmerly, S M Durbin, Mc Graw Hill Companies.
2. Electrical Circuits: An Introduction - KCA Smith & RE Alley, Cambridge University Press.

REFERENCE BOOK(S):

1. Electric Circuit Analysis - K. S. Suresh Kumar, Pearson Education.
2. Electric Circuits - A. Chakrabarhty, Dhanpat Rai & Sons.
3. Electrical Circuits - David A. Bell, Oxford University Press.
4. Network Analysis and Circuits - M. Arshad, Infinity Science Press.
5. Circuits - A. Bruce Carlson, Cengage Learning.

20EE21004 - POWER ELECTRONICS

B Tech. EEE - II Year, I Sem.

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

Pre-requisite(s): **20EC12001 Semiconductor devices and Circuits**

Course objectives: The students would develop ability to

1. Understand the need for power conversion
2. Understand the operation, turn on and turn off techniques of different power electronic switches.
3. Understand the circuit configurations for different power conversions (AC to DC, DC to DC, AC to AC, DC to AC).
4. Interpret the application areas for power electronic converters

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

CO1. Identify the need for power conversion and major application areas
CO2. Analyse different converter configurations for AC to DC power conversion.
CO3. Realize the need for DC to DC power conversion and analyse different configurations
CO4. Analyse AC voltage and frequency conversion circuit configurations
CO5. Apply different DC to AC conversion techniques and analyze different configurations.

UNIT-I

Introduction to Power Conversion: Introduction to power electronics –Review of power semiconductor devices - Study of MOSFET, IGBT, Thyristors (SCR): Basic operation & characteristics- turn-on and turn-off methods (only for SCR).

UNIT-II

Phase Controlled Rectifiers: Basic concept of AC to DC conversion - Concept of controlled and uncontrolled rectifiers - Phase angle control technique – Concept of commutation – Single phase and three phase half wave and full wave-controlled rectifiers with R, RL and RLE loads (bridge and mid-point configuration)

UNIT-III

DC Choppers: Choppers – Control strategies – Step down, step up and step up/down choppers with R, RL and RLE loads, Introduction to chopper-based motor control.

UNIT-IV

AC- AC Converters: Single phase AC voltage controllers with R & RL loads: Thyristor and TRIAC based–Single phase cyclo-converters: Mid-point configuration, Step up and step down, R and RL load (Principle of operation only)

UNIT-V

Inverters: Single phase half and full bridge and three phase VSI and CSI: Operation with R and RL loads, Waveforms- Voltage control techniques for inverters- Pulse width modulation techniques – Numerical, Applications of power electronic converters (with block diagrams).

TEXT BOOK (S):

1. Power Electronics: Circuits, Devices and Applications– by M. H. Rashid, Prentice Hall of India, 4th edition, 2017.
2. Power Electronics – by Vedam Subramanyam, New Age International (P) Limited, Publishers

REFERENCE BOOKS:

1. Power Electronics by M. D. Singh & K. B. Kanchandhani, Tata McGraw Hill Publishing Company, 2nd edition, 2017.
2. Power Electronics - by V. Ramoorthy , 1 edition -2005, OXFORD University Press
3. Power Electronics-by P. C. Sen,Tata Mc Graw-Hill Publishing.
4. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradra, A. Joshi and R. M. K. Sinha, New Age International (P) Limited Publishers, 1996.
5. Power Electronics by P. S. Bhimbra, Khanna Publishers.

20EC21L02– DIGITAL DESIGN LAB

B.Tech. EEE - II Year, I Sem.

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

Prerequisite(s): None.

Course Objectives: The students would 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 course, the student would be able to

CO1. Analyze the functionality of various logic gates using ICs
CO2. Analyze the operation of various Combinational logic circuits using ICs
CO3. Analyze the behaviour 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

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 bits carry lookahead adder using Full Adders.

20EE21L02 - ELECTRICAL CIRCUIT ANALYSIS LAB

B. Tech. EEE - II Year, I Sem.

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

Prerequisite(s): None.

Course Objectives: The students would develop ability to

1. Verify network theorems using physical electrical elements.
2. Plot various locus diagrams of electrical circuits.
3. Understand the concept of resonance
4. Understand the concept of self and mutual inductance.
5. Estimate the network parameters.
6. Understand basic concepts of transient analysis.
7. Estimate the input, output voltages and currents of a 3-phase transformer.

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

CO 1: Apply different theorems to different practical circuits.
CO 2: Determine the locus of Impedance and Admittance of different electrical circuits.
CO 3: Determine the resonance conditions of different electrical circuits.
CO 4: Calculate Self and mutual inductance of a magnetic circuit.
CO 5: Calculate two port network parameters.
CO 6: Obtain the transient response of different electrical circuits with DC and AC excitations.
CO 7: Calculate the line and phase voltages of a 3-phase transformer.

LIST OF EXPERIMENTS:

1. Verification of Superposition theorem and Millman's Theorem
2. Verification of Thevenin's and Norton's theorem
3. Verification of Maximum Power and Reciprocity Theorem
4. Locus diagram of R, L and C combinational Circuits
5. Resonance of R, L and C combinational circuits
6. Determination of Self and mutual Inductance
7. Determination of Z and Y parameters
8. Determination of ABCD and Hybrid parameters
9. Transient Response of R, L and C combinational circuits. with DC excitation.
10. Line and Phase Voltage and Current relationships of a 3-phase transformer.

ADDITIONAL EXPERIMENTS:

1. Verification of Telligen's and Compensation Theorems.
2. Mesh and Nodal analysis

20EE21L03 – POWER ELECTRONICS LAB

B.Tech. EEE - II Year, I Sem.

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

Pre-requisite(s):20EC12L01–Semiconductor Devices and Circuits Lab

Course Objectives: The students would develop ability to

1. Understand the characteristics of three terminal devices like SCR, MOSFET and IGBT.
2. Understand the operation of different firing circuits for SCR
3. Understand the operation and implementation of different converters

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

CO1. Distinguish the characteristics of the switches

CO2. Compare and apply different firing techniques of SCR

CO3. Perform the conversion from AC to DC with different configuration (1 – Phase and 3 – Phase)

CO4. Implement different DC to DC conversion circuits

CO5. Perform AC to AC conversion

CO6. Perform DC to AC conversion.

LIST OF EXPERIMENTS:

1. Characteristics of SCR, MOSFET and IGBT.
2. Firing circuits of SCR
3. Single phase thyristor based controlled rectifier with R and RL load
4. DC chopper
5. AC voltage controller
6. Frequency conversion by single phase cycloconverter.
7. Inverter with R and RL load.
8. Simulation of three phase fully controlled rectifier with R and RL load
9. Simulation of IGBT based step-up and step-down DC chopper.
10. Simulation of three phase inverter with R and RL load.

ADDITIONAL EXPERIMENTS:

1. Simulation of frequency control using inverter
2. Series and Parallel inverter

Note: All the simulation experiments are to be simulated using MATLAB / Sci-lab /Octave / PSPICE software or any other equivalent software

20EE21005 - DESIGN THINKING

B. Tech. EEE - II Year, I Sem.

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

Prerequisite(s): None.

Course Objectives: The students would 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 course, the student would be able to

CO1. Understand the need for innovation, design thinking process, demonstrate relative abilities, and problem-solving methods.
CO2. Apply design thinking approach to real world problems.
CO3. Analyze and synthesize the right problem based on customer need and value perception.
CO4. Demonstrate solution through different types of prototypes, evaluate, refine idea, develop final solution.

Module-I:

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-II:

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

Module-III:

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

Module-IV:
Ideate Process, exploring concept canvas, developing suitable concepts to learn and improve.

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

Module-VI:
Delivering the solution, Embodiment phase of product development, Product Design, Service Design,

Module II to Module VI are to be based on assignments and/or mini projects.

TEXT BOOK (S):
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, and the act or practice of using your mind to consider design, ava academia

20EN21001 - ENGLISH FOR EFFECTIVE COMMUNICATION

B. Tech. EEE - II Year, I Sem.

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

Prerequisite(s): None.

Course Objectives: The students would develop ability to

1. Delineate the contextual meaning of various words and their functions in a sentence.
2. Equip themselves with English language skills related to Vocabulary.
3. Improve English language proficiency with an emphasis on Reading skills.
4. Develop study skills related to Critical Writing

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

CO1. Use words contextually and to communicate effectively.

CO2. Comprehend passages and make the right inferences.

CO3. Apply critical thinking abilities to make reasoned conclusions.

CO4. Inculcate the habit of using advanced vocabulary to be expressive.

Module-I

History of Words: Etymology: Word Origin, Advanced word roots, words borrowed from different languages to English, Portmanteau words**,** also called blended 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.

REFERENCE BOOKS:

1. Lewis Norman: Word Power Made Easy, Goyal Publisher, 2011.
2. Fernald James Champlin, Synonyms and Antonyms, Project Gutenberg, www.gutenberg.net

20CH21M01 - ENVIRONMENTAL SCIENCE

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

B. Tech. EEE - II Year, I Sem.

Prerequisite(s): None.

Course Objectives: The students would 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 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 BOOK (S):

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.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

B.Tech. (EEE)
II Year II Sem.
Detailed Syllabus

20MB22004 - ENGINEERING ECONOMICS AND ACCOUNTING

B. Tech. EEE - II Year II Sem.

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

Prerequisite(s): None.

Course Objectives: Students would develop ability to

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

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

CO1. Understand Business and the impact of economic variables on them.
CO2. Understand the Demand, Supply concepts.
CO3. Analyse the Production, Cost, Market Structure, Pricing aspects.
CO4. Understand capital structure.
CO5. Study the Financial Statements of a Company.

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 BOOK (S):

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 BOOKS:

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

20EC22007- ANALOG CIRCUITS

B.Tech. EEE - II Year II Sem.

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

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

Course objectives: Student would develop ability to

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

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

CO1. Analyse single stage amplifiers at mid-band, low frequency and high frequency regions.
CO2. Analyse multistage BJT amplifiers in mid frequency region.
CO3. Analyse different types of feedback amplifiers using transistors.
CO4. Design and analyse different types of oscillators using transistors.
CO5. Explain different types of power amplifiers and compare them in terms of efficiency.

UNIT-I

Single Stage Amplifiers: Approximate h-parameter model of BJT. Effect of coupling and bypass capacitors on the gain of an amplifier. The Hybrid- pi Common Emitter Transistor Model and its analysis, FET low and high frequency models and its analysis. Design of Single stage BJT and FET amplifiers for given specifications.

UNIT-II

Multi Stage Amplifiers: Cascading of amplifiers and its corresponding frequency response under various coupling methods. Analysis of two-stage RC coupled CE amplifier. Cascade Amplifier and Darlington Pair.

UNIT-III

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

UNIT-IV

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

UNIT-V

Large Signal Amplifiers: Classification of power amplifiers, 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.

TEXT BOOK (S):

1. Millman's Electronic Devices and Circuits – J. Millman, C.C. Halkias, and Satyabrata Jit, 2nd Ed. 1998, TMH.
2. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, 9th Edition, 2006, PHI.

REFERENCE BOOKS:

1. Integrated Electronics, Jacob Millman and Christos C Halkias, 1991 Ed., 2008, TMH.
2. Electronic Circuits: Discrete and Integrated, Donald L.Schilling and Charle Belove, TMH.

20EE22001- GENERATION AND UTILIZATION OF ELECTRICAL ENERGY

B. Tech. EEE - II Year II Sem.

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

Prerequisite(s): None

Course Objectives: Students would develop ability to

1. To understand basic principles of power generation, Hydraulic Turbines.
2. To understand the functioning of hydel, thermal and nuclear power stations.
3. Understand the economic aspects of power generation.
4. To study the basic principles of illumination and different types of heating and welding techniques
5. To understand the basic principle of electric traction systems including speed–time curves of different traction systems.

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

CO 1: Distinguish and analyze different types of power generation and turbines.
CO 2: Identify hydel, thermal and nuclear power stations and draw their layouts.
CO 3: Calculate cost of generation and other tariffs.
CO 4: Estimate the levels of illumination and heating & welding techniques.
CO 5: Determine the speed/time characteristics of different types of traction systems.

UNIT-I

Basic concepts of power generation: Introduction to different sources of energy and their application to generation. Single Line Diagram of Power systems.

Turbines: Classification and performance of turbines

Hydel Power Plant: Layout of Hydel Power plants and its classification, base load and peak load station.

UNIT-II

Thermal Power Stations: Line diagram and working of Thermal Power Station (TPS)

Nuclear Power Stations Principle of operation of Nuclear reactor and reactor Components-Types of Nuclear reactors and brief description of PWR, BWR and FBR.

UNIT-III

Economic Aspects of Power Generation and Tariff: Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors - Numerical Problems. Cost of generation and their division. Desirable characteristics and methods of Tariff: Flat Rate, Block-Rate, two-part, three –part, and power factor tariff methods and Numerical Problems.

UNIT–IV

Illumination: Introduction - terms used in illumination–Laws of illumination–Lumen or flux method of calculation - Types and design of lighting (Numerical Problems).

Electric Heating & Welding: Advantages and methods of electric heating– Arc furnaces – Direct and indirect arc furnaces. Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding.

UNIT-V

Electric Traction: System of electric traction and track electrification– Special features of traction motor. Methods of electric braking: Plugging, rheostat braking, Regenerative braking. Mechanics of train movement–Speed– time curves for different services – Trapezoidal and quadrilateral speed time curves.

Tractive effort calculations– Effect of varying acceleration and braking retardation–Adhesive weight and coefficient of adhesion.

TEXT BOOK (S):

1. "Generation, Distribution and Utilization of Electrical Energy", by C. L. Wadhwa, New age international (private) Limited.
2. "Power System Engineering" by A. Chakrabarti, M. L. Sony, P.V. Gupta, U.S. Bhatnagar, Dhanpatrai & co (P) Limited, Publishers 2008.

REFERENCE BOOKS:

1. Principles of Power Systems - V.K Mehta and Rohit Mehta S. Chand and Company Ltd
2. A Course in Power Systems by J.B. Gupta, S. K. Kataria & Sons publications
3. Utilisation of Electrical Power by Er. R.K. Rajput, Laxmi publications, latest version 2016

20EE22002 – ELECTRICAL MACHINES - I

B.Tech. EEE - II Year II Sem.

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

Prerequisite(s): 20EE21002-Electromagnetic Fields

Course Objectives: Student would develop ability to

1. Understand the fundamental principles of Electro-mechanical energy conversion.
2. Understand the fundamental principles of operation of Electrical machines and the characteristics of DC Machines and Transformers.
3. Understand the machine windings and the MMF pattern of armature and field windings.
4. Understand operation and characteristics of DC machines and Transformers.
5. Estimate the performance of DC Machines and Transformers theoretically.

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

CO1. Analyze structure of DC Electrical machines and their role in various applications.
CO2. Apply the basic concepts of magnetic circuits to DC machines and Transformers.
CO3. Conduct various performance tests on DC machines and Transformers.
CO4. Evaluate various electrical and mechanical quantities associated with DC machines and Transformers.
CO5. Distinguish DC motors and generators based on their characteristics.

UNIT-I

Electro-Mechanical Energy Conversion: Forces and torque in magnetic field systems – energy balance – energy and force in a singly excited magnetic field system, determination of magnetic force - co-energy– multi excited magnetic field systems. DC Generators construction and operation-DC Generators – Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature – E.M.F Equation – Problems. Armature reaction in DC Generator - Armature reaction – Cross magnetizing and de-magnetizing AT/pole – compensating winding –commutation – reactance voltage – methods of improving commutation.

UNIT-II

Types of DC Generators: Types of DC Generators -Methods of Excitation – separately excited and self-excited generators – build-up of E.M.F - critical field resistance and critical speed - causes for failure to self-excite and remedial measures. Load Characteristics of shunt, series and compound generators – parallel operation of DC series generators – use of equalizer bar and cross connection of field windings – load sharing.

UNIT-III

DC Motors: Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Armature reaction and commutation.

Losses – Constant and Variable losses – calculation of efficiency – condition for Maximum efficiency. Speed control of DC Motors: Armature voltage and field flux control methods. Ward-Leonard system. Construction and operation of 3 point and 4 point starters.

UNIT-IV

Transformers: Constructional features of single phase and three phase transformers – EMF equation – Losses – Constant and Variable losses – calculation of efficiency – condition for Maximum efficiency. Transformer on No load and Load –Phasor diagram -equivalent circuit – Regulation –Efficiency-All day Efficiency- three phase transformer connections- parallel operation of single phase and three phase transformer- Auto transformers. All day efficiency.

UNIT-V

Testing of DC Machines and Transformer: Methods of Testing – direct, indirect and regenerative testing – brake test – Swinburne's test –Hopkinson's test – Field's test – Retardation test – separation of stray losses in a D.C. motor test. Polarity test, load test, open circuit and short circuit test, Sumpner's test on transformers.

TEXT BOOK (S):

1. Electrical Machines by P.S Bimbhra, Khanna publications
2. Electrical machinery by A.E Fritzergerald, C. Kingsly and S. Umans Mc Graw Hill Publications

REFERENCE BOOKS:

1. "Performance and Design of Alternating Machines ', Say M.G CBS Publishers and Distributors, New Delhi, First Indian Edition, Reprint 1998
2. "Electric Machinery and Transformers", Irving L. Kosow, Prentice Hall of India Private Ltd., New Delhi, Second Edition, Reprint 2007
3. "Electric Machinery Fundamentals', Stephen J. Chapman, "McGraw Hill Intl. Edition, New Delhi, Fourth Edition, 2005
4. Electrical Machines by B. L. Thereja.
5. Electrical Machines by –S. K Bhattacharya
6. Electrical Machines by –I. J. Nagrathand, D. P.Kothari

20EE22003–SIGNALS, SYSTEMS AND TRANSFORM TECHNIQUES

B.Tech. EEE - II Year II Sem.

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

Prerequisite(s): 20MA11001 – Basic Engineering Mathematics
20MA21001 – Theory of Complex Variables

Course objectives: Student would develop ability to

1. Distinguish different types of Signals, Systems and basic operations on a signal and understand the Fourier series representation of periodic signals.
2. Understand the conversion of both periodic and aperiodic continuous/discrete time domain signal into frequency domain using Fourier transform and the concept of sampling theorem.
3. Understand the characteristics of a linear time invariant system and the concepts of convolution and correlation.
4. Understand usage of Laplace transforms in the analysis of continuous time systems.
5. Understand usage of Z transforms in the analysis of discrete time systems.

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

CO 1. Analyse a given signal in Time domain and frequency domain using Fourier series.
CO 2. Analyse a given signal/system using Fourier transforms.
CO 3. Analyse a given LTI systems and perform convolution / correlation on signals / systems.
CO 4. Analyse a given signal/system using Laplace transform / domains and solve linear differential equations using Laplace transforms.
CO 5. Analyze a given signal/system using Z transform / domains and solve linear difference equations using Z- transforms.

UNIT–I

Signal Analysis: Classification of signals, Basic operations on signals, Classification of systems, Orthogonal signal space, Orthogonal functions, Mean square error.

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

UNIT-II

Fourier Transforms: Fourier transform from Fourier series, Fourier transform of standard signals, Properties of Fourier transforms. Inverse Fourier transforms, Introduction to Hilbert Transform.

Sampling: Sampling theorem – Types of Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing.

UNIT-III

Signal Transmission through Linear Systems: Transfer function of an LTI system. Impulse response of LTI system. Convolution and Correlation - Concept of convolution in time domain and frequency domain, Graphical representation of convolution. Cross correlation and auto correlation functions, Properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum. Relation between the convolution and correlation.

UNIT-IV

Laplace Transforms: Review of Laplace transforms, Concept of region of convergence (ROC) for Laplace transforms and its constraints, Properties of Laplace transforms, Inverse Laplace transform, Partial fraction expansion, solution of differential equations using Laplace transforms,

UNIT-V

Z–transforms: Concept of Z- transform of a discrete signal, Region of convergence in Z-transform and its constraints, properties of Z-transforms, Inverse Z-transform. Distinction between Laplace, Fourier and Z Transforms.

TEXT BOOK (S):

1. Signals and Systems – A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.

REFERENCE BOOKS:

2. Signals and Systems: Continuous and Discrete by Rodger E. Ziemer , William H Tranter , D. R. Fannin, 4th Edition Pearson Education Limited.
3. Signals and systems, Schaum's outlines – Hwei Hsu, McGraw Hill Professional, 1995
4. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2 Ed
5. Signals, Systems & Communications – B.P. Lathi, BS Publications, 2003

20EC22L04 –ANALOG CIRCUITS LAB

B.Tech. EEE - II Year II Sem.

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

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

Course Objectives: Student would develop ability to

1. Obtain the frequency response of single stage amplifiers.
2. Obtain the frequency response of two stage amplifier.
3. Understand the frequency response of feedback amplifiers.
4. Understand the design considerations of oscillators namely, RC phase shift and LC oscillators for a given frequency of oscillations.
5. Understand the conversion efficiency of large signal amplifiers, Class A and Class B.

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

CO1. Verify the frequency response of single stage amplifier circuits.
CO2. Verify the frequency response of two stage FET amplifier circuit.
CO3. Compare the frequency response of an amplifiers with and without feedback.
CO4. Design and verify RC-phase shift and LC oscillators for given frequency of oscillations.
CO5. Verify the power conversion efficiency of Class-A and Class-B power amplifiers.

LIST OF EXPERIMENTS:

1. Design of single stage RC coupled BJT amplifier
2. Frequency response of Cascode Amplifier
3. Current gain and input impedance of Darlington pair.
4. Frequency response of Current Series 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

20EE22L01–ELECTRICAL MACHINES-I LAB

B.Tech. EEE - II Year II Sem.

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

Prerequisite(s): 20EE21002 – Electromagnetic Fields

Course objectives: Student would develop ability to

1. Study and understand the operation of different types of DC generators, Motors and Transformers.
2. Analyse performance aspects of various testing methods
3. Understand the speed controlling techniques of DC shunt motors.
4. Understand the parallel operation of transformers.

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

CO1. Evaluate the critical field resistance and critical speed of DC shunt generator.
CO2. Obtain the performance characteristics of DC machines and Transformer.
CO3. Apply different speed controlling techniques to DC shunt motor.
CO4. Convert three phase supply to two phase supply.
CO5. Operate Transformers when connected in parallel.

LIST OF EXPERIMENTS:

1. Magnetization characteristics DC shunt generator (Determination of critical field Resistance critical speed).
2. Load test on DC shunt generator (Determination of characteristics).
3. No load and Brake test on DC shunt motor (Determination of performance curves).
4. Load test on DC compound generator (Determination of characteristics).
5. Field test on DC series machines (Determination of efficiency).
6. Speed control of DC shunt motor.
7. OC and SC Test on single phase Transformer.
8. Sumpner's Test on single phase Transformer's.
9. Parallel operation of two single phase Transformers.
10. Three phase to two phase conversion.

ADDITIONAL EXPERIMENTS:

1. Hopkinson's test on DC shunt machines. Predetermination of efficiency.
2. Load test on DC Series generator. Determination of characteristics.

20EE22L02 - SIGNALS, SYSTEMS AND TRANSFORM TECHNIQUES LAB

B.Tech. EEE - II Year II Sem.

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

Prerequisite(s): 20CS11L01-Programming for Problem Solving–I Lab

Course Objectives: Student would develop ability to:

1. Analyse linear systems and signals
2. Understand various transform techniques
3. Analyse sampling principles
4. Understand various similarity measures between signals /sequences.
5. Understand the principles of regularity of occurrence in signals

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

CO 1. Generate different signals and sequences and perform mathematical operations on it.
CO 2. Explain the principles of system classification, using its characteristics in time and frequency domain representations.
CO 3. Express the given time domain signal in frequency domain and explain the respective convergence properties.
CO 4. Convolve and correlate different signals.
CO 5. Verify the periodicity and aperiodicity of signals.

LIST OF EXPERIMENTS:

1. Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Ramp and Sinusoid.
2. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
3. Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System.
4. Convolution and Correlation between (i) Signals and (ii) sequences.
5. Verification of Gibb's Phenomenon
6. Computation of the Even and Odd parts of Signal/Sequence, Real and Imaginary parts of a complex Signal
7. Computation of Unit Impulse, Unit Step and sinusoidal response of the given LTI system.
8. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
9. Verification of Sampling theorem
10. Checking the given signal for Periodicity

ADDITIONAL EXPERIMENTS:

1. 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
2. Waveform Synthesis using Laplace Transform

Note: All the experiments are to be simulated using MATLAB / Sci-lab /Octave / PSPICE software or any other equivalent software

20EN220I ENGLISH FOR CAREER DEVELOPMENT

B.Tech. EEE - II Year II Sem.

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

Prerequisite(s): None

Course Objectives: Student would develop ability to

1. Understand the importance of vocabulary to be used in different situations.
2. Read, comprehend the passages, summarize and paraphrase information in a text.
3. Communicate effectively in different socio-cultural contexts with proper articulation.
4. Write precisely.

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

CO1. Synergize the acquired skills to improve employability prospects by
CO2. Acquiring relevant vocabulary
CO3. Making inferences and predictions based on comprehension of a text.
CO4. Using effective conveying strategies and develop effective Presentation Skills.
CO5. Producing well organized essays and use a variety of accurate sentence structures.

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 (S):

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

B.Tech. (EEE)
III Year I Sem.
Detailed Syllabus

20MA31001- STATISTICS FOR MACHINE LEARNING

B. Tech. EEE - III Year I Sem.

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

Prerequisites(s): None

Course Objectives: Develop ability to

1. Understand different types of random variables and their distributions.
2. Estimate the minimum proportion of observations that fall within a specified value; Solve counting problems using generating functions.
3. Estimate the population parameter from a sample and identify the different types of Testing of hypothesis.
4. Classify the linear and logistic regression.
5. Observe the closest point of the lines from both the classes**.** Learn the concept of PCA.

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

CO1. Distinguish between random variables pertaining to discrete / continuous distribution systems and apply the discrete distributions like Binomial and Poisson and continuous distribution like Normal and their properties.

CO2. Calculate the minimum proportion of observations that fall within a specified value analyse probability distribution functions.

CO3. Interpret the result of a test of hypothesis in the context of small and large samples.

CO4. Apply linear and logistic regression to estimate and analyze the association between dependent and independent variable.

CO5. Maximize the margin. Reduces the linear dimensionality and improves the feature extraction.

UNITI

Basics of Probability Theory, Baye's Theorem; Random Variables (Discrete and Continuous); Probability Distribution of RV, Expectation, Variance (Binomial, Poisson, Uniform, Normal and Exponential).

UNIT II

Chebyshev's and Markov inequalities, Law of Large Numbers and Central Limit Theorem.

Data simulations in parametric setup: Random number generation (a) Discrete RVs (Binomial, Poisson and Uniform) (b) Continuous RVs (Normal and Exponential). Acceptance/Rejection algorithm.

UNITIII

Parameter Estimation: Estimation of Model Parameters (Maximum Likelihood Estimation and Method of Moments), Confidence Interval (CI) Estimation, Bayesian Estimation and CI.

Testing of Hypothesis: Z-test, t-test, chi squared-test and F-test (concept of p-value).

UNITIV

Linear/Non-linear models: Multiple Linear Regression: Multiple Regression Models, Hypothesis Test for Significance of regressors, Logistic Regression: Models with a Binary Response Variable, Estimating the Parameters in a Logistic Regression Model, Interpretation of the Parameters in a Logistic Regression Model; Classification and Density Estimation.

UNIT V

Classification (SVM), Clustering (K-means) and Dimension Reduction (PCA).
Kernel Methods: Mercer's Kernels, Kernel Classification, Kernel PCA.

TEXT BOOK(S):

1. Probability and Statistics for Engineers and Scientists by Sheldon Ross, Academic Press, 5th Edition, 2014.
2. Introduction to Statistical Machine Learning, Masashi Sugiyama, Book Aid International, 2016.

REFERENCE BOOK(S):

1. Probability for Statistics and Machine Learning: Fundamentals and Advanced Topics by Anirban Das Gupta, Springer 2011.
2. Statistical Inference by George Casella and Roger L. Berger, Thomson Learning, 2002.
3. An Introduction to Statistical Learning with Applications in R by James, G., Witten, D., Hastie, T., Tibshirani, R. Springer 2013.
4. Introduction to Linear Regression Analysis, Fifth Edition by Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, Wiley series in Probability and Statistics 2012.

20EE31001 - ELECTRICAL POWER TRANSMISSION SYSTEMS

B.Tech. EEE -III Year I Sem.

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

Prerequisite(s): 20EE22001- Generation and Utilization of Electrical Energy.
20EE21003-Electrical Circuit Analysis

Course Objectives: Develop ability to

1. Compute different parameters of transmission lines.
2. Estimate the efficiency and regulation of transmission lines.
3. Understandtheeffectoffactorsgoverningtheperformanceoflongtransmissionline.
4. Designoverheadlineinsulatorsandtoestimatethesagandtensionintransmissionlines.
5. Understand the concepts of underground cables.

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

CO1. Model the transmission lines.
CO2. Determine the performance characteristics of transmission lines.
CO3. Determine the factors that govern the performance of the transmission lines
CO4. Develop string insulators for all voltage levels
CO5. Model the underground cables and determine its performance.

UNIT–I

Transmission Line Parameters: Types of conductors – calculation of resistance for solid conductors –Calculation of inductance for single phase and three phase, single circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single circuit lines, Numerical Problems.

UNIT–II

Performance of Short and Medium Length Transmission Lines: Classification of Transmission Lines – Short, medium and long line and their model representations – Nominal- T, Nominal-Pie and A, B, C, D Constants for symmetrical & Asymmetrical Networks, Numerical Problems. Mathematical Solutions to estimate regulation and efficiency of all types of lines –Numerical Problems

Performance of Long Transmission Lines: Long Transmission Line-Rigorous Solution, evaluation of A, B, C, D Constants, Interpretation of the Long Line Equations, Incident, Reflected and Refracted Waves.

UNIT–III

Power System Transients: Types of System Transients–Travelling or Propagation of Surges–Attenuation, Distortion, Reflection and Refraction Coefficients – Termination of lines with different types of conditions – Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems).

Various Factors Governing the Performance of Transmission line: Skin and Proximity effects –Description and effect on Resistance of Solid Conductors – Ferranti effect –

Charging Current. Corona –Description of the phenomenon, factors affecting corona, critical voltages and power loss.

UNIT– IV

Overhead Line Insulators: Types of Insulators, String efficiency and Methods for improvement, Numerical Problems – voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.

Sag and Tension Calculations: Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems – Stringing chart and sag template and its applications.

UNIT–V

Underground Cables: Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Corebelted cables, Numerical Problems. Grading of Cables – Capacitance grading, Numerical Problems, Description of Inter-sheath grading, HV Cables.

TEXTBOOKS:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U. S.Bhatnagar, and A.Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.
2. Electricalpowersystems –byC.L. Wadhwa, NewAgeInternational(P)Limited, Publishers,1998.

REFERENCEBOOKS:

1. Power system Analysis – by John J Grainger William D Stevenson, TMC Companies, 4thedition
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. Power System Analysis by Hadi Saadat – TMH Edition.
4. Modern Power System Analysis by I.J.Nagaraj and D.P.Kothari, Tata Mc Graw Hill, 2ndEdition.

20EE31002 – ELECTRICAL MACHINES-II

B.Tech. EEE -III Year I Sem.

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

Prerequisite(s): 20EE22002 -Electrical Machines-I

Course Objectives: Develop ability to

1. Describe the construction, working principle with phasor diagram, characteristics and torque equations of poly phase induction motor and single-phase Induction motor.
2. Summarize the performance indices using suitable test on three phase and single-phase induction motors and understand speed control methods.
3. Explain construction, working principle with phasor diagram, characteristics of synchronous machines.
4. Comprehend the methods to determine regulation of synchronous generator and parallel operation of synchronous alternators.
5. Understand the operation of synchronous motor and its applications: power factor improvement, constant speed operations.

Course Outcomes (COs): On completion of this course, student will be able to

CO1. Analyse construction, operation, characteristics of Induction motors and evaluate starting torque, full load torque and maximum torque.
CO2. Compute power and efficiency of induction motor by performing suitable tests and describe speed control methods
CO3. Analyse construction, operation, production of EMF and suppression of harmonics in a synchronous machine.
CO4. Examine the regulation of synchronous generator and outline the parallel operation of alternators.
CO5. Implement reactive power compensation using synchronous motor for any application.

UNIT - I

Poly-Phase Induction Machines: Poly-Phase Induction motors- Construction- Types- production of rotating magnetic field – principle of operation – rotor EMF & rotor frequency – rotor reactance, rotor current and rotor power factor at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation – Torque equation – expression for maximum torque and starting torque – torque slip characteristics – double cage and deep bar rotors – equivalent circuit – phasor diagram – crawling and cogging. Induction generator – principle of operation.

UNIT - II

Circle Diagram of Induction Motor: Circle diagram – no load and blocked rotor tests – predetermination of performance indices – methods of starting, starting current and torque calculations.
Speed Control of Induction Motor: Change of frequency and poles, cascade connection. Injection of an EMF into rotor circuits (Qualitative treatment only)
Single Phase Induction Motor: Constructional features – double revolving and cross field theory – equivalent circuit – torque slip characteristics – types of single-phase induction motors.

UNIT - III

Synchronous Machines & Characteristics: Constructional features of round rotor and salient pole machines – armature winding – integral slot and fractional slot windings; distributed and concentrated windings – distribution, pitch and winding factor – E.M.F equation. Harmonics in generated EMF – suppression of harmonics – armature reaction – leakage reactance – synchronous reactance and impedance – experimental determination – phasor diagram and load characteristics – salient pole machines – two reaction analysis – phasor diagrams.

UNIT - IV

Regulation of Synchronous Generator: Synchronous impedance method, MMF method, ZPF method and ASA method – determination of $\mathbf{X_d}$ & $\mathbf{X_q}$ (slip test) – regulation of alternators.

Parallel operation of Synchronous Generator: Synchronizing alternators with infinite bus bars – synchronizing power and torque – parallel operation and load sharing - effect of change of excitation and mechanical power input. Analysis of short circuit current wave form - determination of sub-transient, transient and steady state reactance.

UNIT - V

Synchronous Motors: Theory of operation – phasor diagram – variation of current and power factor with excitation – synchronous condenser – synchronous phase modifier – Mathematical analysis for power developed. Hunting and its suppression – methods of starting – merits and demerits of synchronous motors – applications of synchronous motors.

TEXT BOOK(S):

1. Nagrath I.J., Kothari D.P "Electrical Machines", Tata Mc Graw Hill, 2010.
2. A.E Fitzgerald, Charles Kingsley and S.D Umans "Electric Machinery",Tata Mc Graw Hill, 2003.

REFERENCE BOOK(S):

1. A.S Langsdorf "Theory of AC Machines", Tata Mc Graw Hill, 2001.
2. C.I Hubert "Electric Machines", Pearson Edition, 2003.
3. Parkar Smith N.N "Problems in Electrical Engineering", CBS publishers and distributors.
4. P.S. Bimbra Electrical Machinery – Khanna publications, 2015.

20EE31003 - POWER SYSTEM PROTECTION

(Professional Elective - I)

B.Tech. EEE -III Year I Sem.

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

Prerequisite(s): 20EE22001: Generation and Utilization of Electrical Energy

Course Objectives: Develop ability to

1. Understand basic operation of Circuit Breakers
2. Understand basic operation of different Relays and its applications
3. Understand the methods used for protection of Generators, Transformers, feeders and bus bars
4. Understand concept of Neutral grounding and Earthing.
5. Understand the protection techniques against over voltages and other hazards.

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

CO1. Various types of protective devices and their coordination

CO2. Protection of generators, transformers, feeders, bus bars through different types of protective devices.

CO3. Over voltage protection and lightening

CO4. Earthing and Grounding

CO5. Application of above conceptual things to real world electrical and electronics problems.

UNIT -1

Circuit Breakers: Introduction – elementary principles of arc interruption, Recovery, Re-striking Voltage and Recovery voltages Re-striking Phenomenon, Average and Max. RRRV, Numerical problems – Current Chopping and Resistance Switching and Numerical Problems.
Description and Operation of types of circuit breakers: Minimum Oil Circuit Breaker, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

UNIT – II

Electromagnetic and Static Relays: Principle of Operation and Construction of Attracted armature, Balanced Beam, Induction Disc and Induction Cup Relays.
Application of Relays: Over-current/Under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays. Universal torque equation.
Distance Relays: Impedance, Reactance and Mho relays, Characteristics and Comparison.
Static Relays: Introduction, Static Relays verses Electromagnetic Relays.

UNIT – III

Protection of generators: against Stator faults, Rotor faults, and Abnormal Conditions, Restricted Earth fault and inter-turn fault protection. Numerical Problems on percentage winding unprotected.

Protection of transformers: Protection of power transformers-Percentage Differential Protection, Numerical Problem on Design of CTs Ratio and Buchholz relay Protection.

UNIT – IV

Feeder and Bus - Bar Protection: Protection of Lines – Over Current, Carrier Current and Three – zone distance relay protection using impedance relays. Translay Relay. Protection of bus bars – Differential Protection**.**

Neutral Grounding: Grounded and Ungrounded Neutral Systems. Effects of Ungrounded Neutral on system performance. Methods of Neutral grounding: Solid, Resistance, Reactance, Resonant.

UNIT – V

Protection against over voltages due to lightening: Introduction, internal and external causes of overvoltage's, mechanism of lighting and wave shape of lighting strokes, protection against lighting- Expulsion, valve and metal oxide Lighting Arresters – **Insulation Coordination** – BIL, Impulse Ratio, Standard impulse Test Wave, Volt- Time Characteristics.

TEXTBOOK(S):

1. Power System Protection and Switchgear by Badari Ram, D. N. Viswakarma, TMH Publications
2. Switchgear and Protection – by Sunil S Rao, Khanna Publishers

REFERENCE BOOK(S):

1. A Text book on Power System Engineering by B. L. Soni, Gupta, Bhatnagar, Chkarabarthy, Dhanpat Rai & Co.
2. Fundamentals of Power System Protection by Paithankar and S. R. Bhide, PHI, 2003.
3. Electrical Power Systems – by C. L. Wadhawa, New Age International (P) Limited, Publishers, 3rdedition.
4. A Course in Power Systems by J. B. Gupta S. K. Kataria& Sons.

20EE31004 – RENEWABLE ENERGY SYSTEMS
(Professional Elective - I)

B.Tech. EEE – III Year I Sem.

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

Prerequisites: **None**

Course Objectives: Develop ability to
1. Understand the basic concepts of solar energy.
2. Understand the methods of storage of solar energy.
3. Understand basic concepts of wind energy, biomass energy.
4. Understand basic concepts of geothermal energy and ocean energy.
5. Understand the need of direct energy conversion.

Course Outcomes: At the end of the course, the student would be able to
CO1. Get thorough knowledge on various types of renewable energy sources.
CO2. Develop storage systems of solar energy for different applications.
CO3. Get thorough knowledge on hybrid energy systems.
CO4. Get thorough knowledge on principles of direct energy conversion.
CO5. Apply the above conceptual things to real world electrical and electronic problems.

UNIT-I
Principles of solar radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surface, Instruments for measuring solar radiation and sunshine, solar radiation data.

UNIT-II
Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.
Storage & Applications: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications - solar heating/cooling technique, solar distillation and drying, photo voltaic energy conversion.

UNIT-III
Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Bertz criteria.
Bio-mass: Principles of Bio-conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C Engine operation and economic aspects.

UNIT-IV
Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: OTEC, Principles, utilization, setting of OTEC plants, thermodynamic cycles.
Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants and their economics.

UNIT-V
Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, and principles of DEC.

TEXT BOOK(S):
1. Non-Conventional Energy Sources, G. D. Rai, Khanna Publishers.
2. Introduction to renewable energy, Vaughn Neison, CRC Press (Taylor&Francis)

REFERENCE BOOK(S):
1. Renewable Energy Resources, Twidell & Wier,CRC Press (Taylor &Francis)
2. Renewable Energy sources and Emerging Technologies, D. P. Kothari, K. C Singal, Rakesh Ranjan, PHI Learning Private Limited.
3. Fundamentals of Renewable Energy systems, D. Mukherjee, S. Chakrabarty, New age International.
4. Renewable Energy Power for a sustainable Future, God frey Boyle, Oxford University Press.

20EE31005 – ELECTRICAL ESTIMATION AND COSTING

(Professional Elective - I)

B.Tech. EEE - III Year I Sem.

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

Prerequisite(s): 20EE22001 - Power Systems – I

Course Objectives: Develop ability to

1. Understand the general principles of estimation and costing.
2. Prepare estimates for electrification of residential buildings
3. Prepare estimates for electrification of Commercial installations.
4. Understand the costing factors involved in installation of overhead transmission and distribution lines.
5. Understand the costing factors involved in installation design and estimation of substations.

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

CO1. Determine the factors involved in general aspects of costing and estimation.
CO2. Assess the factors involved in costing and estimation of residential buildings.
CO3. Assess the factors involved in costing and estimation of commercial installations.
CO4. Identify the components required in the installation of overhead transmission and distribution lines.
CO5. Understand the components required in the installation of substations

UNIT – I

General principles of estimation: Introduction to estimation & costing, Electrical Schedule. Market Survey and source selection. Recording of estimates, Determination of required quantity of material, Labor conditions. Determination of cost material and labor Contingencies. Overhead charges, Profit, Purchase system, Purchase enquiry and selection of appropriate purchase mode. Comparative statement, Purchase orders., Indian Electricity Act-Introduction only

UNIT – II

Residential building electrification: General guidelines for wiring of residential installation and positioning of equipment. Load calculations and selection of size of conductor, wires and cables. Selection of rating of main switch Distribution board, protective switchgear ELCB and MCB and wiring accessories, Earthing. Preparation of detailed estimates and costing of residential installation.

UNIT – III

Electrification of commercial installation: Concept of commercial installation, Difference between electrification of residential and commercial installation, Fundamental considerations for commercial building, Load calculation and selection of size of service connection and nature of supply, sizing of the cables, bus bar and bus bar chambers,

Earthing. Sequence to be followed to prepare estimate, Preparation of detailed estimate and costing of commercial installation.

UNIT – IV

Design and estimation of overhead transmission & distribution lines: Main components of overhead lines. Factors governing height of pole, Determination of size of conductor for overhead transmission line, Cross arms, Pole brackets and clamps, Guys and Stays, Lightning Arrestors, Phase plates, Danger plates, Anti climbing devices, Bird guards, Beads of jumpers. Testing and commissioning of overhead distribution lines.

UNIT – V

Design and estimation of substations: Introduction, Classification of substation, Indoor substations, Outdoor substations, Selection and location of site for substation, Equipment for substation and switchgear installations, Substation auxiliaries supply, Substation Earthing.

TEXT BOOKS:

1. “Residential Commercial and Industrial Systems”, H. Joshi, McGraw Hill Education, 2008
2. "Electrical Installation Estimating & Costing", J.B.Gupta, S.K.Katria& Sons New Delhi

REFERENCE BOOKS:

1. "Electrical Design Estimating and Costing", K.B.Raina, S.K.Bhattacharya, New Age International
2. "Electrical Wiring Estimating and Costing", S.L.Uppal, G. C. Garg, Khanna Publishers Delhi

20EE31006 – SPECIAL MACHINES

(Professional Elective - I)

B.Tech. EEE - III Year I Sem.

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

Prerequisite(s): 20EE22002 – Electrical Machines - I
20EE31002 – Electrical Machines – II

Course Objectives: Develop ability to

1. describe the construction, working principle, control of stepper motors.
2. describe the construction, working principle, control of Switched Reluctance Motors (SRM).
3. explain construction, working principle of Permanent Magnet DC motor (PMDC) and Permanent Magnet Brushless D.C. (BLDC) motors along with its control.
4. comprehend the operations of permanent magnet synchronous motor and synchronous reluctance motor along with its control.
5. understand the operation of DC and AC servo motors.

Course Outcomes: On completion of this course, student would be able to

CO1. Analyze construction, operation and control of Stepper Motor.
CO2. explain the control strategies for switched reluctance motors.
CO3. compare and Analyze PMDC and BLDC Motors
CO4. explain the control strategies of PMSM and synchronous reluctance motor
CO5. Analyze the AC and DC servo motors.

UNIT I

Stepper Motors

Variable Reluctance (VR) stepper motor, Permanent Magnet Stepper motor, Hybrid Stepper motor, other types of stepper motors. Windings in Stepper Motors. Torque equation, Characteristics of Stepper motor. Open-loop and closed-loop control of stepper motors. Comparison of Stepper Motors.

UNIT II

Switched Reluctance Motors

Constructional features, Principle of operation, basics of SRM Analysis, constraints of pole Arc and Tooth arc, Torque equation and characteristics, power converter circuits, control of SRM, current regulators, sensor less control of SRM.

UNIT III

Permanent Magnet DC (PMDC) Motor

Construction, Principle of working, Torque equation and equivalent circuit, performance characteristics, types of PMDC motors.

Brushless Permanent Magnet DC (BLDC) Motor

Construction, classification of BLDC motors, electronic commutation, Principle of operation. Sensor less control of BLDC motor. Comparison of conventional DC motor and BLDC motor.

UNIT IV

Permanent Magnet Synchronous Motor

Construction, Principle of operation, EMF Equation, Torque equation, Phasor diagram, Control of PMSM – (Only DSP based control and Transfer function model of PMSM drive).

Synchronous Reluctance Motor

Construction, working, phasor diagram and torque equation. Control of Synchronous reluctance motor.

UNIT V

DC Servo Motors

Construction, Principle of operation, Characteristics of DC servo motor, transfer function of DC servo motor.

AC servo Motor:

Construction and working, Torque-speed characteristics of servo motor, transfer function of AC servo motor.

TEXT BOOK(S):

1. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014
2. Miller, T.J.E. "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 1989.

.

REFERENCE BOOK(S):

1. Venkata Ratnam K., Special Electrical Machines, CRC Press, 2009
2. R.Krishnan, 'Switched Reluctance Motor Drives – Modelling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.4.
3. Kenjo,T., and Sugawara, A., Stepping Motors and their Microprocessor Controls, Oxford Science Publications, 1984.

20CE31061-BUILDING TECHNOLOGY
(Open elective – I)

B.Tech. EEE - III Year I 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 building Bye laws and plan the building.
CO 3: Estimate the repairs in building and types of transportation in building.
CO 4: Assess the prefabrication systems and air conditioning required in buildings.
CO 5: Explain principles of acoustics in building and plumbing.

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 BOOK(S):

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 BOOK(S):

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.

20ME31063– NANOMATERIALS AND TECHNOLOGY

(Open Elective - I)

B.Tech. EEE - III Year I Sem.

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

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 nano materials by their superior characteristics
CO2. Demonstrate synthesis of zero-dimensional nano structured materials.
CO3. Illustrate conducive methods to synthesize one dimensional nano structure
CO4. Compare and comprehend methods to produce two-dimensional nano structures.
CO5. Comprehend 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 Vapor Deposition (PVD): Evaporation molecular beam epitaxy (MBE), Sputtering, Comparison of Evaporation and sputtering.

Chemical Vapor Deposition (CVD): Typical chemical reactions, Reaction kinetics, transport ant 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 fullerene and nano tubes. Carbon fuller ness: formation, properties and applications. Carbon nano tubes: formation and applications.

TEXT BOOK(S):

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.

REFERENCE BOOK(S):

1. Nano: The Essentials; T. Pradeep, Tata McGraw-Hill, 2008.
2. Nanotechnology and Nano electronics, W.R. Fahrner, Springer, 2006.

20EC31064 – ELECTRONIC MEASURING INSTRUMENTS
(Open Elective - I)

B.Tech. EEE - III Year I Sem.

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

Prerequisite: None

Note: No detailed mathematical treatment is required for this course.

Course Objectives: Develop ability to
1. Understand various measuring systems functioning and metrics for performance analysis.
2. Understand principle of operation, working of different electronic instruments viz. signal generators, signal analysers, recorders and measuring equipment.
3. Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Course Outcomes: At the end of this course, the student would be able to
1. Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement.
2. Measure various physical parameters by appropriately selecting the transducers.
3. Use various types of signal generators, signal analysers for generating and analysing various real time signals.

UNIT-I
Block Schematics of Measuring Systems and Performance Metrics: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag.

UNIT-II
Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, and Specifications.

UNIT-III
Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range,
True RMS Responding Voltmeters, Specifications of Instruments. CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes.

UNIT-IV
Recorders: X-Y Plotter, Curve tracer, Galvanometric Recorders, Servo transducers, pen driving
mechanisms, Magnetic Recording, Magnetic recording techniques.

UNIT-V

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

TEXT BOOK(S):

1. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.
2. Electronic Instrumentation: H.S.Kalsi – TMH, 2nd Edition 2004.

REFERENCES BOOK(S):

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI 5th Edition 2003.
3. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.
4. Industrial Instrumentation: T.R. Padmanabham Springer 2009.

20CS31065 - WEBPROGRAMMING
(Open Elective - I)

B.Tech. EEE - III Year I Sem.

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

Prerequisite(s): 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: Students would be able to
CO1. Develop web programs using HTML
CO2. Develop intuitive interfaces using CSS
CO3. Use JavaScript for client-side validations
CO4. Design web applications using XML as back end
CO5. Implement web applications using PHP as server-side script

UNIT-I
Introduction – HTML, XML, and the World Wide Web. Protocols, IP and TCP, HTTP, CGIHTML – 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

20MB31066-INTELLECTUAL PROPERTY RIGHTS
(Open Elective - I)

B.Tech. EEE - III Year I 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. Acquire knowledge on intellectual property rights
CO2. Track the regulation process of trademarks. Discuss the functions of trademark.
CO3. Identify the importance of copyrights, patents searching process and transfer of Ownership
CO4. Know about secret laws, unfair competition, false advertising.
CO5. Reciprocate to new developments of intellectual property rights.

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 BOOK(S):

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.

REFERENCE BOOK(S):

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.

20EN31L01 - PROFESSIONAL COMMUNICATION SKILLS (PCS) LAB

B.Tech. EEE - III Year I Sem.

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

Pre-Requisites: **None**

Course Objectives: Develop ability to

1. Acquire behavioural skills required for their personal and professional life.
2. Help students develop their leadership skills.
3. Read and comprehend texts and respond appropriately in different Socio-Cultural contexts.
4. Communicate their ideas effectively orally and in written form.

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

CO1. Demonstrate effective Listening and Speaking Skills.
CO2. Develop proficiency in academic reading and writing.
CO3. Cultivate employability skills thereby increasing Job prospects.
CO4. Communicate confidently for all official purposes.

MODULEI

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.

MODULEII

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

MODULEIII

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 Viseme'.

MODULEIV

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

MODULEV

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

20MA310L1 STATISTICS FOR MACHINE LEARNINGLAB

B. Tech. EEE-III Year, I Sem.

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

Prerequisites(s): 20MA31001- Statistics for Machine Learning

Course Objectives: Develop ability to

1. Understand the basic concepts of R-programming. Learn descriptive statistics and data types in R -programming. Describes the shape, center, and spread of sampling distributions of sample statistics.
2. Recognize the logic and framework of the inference of hypothesis testing.
3. Use regression analysis to predict the value of a dependent variable based on an independent variable.
4. Learn the concepts of SVM and Kernel methods.

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

CO1. Perform built-in commands and operations with matrices in R-programming. Analyse the appropriate data type of variables and evaluate various Frequency Distributions in R- programming. Determine the mean and standard deviation of a sampling distribution using R.
CO2. Develop a code for testing of hypothesis using Z-test, t-test, chi-square test, F-test.
CO3. Classify Linear and Logistic regression.
CO4. Develop a Code for SVM and Kernel methods for risk analysis.

List of Experiments

Week	Name of the Experiment
1	Introduction to R Programming.
2	Introduction to descriptive statistics using R (Frequency Distribution and Cumulative Distribution Function).
3	Acceptance/Rejection Sampling in R.
4	Maximum likelihood and method of moments estimation. Testing of Hypothesis based on Z-test. Concept of p-value in R.
5	Testing of hypothesis based on t-test, chi-square test and F-test. Confidence interval estimation in R.
6	Multiple linear regression: Outlier analysis, residual analysis, test for normality, multi-collinearity in R.
7	Logistic Regression in R.
8	Classification with SVM in R.
9	Dimensionality reduction with PCA in R and K-means Clustering in R.
10	Kernal PCA and Kernal SVM in R.

List of Additional programs

S. No	Name of the Experiment
1	Generating Functions (Binomial, Poisson, Uniform, Normal and Exponential) using R.
2	Multiple linear regression: Testing overall hypothesis and testing significance of individual variables, model selections and prediction in R.

20EE31L01 – ELECTRICAL MACHINES – II LAB

B.Tech. EEE -III Year I Sem.

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

Prerequisite(s): 20EE22L01 Electrical Machines – I LAB

Course Objectives: Develop the ability to

1. ascertain performance parameters of single phase and three phase induction motor using direct and indirect tests.
2. determine equivalent circuit parameters of a single – phase and three-phase induction motors.
3. estimate the 'regulation' of alternator by different methods.
4. compute reactances - $\mathbf{X_d}$ and $\mathbf{X_q}$ of a salient pole synchronous machine.
5. demonstrate the use of **'V'** and **'Inverted V'** curves for power factor adjustment using three-phase synchronous motor.

Course Outcomes (COs): On completion of this course, student will be able to

CO1. Analyse the performance of single phase and three phase induction motor by drawing the characteristics.
CO2. calculate equivalent circuit parameters of a single – phase and three-phase induction motors.
CO3. assess the 'regulation' of three phase alternator by different methods.
CO4. differentiate between the reactances $\mathbf{X_d}$ and $\mathbf{X_q}$ of salient pole synchronous machine.
CO5. adjust Power Factor using three phase synchronous motor.

List of Experiments:

1. Perform 'Brake test' on three-phase induction motor.
2. Perform 'No-load' and 'blocked rotor tests' on three-phase induction motor.
3. Obtain equivalent circuit parameters of a single-phase induction motor.
4. Obtain equivalent circuit parameters of a three-phase induction motor
5. Perform 'Brake test' on single phase induction motor.
6. Assess the regulation of a three-phase alternator by synchronous impedance & MMF methods.
7. Assess the regulation of a three-phase alternator by ZPF & ASA methods.
8. Determination of $\mathbf{X_d}$ and $\mathbf{X_q}$ of a salient pole synchronous machine.
9. Plot 'V' and 'Inverted V' curves of a three-phase synchronous motor.
10. Evaluate the efficiency of three-phase alternator. ``

20MA31P01 – LOGICAL REASONING-I

B. Tech. EEE-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

CO1. Analyse the difference between simple and compound interest and solve various related problems; Analyze the factors that influence the level of profit/loss for the given problem; Evaluate percentages of different quantities and apply ratios and proportions to solve real-life problems.

CO2. Apply the various types of averages to analyze the feature of the given data; Apply various principles to solve problems on time and distance; Analyze the time period of work done problems.

CO3. Derive the logical connectives for the given simple and compound statements; Interpret the validity of conclusions drawn from the given statements and determine strong/weak arguments from a given statement; Deduce the similarities of the objectives for various analogies.

CO4. Use critical thinking and logic to solve problems on Non-Verbal reasoning; Construct a family tree based on the given information and solve blood relation problems; Solve analytical puzzles using binary logic.

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 BOOK(S):

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 BOOK(S):

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.

20CS31M03- INTRODUCTION TO CYBER SECURITY

(Mandatory Course)

B. Tech. EEE-III Year, I Sem.

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

Prerequisite(s): None

Course objectives: Develop ability to

1. To familiarize various types of cyber-attacks and cyber-crimes
2. To give an overview of the cyberlaws
3. To study the defensive techniques against these attacks

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

CO1. Know about cyber-attacks,
CO2. Get aware of cyber-crimes, cyber laws
CO3. Protect them self and ultimately the entire Internet community from such attacks.

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 back ground 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, CRCPress.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&FGroup.

B.Tech. (EEE)
III Year II Sem.
Detailed Syllabus

20EC32007– COMPUTER ARCHITECTURE AND MICROPROCESSORS

B.Tech. EEE - III Year II 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 the design of the functional units of a digital computer system.
CO2. Explain the Architecture and features of 8086.
CO3. Develop Assembly Language Programs using 8086 instructions set and interface different
CO4. I/O devices with 8086.
CO5. Explain Serial communication interface and different types of memory elements of a computer.
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, Inter-processor communication and synchronization, Cache Coherence.

TEXT BOOK(S):

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 BOOK(S):

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.

20EE32001 -POWER SYSTEM ANALYSIS

B.Tech. EEE -III Year II Sem.

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

Prerequisite(s): 20EE21003 Electrical Circuit Analysis
20EE22001 Generation and Utilization of Electrical Energy
20EE31001 Electrical Power Transmission Systems

Course Objectives: Develop ability to
1. Understand Single line diagram and per unit quantity representation of Power systems
2. Study Symmetrical components and various faults in power systems
3. Formulate various Network Matrices in power systems
4. Know the importance of load flow studies and analysis by various load flow methods.
5. Analyze steady state stability and transient state stability.

Course Outcomes (COs): At the end of this course, students would be able to
CO1. Perform a wide-variety of per-unit conversions and fault analysis
CO2. Analyze short circuit studies for the protection of power system
CO3. Develop Y_{bus} and Z_{bus} matrices.
CO4. Analyze load flow for various requirements of the power system.
CO5. Estimate stability and instability in power systems

UNIT-I
Single line diagram: Impedance diagram and Reactance diagram.
Per-Unit System of Representation: Per-Unit quantities- changing the base of per unit quantities, equivalent reactance network of a three phase Power System, Numerical Problems.
Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Numerical Problems.

UNIT-II
Symmetrical Component Theory: Symmetrical Component Transformation, Positive, Negative and Zero sequence components: Voltages, Currents and Impedances, Numerical Problems. Sequence Networks for Alternator and 3 phase transformers.
Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without fault impedance, Numerical Problems.

UNIT-III
Power System Network Matrices: Bus Incidence Matrix, Y bus formation by Direct and Singular Transformation Methods, Numerical Problems. Formation of Z Bus: Partial network, Algorithm for the Modification of Z Bus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems)

UNIT-IV
Power flow Studies: Necessity of Power Flow Studies – Derivation of Static load flow equations – Load flow solutions using Gauss Seidel Method: Acceleration Factor, Load flow solution with and without P-V buses, Algorithm and Flowchart. Numerical Load flow

Solution for Simple Power Systems (Max. 3-Buses): Determination of Bus Voltages, (Sample One Iteration only)
Newton Raphson Method in Rectangular and Polar Co-Ordinates Form: Load Flow Solution with or without PV Buses- Derivation of Jacobian Elements, Algorithm and Flowchart - Comparison of Gauss Seidel and Newton Raphson Methods.

UNIT-V

Power System Stability Analysis: Elementary concepts of Steady State, Dynamic and Transient Stabilities. Swing equation (Derivations and Numerical Problems). Power Angle Curve and Determination of Steady State Stability by change in load angle.
Determination of Transient Stability by Equal Area Criterion by change in mechanical input, Application of Equal Area Criterion, Critical Clearing Angle - Solution of Swing Equation: Point-by-Point Method. Methods to improve steady state and transient Stabilities.

TEXT BOOK(S):

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Power System Analysis by N.V Ramana, Pearson education publishers.

REFERENCE BOOK(S):

1. Power system Analysis and design by Dr.B.R Gupta : S.Chand publishers.
2. Modern Power system Analysis – by I.J.Nagrath& D.P.Kothari: Tata McGraw-Hill Publishing company, 2nd edition.
3. Computer techniques and models in power systems, By K.Uma rao, I.K.International
4. Power System Analysis by Hadi Saadat – TMH Edition.

20EE32002–CONTROLSYSTEMS

B.Tech. EEE - III Year II Sem.

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

Prerequisite(s):20MA12002– Computational Mathematics
20EE22003 – Signals, Systems and Transform Techniques

Course Objectives: Develop ability to

1. Understand basic systems and their open loop and closed loop characteristics
2. Understand mathematical modelling of systems and their representation.
3. Understand time domain analysis in first order and second order system and their design.
4. Understand the concept of stability and methods to determine stability
5. Understandfrequencydomainanalysisandstabilityanalysisthroughfrequencyplots.

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

CO1. Identifyanddistinguishdifferentsystemsandunderstandtheimportanceof feedback.
CO2. Perform mathematical analysis of Electrical systems, Translational and Rotational mechanical systems
CO3. Obtain transfer functions of various systems.
CO4. Solve firstorderandsecondordersystemsandanalyzetheircharacteristicresponses.
CO5. Perform stability analysis of given systems in time domain.
CO6. Perform frequency domain analysis

UNIT–I

Introduction: Concepts of Control Systems- Open Loop and closed loop control systems and their differences, Industrial control systems, Feed-Back Characteristics - Effects of feedback. Mathematical models: Differential equations, transfer functions – Electrical systems, Translational and Rotational mechanical systems.

UNIT II

Transfer Function Representation: Transfer Functions of: DC Servo motor - AC Servo motor - Synchro transmitter and Receiver, Block diagram algebra, Signal flow graph: Mason's gain formula.

UNIT–III

Time Response Analysis: Introduction to time and frequency domain analysis, Standard test signals, Time response of first and second order systems- Characteristic equation, Steady state and transient response, Time domain specifications, Steady state errors and error constants– Introduction to design-P, PI and PID controllers**.**

UNIT–IV

Stability Analysis in time domain: The concept of stability–Routh's stability criterion

Root locus technique: The root locus concept - construction of root loci. Introduction to Lag – Lead Compensation.

UNIT–V

Frequency Response Analysis: Introduction to frequency domain analysis and methods–Bode Plots, Polar Plots, Nyquist Plots, Stability Analysis.

TEXTBOOK(S):

1. "Control Systems Engineering", I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers.
2. "Control Systems Engineering", 6th Edition Norman S. Nise, Wiley.

REFERENCEBOOK(S):

1. "Control Systems–Principles and Design", M. Gopal, Tata Mc Graw hill Publication
2. "Automatic Control Systems", Farid Golnagarhi, Benjamin. C.Kuo, Wiley & Sons.
3. "Modern Control Engineering", Katsuhiko Ogata, Prentice HallofIndia.
4. "Control Systems", A. Jairath, Ane Books Ltd.

20EE32003-SMART GRID TECHNOLOGIES

(Professional Elective - II)

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

B. Tech. EEE - III Year II Sem.

Prerequisite(s): 20EE21004 – Power Electronics
20EE22001– Generation and Utilization of Electrical Energy
20EE31001-Electrical Power Transmission Systems
20EE31003 – Power System Protection
20EE31004 – Renewable Energy Systems

Course Objectives: Develop ability to

1. Understand the basic concepts of Smart grid, microgrid
2. To understand the communication technologies, infrastructure required for smart metering
3. Integrate renewable energy generation to smart grids.
4. Understand the smart grid technologies.
5. Understand the Power Quality associated with Smart Grids.

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

CO1. Do Power Flow calculations and explain functions of smart grid components
CO2. Use Smart meters for effective power network communication
CO3. Integrate Renewable energy generation with smart grids.
CO4. smart grid technologies and protection
CO5. Operate, communicate and control smart grids, Power quality events

UNIT I

Introduction to Smart Grid: Conventional grid, Micro grid, Smart Grid - definition, Applications, Government and Industry - Standardization, Functions of Smart Grid Components, Wholesale energy market in smart grid, smart vehicles in smart Grid.

UNIT II

Smart Communication: Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broad band over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Smart Measurement: Monitoring Phasor Measurement Unit (PMU), Smart Meters, Wide area monitoring systems (WAMS), Advanced metering infrastructure (AMI) – GIS and Google Mapping Tools, IP – based systems, Network Architectures.

UNIT III

Renewable Energy and Storage: Renewable Energy Resources – Sustainable Energy Options for the Smart Grid — Demand response issues – Environmental Implications – Storage Technologies – Grid integration issues of renewable energy sources.

UNIT IV

Smart Grid Technologies: Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Protection and control.

UNIT V

Power Quality Management in Smart Grid: Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

TEXT BOOK(S):

1. "Smart Grid: Fundamentals of design and analysis", James Momoh, John Wiley & Sons Inc, IEEE press2012.
2. Smart grid: Technology and applications", Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley U sons Inc.,2012

REFERENCE BOOK(S):

1. James Momoh, "Smart Grid Fundamentals of Design and Analysis" IEEE Press, Wiley Publications, 2012
2. Smart grid Hand Book for Regulators and policy makers, Nov 2017 published by India Smart Grid Forum
3. Bharat Modi, Anuprakash, Yogesh Kumar, "Fundamentals of Smart grid Technology", Katson publishers, 2015 With effect from the academi

20EE32004 - ENERGY CONSERVATION AND AUDIT

(Professional Elective - II)

B.Tech. EEE - III Year II Sem.

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

Pre-requisites: 20EE22001– Generation and Utilization of Electrical Energy
20EE31004 – Renewable Energy Systems

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 the types of audits and the instruments used for auditing.
5. Understand basic terms related to energy action planning, management, monitoring and targeting.

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

CO1 Explain the significance of energy in India.
CO2 Explain the importance of energy conservation.
CO3 Explain different acts and policies of energy conservation suggest energy saving methodologies.
CO4 Prepare energy audit report.
CO5 Evaluate the energy saving and conservation in different electrical utilities.

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 Intensity on Purchasing Power Parity (PPP) - Electricity Pricing – 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 – Understanding Energy Costs – Benchmarking – Energy Performance – Matching Energy Usage to Requirement – Maximizing System Efficiencies – Optimizing Input Energy Requirements – Fuel and Energy Substitution.

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 Audit: Definition – Need for Energy Audit – Types of Energy Audit and Approach – Instruments and Metering for Energy Audit – Manner and Intervals for Conducting Energy Audit (Bureau of Energy Efficiency Regulations, 2008).

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 BOOK(S):

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 BOOK(S):

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.

20EE32005 – ADVANCED POWER ELECTRONICS

(Professional Elective - II)

B.Tech. EEE - III Year II Sem.

L	T	P/D	C
3	-	--	3

Pre requisites: 20EE21004- Power Electronics

Course Objectives: Develop ability to

1. Understand linear and switched supplies
2. Understand resonant converters
3. Understand concepts of multi-pulse and multilevel converters
4. Understand the applications of power electronic converters

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

1. Differentiate linear and switched mode power supplies
2. Compare ZCS and ZVS topologies
3. Explain the operation of multilevel and multi-pulse converters
4. Illustrate the importance of power electronics in HVDC and FACTS applications

UNIT – I

Switching voltage regulators: Linear vs switching supplies – Review of DC-DC voltage regulator – Isolated supplies: Flyback, Forward, Half bridge, Full bridge, Push-pull converters- Introduction to SMPS

UNIT – II

Resonant converters: Introduction – classification- ZVS & ZCS – clamped voltage topologies

UNIT-III

Multilevel converter: Concept of multilevel – topologies – features and relative comparison-introduction to PWM technique for multi-level converters (principle only)

Multi-pulse converters: Concept of multi-pulse- configurations – different phase shifting transformer configurations - applications

UNIT – IV

HVDC transmission: Introduction – operation of 12-pulse converter – equipment required for HVDC system and their significance – comparison of AC & DC transmission

UNIT – V

FACTS Devices: Importance of reactive power compensation – benefits of FACTS devices – Types of FACTS devices – Comparison- Advantages and disadvantages

TEXT BOOK(S):

1. Power Electronic Circuits, Devices and applications by M.H.Rashid, PHI.
2. Power Electronics – converter, applications &design, Ned Mohan, tore M. Undeland and William. P. Robbins, John Wiley and sons

REFERENCE BOOK(S):

1. Modern Power Electronics and AC drives by Bimal.K.Bose, Prentice Hall India.
2. Power electronic converter harmonics – multi-pulse methods for clean power, Derek.A.Paise, IEEE Press
3. Modern Power Electronics, P.C.Sen, S.Chand & Co. Ltd.
4. Power Electronics essentials and applications, L. Umanand, Wiley India Pvt. Ltd

20EE32006-ELECTRICAL DISTRIBUTION SYSTEMS

(Professional Elective - II)

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

B.Tech. EEE - III Year II Sem.

Prerequisite(s): 20EE22001- Generation and Utilization of Electrical Energy
20EE31001 – Electrical Power Transmission Systems

Course Objectives: Develop ability to

1. To distinguish between transmission and distribution systems
2. To comprehend design considerations of feeders
3. To compute voltage, drop and power loss in feeders
4. To comprehend protection of distribution systems
5. To examine the power factor improvement and voltage control

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

CO1. distinguish between transmission, and distribution line and design the feeders
CO2. compute power loss and voltage drop of the feeders
CO3. design protection of distribution systems
CO2. Comprehend the importance of voltage control
CO3. Comprehend the power factor improvement

UNIT - I

General Concepts: Introduction to distribution system, Coincidence factor - contribution factor - Loss factor - Relationship between the load factor and loss factor. Load growth, Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

Distribution Feeders: Design Considerations of Distribution Feeders: Radial, loop and network types of primary feeders, Introduction to low voltage distribution systems (LVDS) and High voltage distribution systems (HVDS), voltage levels, Factors effecting the feeder voltage level, feeder loading, basic design practice of the secondary distribution system, secondary banking.

UNIT - II

Substations: Location of Substations: Rating of distribution substation, service area with ‘n’ primary feeders. Benefits derived through optimal location of substations. Optimal location of Substations (Perpendicular bisector rule and X, Y co-ordinate method).

System Analysis: Voltage drop and power-loss calculations: Derivation for voltage drop and power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines, analysis of non-three phase systems.

UNIT - III

Protection: Objectives of distribution system protection, types of common faults and procedure for fault calculations, over current Protective Devices: Principle of operation of Fuses, Auto-Circuit Recloser - and Auto-line sectionalizes, and circuit breakers.

Coordination: Coordination of Protective Devices: Objectives of protection co-ordination, general coordination procedure, Types of protection coordination: Fuse to Fuse, Auto-Recloser to Fuse, Circuit breaker to Fuse, Circuit breaker to Auto-Recloser.

UNIT - IV

Compensation for Power Factor Improvement: Capacitive compensation for power-factor control - Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched), effect of series capacitors, difference between shunt and series capacitors, Calculation of Power factor correction, capacitor allocation - Economic justification of capacitors - Procedure to determine the best capacitor location.

UNIT - V

Voltage Control: Voltage Control: Importance of voltage control, methods of voltage control, Equipment for voltage control, effect of shunt capacitors, effect of series capacitors, effect of AVB/AVR on voltage control, line drop compensation

TEXT BOOK(S):

1. Turan Gonen, Electric Power Distribution System Engineering, CRC Press, 3rd Edition 2014.
2. V. Kamaraju, Electrical Power Distribution Systems, Tata McGraw Hill Publishing Company, 2 nd edition, 2010.

REFERENCE BOOK(S):

1. G. Ram Murthy, Electrical Power Distribution hand book, 2nd edition, University press 2004.
2. A.S. Pabla, Electric Power Distribution, Tata McGraw Hill Publishing company, 6th edition, 2013.

20EC32L04– MICROPROCESSORS AND ASSEMBLY LANGUAGE PROGRAMMING LAB

B.Tech. EEE- III Year II Sem.

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

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

Course Objectives: Develop ability to

1. Write Assembly Language Programs for various arithmetic and logical operations using8086.
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 programs in assembly language using the instruction set of 8086 through MASM software as well as using 8086 Kit.
CO2. Write the program to design a Digital clock using 8086
CO3. Interface different I/O devices with 8086.
CO4. 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 16bit 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 DACto8086
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.

20EE32L01–POWER SYSTEM SIMULATION LAB

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

B.Tech. EEE III Year II Sem.

Prerequisites:20EE22001 - Generation and Utilization of Electrical Energy
20EE22002 - Electricals Machines I

Course Objectives: Develop ability to

1. To determine equivalent circuit parameters of 3-winding transformer.
2. Find sub-transient reactance of a salient pole synchronous machine and three phase transformers.
3. Calculate fault current for various fault analysis.
4. Apply iterative techniques to typical power systems using Gauss Seidel method.
5. Understand the behavior of DC distribution systems and voltage stability problems in power systems.

Course outcomes: On completion of this course, students would be able to

CO1. Draw the equivalent circuit of 3 -winding transformer
CO2. Review sequence impedances of salient pole Synchronous machine and3-phase Transformer
CO3. Apply Fault calculations for various faults in power systems.
CO4. Apply iterative techniques to typical power systems using Gauss Seidel method.
CO5. Understand the behaviour of distribution systems and voltage stability problems in power systems.

List of experiments:

1. Determination of Equivalent circuits of 3-winding transformer.
2. Determination of Sequence impedance of salient pole synchronous machine
3. Fault analysis-I
   i. Single line to ground fault(L-G)
   ii. Line to Line fault(L-L)
4. Fault analysis-II
   i. Double line to Ground fault(L-L-G)
5. Determination of Sequence Impedance of Three Phase Transformer.
6. Solution of power flow using Gauss Seidel Method
7. ABCD constants for long lines and voltage profile observation for open circuit line with and without shunt reactor compensation.
8. The performance of power system stabilizer.
9. Steady state stability for small disturbances with and without change in output.
10. Voltage stability problems in transmission lines.

20EE32L02–CONTROLSYSTEMS LAB

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

B.Tech. EEE – III Year II Sem.

Prerequisite(s):20EE22L01– Electrical Machines-1 Lab
20EE31L01-Electrical Machines -II lab

Course Objectives: Develop ability to

1. Understand the concepts of time response analysis.
2. Understand the effect of controllers and compensators in the context of a second order system response
3. Understand the control aspects in applications like synchro, DC motor and AC motor
4. Understand stability analysis of a system.

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

CO1. Determine the time domain specifications for a given system
CO2. Draw the characteristics of synchro transmitter and receiver
CO3. Analyze the effect of P, PI, PD, PID controller DC servomotor
CO4. Determine the Transfer Function of DC Generator and DC shunt motor.
CO5. Draw the characteristics of AC servomotor.
CO6. Simulate the stability analysis of a Linear Time Invariant system.
CO7. Evaluate the gain margin and phase margin of a given system using Lead-Lag compensators.

LIST OF EXPERIMENTS:

1. Time response of second order system
2. Characteristics of synchro's
3. Effect of P, PI, PD, PID controller on a second order system (DC servo motor)
4. Transfer function of DC shunt motor
5. Characteristics of AC servo motor.
6. Transfer function of DC Generator
7. Effect of feedback on DC servomotor using MATLAB.
8. Simulation of root locus for a Linear Time Invariant System & perform stability analysis.
9. Simulation of Bode plot and Nyquist plot for a Linear Time Invariant System and perform stability analysis.
10. Design of Lead-Lag compensator for the given system and with specification using suitable software.

ADDITIONAL EXPERIMENTS

1. Simulation of Time response of second order system
2. Determination of steady state errors through simulation

Note: All simulation experiments will be simulated using suitable software (USING MATLAB/ PSPICE/SUITABLE SOFTWARE)

20EN32001– ENGLISH FOR PROFESSIONAL SUCCESS

B. Tech. EEE – III Year II Sem.

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

Prerequisite(s): None

Course Objectives: Develop ability to
1. Recognize and understand the meanings of Phrases, Phrasal verbs and Idioms.
2. Read critically to comprehend the given text.
3. Understand the nature and importance of presentation skills.
4. Know the importance of organizational communication.

Course Outcomes: At the end of the course, students would be able to
CO1. Appreciate the value of using Phrases, Phrasal verbs and Idioms.
CO2. Identify the supporting statements, their relevance or irrelevance, common arguments, opposing points of views and refutations.
CO3. Use effective body language and tone to deliver a fervent and well-knit presentation.
CO4. Prepare circulars, notices, minutes and memos effectively.

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.

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.

20MA32P01 – LOGICAL REASONING-II

B. Tech EEE - III Year II Sem.

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.
2. 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, students will be able to

CO1. Analyze the difference between permutation and combination and solve various arrangement and selection related problems; Evaluate probability problems using various rules; Apply appropriate methods to evaluate LCM, HCF, Square Roots, Cube Roots, Surds and Indices; Apply the rules of allegation to solve the problems related to mixture.

CO2. Analyze the linear and circular sitting arrangements and also solve the coding and decoding problems with same and different set of letters; Evaluate the problems of number and letter series.

CO3. Solve calendar related problems; Illustrate different forms of Alphabet Arrangements and problems based on letter word; Solve the problems using the various concepts of directions.

CO4. Perform mathematical operations on clocks; Evaluate various problems on cubes and cuboids; Solve problems on data sufficiency and interpretation of data using various types of graphs.

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:

5. **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.

6. **Number and letter Series:** Difference series, Product series, Squares series, Cubes series, Alternate series, Combination series, Miscellaneous series, Place values of letters.

7. **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.

8. **Alphabet Test:** Alphabetical order of verbs, letter-word problems, rule-detection, alphabetical quibble, word formation.

9. **Direction sense Test**: Direction from the initial point: directions, cardinal directions, problems on distances, problems on clocks, problems on angles, problems on shadows.

10. **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.

11. **Cubes**: Basics of a cube, finding the minimum number of cuts when the number of identical pieces is 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.

12. **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 BOOK(S):

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 BOOK(S):

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.

20MB32M04 – PROFESSIONAL ETHICS

(Mandatory Course)

B. Tech. EEE - III Year II Sem

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

Pre-requisites: None

Course Objectives: Develop ability to

1. Imbibe and internalize the Values and Ethical Behaviour in the personal and Professional lives.

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

CO1. Recognize the importance of Values and Ethics in their personal lives and professional careers.

CO2. Learn the rights and responsibilities as an employee, team member and a global citizen.

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 BOOK(S):

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

REFERENCE BOOK(S):

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.

B.Tech. (EEE)
IV Year I Sem.
Detailed Syllabus

20EE41001 – INTRODUCTION TO AI IN ELECTRICAL ENGINEERING

B.Tech. EEE - IV Year I Sem.

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

Prerequisite(s): 20EE32001 – Power System Analysis

Course Objectives: Develop ability to

1. Identify problems where AI techniques are applicable.
2. Apply selected basic AI techniques to these problems (i.e., a project).
3. Judge the applicability of more advanced techniques to these problems.
4. Design and build systems that both acts intelligently and learn experientially

Course Outcomes: On completion of this course, students would be able to

CO1. Gain basic knowledge of soft computing techniques
CO2. Understand how the soft computing techniques can be used for solving the problems of power systems operation and control.
CO3. Design of ANN based systems for function approximation used in load forecasting.
CO4. Design of Fuzzy based systems for load frequency control in power systems
CO5. Solve problem of Optimization in power systems.

UNIT - I

Introduction, definition of AI difference between soft computing techniques and hard computing systems, expert systems brief history of ANN, Fuzzy, GA and Hybrid Systems.

UNIT – II

Fundamental concepts, Basic models, learning rules, Single layer and multi-layer feed-forward and feedback networks, Supervised and unsupervised methods of training, Recurrent networks, Modular network. Application of Neural Network in Power System

UNIT – III

Introduction, Comparison between Fuzzy and crisp logic, Fuzzy sets, Membership function, Basic fuzzy set operations, properties of Fuzzy set, fuzzy relations, Fuzzy interference system, Mamdani, Sugeno, Fuzzy rule-based system, defuzzification methods.

UNIT – IV

Working principles, difference between GA and traditional methods, Different types of coding methods, fitness function, different types GA operators 1. Roulette wheel selection 2. Stochastic remainder Roulette wheel selection, Rank selection, Tournament selection and stochastic universal sampling, different types of cross over methods in GA, Mutation, Schema theorem, elite preserving operator, GAs for constrained optimization, understating of working of GA using flow chart.

UNIT – V

Introduction to Integrated hybrid systems such as neuro-fuzzy, fuzzy-neuro.
Applications: Short term and long-term load forecasting, Identification, Classification, Fault location and fault diagnosis, Economic load dispatch, DC/AC four quadrant drive control.

TEXT BOOK(S):

1. Neural Networks, Fuzzy logic and Genetic algorithms By S. Rajasekaran, G. A. Vijayalakshmi Pai PHI publication
2. Artificial Intelligence and Intelligent Systems, OXFORD University Press, New Delhi, 2005- N. P. Padhy

REFERENCE BOOK(S):

1. Optimization for Engineering Design by Kalyanmoy Deb PHI publication
2. Multi-objective Optimization using Evolutionary Algorithms ByKalyanmoy Deb Willey Publication
3. Artificial intelligence techniques in power systems by KEVIN WARWICK, ARTHUR EKWUE RAJ AGRAWAL

20EE41002 – INSTRUMENTATION AND MEASUREMENT TECHNIQUES

B.Tech. EEE - IV Year I Sem.

Prerequisite(s): 20EE32002 - Control Systems

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

Course Objectives: Develop ability to

1. Explain the concept of principle of operation of all analog measuring instruments namely PMMC type, Moving Iron type, Dynamometer type of Instruments
2. Comprehend principle of operation of DC and AC Potentiometers, Instrument Transformers.
3. Identify AC bridges for measuring Resistance, Inductance and Capacitance.
4. Understand the principle of operation of different type of transducers.

Course Outcomes: On completion of this course, student will be able to

CO1. differentiate between different types of torques in measuring instruments and determine how to extend the range of instruments.

CO2. explain the operation of Instrument Transformers and the also the methods to measure unknown resistances, current and voltages using DC and AC potentiometers.

CO3. use dynamometer type wattmeter for measurement of power and analyze the operation of single-phase induction type of energy meter.

CO4. identify different types of bridges to measure unknown resistances, inductances and capacitances.

CO5. differentiate between a sensor and transducer and understand the principle of operation of different types of transducers

UNIT – I

Introduction to Measuring Instruments: Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters - types.

UNIT –II

Potentiometers: Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate types Standardization – applications.

Instrument Transformers: CT and PT – Ratio and phase angle errors – design considerations. Type of P.F. Meters –dynamometer and moving iron type – 1-phase – Frequency meters – resonance type and Weston type.

UNIT –III

Measurement of Power: Single phase dynamometer wattmeter, LPF and UPF, Double element and three elements dynamometer wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems.

Measurement of Energy: Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading. Three phase energy meters

UNIT – IV

Resistance Measurements: Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge – Carey Foster's bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method.

A.C. Bridges: Measurement of Inductance, Quality Factor - Maxwell's bridge, Hay's bridge, Anderson's bridge, Owen's bridge. Measurement of capacitance and loss angle – Desauty's bridge. Wien's bridge – Schering Bridge.

UNIT – V

Transducers and Oscilloscope: Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle of operation of resistor, inductor, LVDT and capacitor transducers; Strain gauge and its principle of operation, Gauge factor, Thermistors, Thermocouples, Piezo electric transducers, photovoltaic, photo conductive cells, photo diodes. Cathode ray oscilloscope-Cathode ray tube-time base generator-horizontal and vertical amplifiers - applications of CRO-Measurement of phase and frequency-Lissajous patterns.

TEXT BOOK(S):

1. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, fifth Edition, Wheeler Publishing.
2. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications.

REFERENCE BOOK(S):

1. Electrical Measurements – Buckingham and Price, Prentice – Hall.
2. Electrical Measurements: Fundamentals, Concepts, Applications – Reissland, M.U, New AgeInternational (P) Limited, Publishers.
3. Principles of Measurement and Instrumentation – by A.S Morris, Pearson /Prentice Hall of India.

20EE41003 –HVDC AND FACTS

(Professional Elective - III)

B.Tech. EEE -IV Year I Sem.

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

Prerequisite: 20EE21004- Power Electronics
20EE31001- Electrical Power Transmission Systems
20EE32006 -Electrical Distribution Systems

Course Objectives: Develop ability to

1. Deal with the importance of HVDC Transmission and Converters
2. Deal with firing angle and DC link control of HVDC System
3. Deal with harmonics and modelling of DC/AC converters.
4. Know the importance of controllable parameters and types of FACTS controllers & their benefits
5. Control STATCOM and SVC and their comparison and the regulation of STATCOM, functioning and control of GCSC, TSSC, FC-TCR, TSCTCR and UPFC

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

CO1. Understand the importance of power transmission through HVDC

CO2. Calculate power conversion between Ac to DC and DC to AC and firing angle control

CO3. Understand the fundamentals of FACTS Controllers, objectives of Shunt and Series compensation

CO4. Choose proper controller for the specific application based on system requirements.

CO5. Learn the control circuits of Shunt Controllers SVC & STATCOM for various functions.

UNIT-I

Introduction of DC transmission – Comparison of AC and DC transmission – Application of DC transmission –Planning for HVDC transmission –Modern trends in DC transmission – Types of DC links – Typical layout of HVDC station- Analysis of Graetz circuit with or without overlap – Characteristics of twelve pulse converter.

UNIT-II

Principle of DC link control–Converter control characteristics - firing angle control - Current and extinction angle control - Starting and stopping of DC link.

UNIT-III

Introduction of harmonics –Generation of harmonics- Characteristics of current harmonics – Design of AC filter and DC filter –Carrier frequency and RI noise— Modeling of DC/AC converter - -Simultaneous Method-Sequential method.

UNIT-IV

Concept of flexible AC transmission - Overview of FACTS devices- Co-ordination of FACTS with HVDC - Importance of reactive power compensation - Static VAR Compensator (SVC) –Flow of power in AC Parallel paths and meshed systems - Objectives

of shunt compensation - STATCOM configuration and operating principle - comparison between SVC and STATCOM.

UNIT-V

Thyristor Controlled Reactor (TCR), Fixed Capacitor Thyristor Controlled Reactor (FC-TCR) - Thyristor Switched capacitor and Reactor - Thyristor Switched capacitor- Thyristor Controlled Reactor (TSCTCR) - Introduction to Static Synchronous Series Compensator - Advantages and limitation of SSSC - Introduction to UPFC and operating principle.

TEXT BOOK(S):

1. Understanding FACTS, Concepts and Technology of Flexible AC Transmission Systems, Narain. G. Hingorani, Laszlo Gyugyi, IEEE Press, Wiley India.
2. HVDC Transmission, S. Kamakshaiah, V. Kamaraju, The Mc- Graw Hill Companies.

REFERENCE BOOK(S):

1. K. R. Padiyar "FACTS CONTROLLERS in Power Transmission & Distribution," New Age International (P) Ltd.
2. K. R. Padiyar "HVDC POWER TRANSMISSION SYSTEMS Technology and System Interactions," New Age International (P) Ltd.,".
3. HVDC and FACTS Controllers applications of static converters in power systems, Vijay K. sood, Kluwer Accademic Publishers.
4. Thyristor- Based Controllers for Electrical Transmission Systems, R.Mohan Mathur, Rajiv K.Varma.Wiley India.

20EC41013 - DIGITAL SIGNAL PROCESSING

(Professional Elective - III)

B. Tech EEE - IV Year I Sem.

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

Prerequisites: 20EE22003 - Signals and Systems
20EE22L02 - Signals, Systems and Transformation Techniques

Course Objectives: Develop Ability to

1. Understand the principles of analysing 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. Classify given discrete time system based on various system properties
CO2. Perform frequency domain analysis of the given discrete time signal an
CO3. Design and realize IIR filter for the given specifications
CO4. Explain the concept of windowing and design of a linear phase FIR filters for given specifications
CO5. Explain the importance of multi-rate signal processing and the principles of sampling rate conversion.

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 low pass 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.

TEXTBOOK(S):

1. John G. Proakis, D. G. Manolakis: Digital signal Processing: Principles, Algorithms and Applications- 4thEdition, Pearson/PHI, 2009.
2. S. K. Mitra: Digital Signal Processing, 3/e, TMH, 2006.

REFERENCE BOOK(S):

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.

20EE41004 – DESIGN FOR INTERNET OF THINGS

(Professional Elective - III)

B.Tech. EEE IV Year I Sem.

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

Prerequisite(s):20CS11001 - Programming for Problem Solving – I
20EE32002 - Control Systems
20EC32006 - Computer Architecture and Microprocessors

Course Objectives: Develop ability to

1. Assess the vision and introduction of IoT and understanding how M2M is connected to internet of things
2. Identify the appropriate hardware and software components of IoT for communication
3. Gain knowledge on Cloud Storage models, web servers and to integrate device, data and cloud management framework for IoT.
4. Learn the concepts of various data analytics and operational technology security with IoT.
5. Know the use cases in Industrial and domestic applications.

Course Outcomes: On completion of this course, student would be able to

CO1. Interpret the vision of IoT from a global context, compare and contrast M2M and IoT Technology.
CO2. Relate the appropriate hardware and software components of IoT for providing the communication among the devices.
CO3. Implement device, data and cloud management services for IoT applications.
CO4. Explore various data analytical techniques and operational security for IoT applications.
CO5. Compare the Industrial applications in Industrial and domestic applications.

UNIT I

Introduction to Internet of Things: Definition and Characteristics of IoT, Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.

UNIT II

Elements of IoT: Network of interconnected and collaborating objects, Embedded systems architecture: Key hardware and software elements- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP. Application Transport Method: SCADA.

UNIT III

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs Web server – Web server for IoT, Cloud for IoT

IoT Application Development: Solution framework for IoT applications- Implementation of Device Integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

UNIT IV

Data and Analytics for IoT: Introduction to Big Data Analytical Tools for IoT, Data Analytics for IoT, Edge Streaming Analytics, Network Analytics, Machine Learning for IoT Securing IoT: Introduction to OT (Operational Technology) security, a brief history and common challenges in OT (Operational Technology) Security.

UNIT V

Case studies: IoT applications in home and home appliances, infrastructures, buildings, security, Industries, other IoT electronic equipment. Concepts of Industry 4.0.

TEXT BOOK(S):

1. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education. Mar 2017
2. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017

REFERENCE BOOK(S):

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. An Introduction to Internet of Things - Where and How to start", Mihai Tudor Panu. Nov 2017, Intel Notes.
3. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, Pethuru Raj and Anupama C. Raman, CRC Press.
4. Designing the Internet of Things, Adrian McEwen & Hakim Cassimally, Wiley.
5. Getting Started with the Internet of Things, Cuno Pfister, O Reilly Media.

20EE41005 – ELECTRICAL DRIVES

(Professional Elective - III)

B.Tech. EEE - IV Year I Sem.

L	T	P/D	C
3	-	--	3

Pre requisites: 20EE21004- Power Electronics
20EE22002 - Electrical Machines-I
20EE31002 - Electrical Machines II

Course Objectives: Develop ability to

1. Control DC motors through power electronic converters – phase-controlled rectifiers and DC choppers
2. Comprehend concept of four Quadrant operation of DC motors
3. Understand concepts related to AC motor control through power electronic converters – AC voltage controllers, voltage and current source inverters.
4. Understand selection and applications of drives – PMAC and PMDC drives

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

1. Acquire knowledge to control DC motors through single phase and three phase thyristor-controlled rectifiers and DC choppers
2. Learn and implement four quadrant operation of DC motors for various applications
3. Operate and control of three phase induction motor drives
4. Acquire knowledge to operate AC motor drives – synchronous and PMAC drives
5. Select drive systems for vehicle applications

UNIT – I

Control of DC motors through phase-controlled rectifiers: Introduction to electric drives – Control of separately excited DC motor and DC series motor using single phase and three phase thyristor based controlled rectifiers-continuous current operation – output voltage and current waveforms – Speed–torque characteristics- Numerical – Introduction to permanent magnet brushless DC (PMBLDC) motor drive (block diagram only)

UNIT – II

Control of DC motors by choppers: Single quadrant and two quadrant operation of chopper fed separately excited DC motor and DC series motor – Continuous current operation – Output voltage and current wave forms – Speed torque expressions – speed torque characteristics – Problems on chopper fed DC Motors – Closed Loop operation-speed controlled drive system & current control loop (block diagram only)

UNIT-III

Four Quadrant Operation of DC Motors: Introduction to Four quadrant operation – Motoring and Electric Braking: Plugging, Dynamic and Regenerative Braking - Four quadrant operation of D.C motors by dual converters and DC choppers- Closed loop

operation of DC motor – PWM current controller & hysteresis current controller (Block Diagram Only).

UNIT – IV

Induction motor drives -analysis and performance of three phase induction motors- Stator voltage control**:** Control of induction motor by AC Voltage Controllers -Variable frequency control: Variable frequency control of induction motor by voltage source inverters (VSI) and current source inverter (CSI) -PWM control – Principle of direct vector control (only block diagram) Static rotor resistance control: Slip power recovery – Static Scherbius & Kramer drive –Numerical

UNIT – V

Control of Synchronous Motors: Separate control &self-control of synchronous motors – Operation of self-controlled synchronous motors by VSI and CSI – Operation & Waveforms – sinusoidal Permanent Magnet AC (PMAC) drive (block diagram only)- Selection of electric drives and control schemes for electric vehicle applications.

TEXT BOOK(S):

1. Fundamentals of Electric Drives – by Gopal. K. Dubey Narosa Publications
2. Electric Motor drives – modelling, analysis & control – by R.Krishnan, PHI publication

REFERENCE BOOK(S):

1. Modern Power Electronics and AC drives by Bimal.K.Bose, Prentice Hall India.
2. Electric Drives by Nisit K. De, P.C. Sen, PHI Publications
3. Power Electronic Circuits, Devices and applications by M.H.Rashid, PHI.
4. 4. Power Semiconductor drives by P.V. Rao BS Publications

20EE41006 – RESTRUCTURED POWER SYSTEM

(Professional Elective - IV)

B.Tech. EEE - IV Year I Sem.

L	T	P/D	C
3		-/-	3

Prerequisite(s):20EE22001 - Generation and Utilization of Electrical Energy
20EE31001 - Electrical Power Transmission Systems
20EE32001 - Power System Analysis

Course Objectives: Develop ability to

1. To introduce the restructuring of power industry and market models.
2. To impart knowledge on fundamental concepts of congestion management.
3. To analyse the concepts of locational marginal pricing and financial transmission rights.
4. To Illustrate about various power sectors in India

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

CO1. Gain knowledge on restructuring of power industry
CO2. Comprehend basics of congestion management
CO3. Identify the need of ancillary services and pricing of transmission network
CO4. Learners will have knowledge on the various power sectors in India

UNIT I

Key Issues in Electric Utilities: Introduction – Reasons for restructuring / deregulation of power industry, restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion.

UNIT II

Open Access Same-Time Information System (Oasis) & Market Power: Structure of OASIS - Posting of Information – Transfer capability on OASIS.
Market Power: Introduction - Different types of market Power – Mitigation of Market Power - Examples.

UNIT III

Transmission Congestion Management: Introduction: Definition of congestion, Reasons for transfer capability limitation, Importance of congestion management in deregulated environment, Effects of congestion, Desired features of congestion management schemes, Classification of congestion management methods, Transfer Capability Issues – ATC – TTC – TRM – CBM Calculations – Calculation of ATC based on power flow.

UNIT IV

Power System Operation in Competitive Environment: Introduction – Operational Planning Activities of ISO- The ISO in Pool Markets – The ISO in Bilateral Markets – Operational Planning Activities of a GENCO.

UNIT V

Transmission Cost Allocation Methods & Ancillary Services Management: Introduction - Transmission Cost Allocation Methods: Postage Stamp Rate Method – Contract Path Method - MW-Mile Method – Unused Transmission Capacity Method - MVA-Mile method – Comparison of cost allocation methods.

Ancillary Services Management: Introduction – Reactive Power as an Ancillary Service – a Review – Synchronous Generators as Ancillary Service Providers.

TEXT BOOK (S):

1. Kankar Bhattacharya, Math H.J. Boller and Jaap E. Daalder, Operation of Restructured Power System, Kulwer Academic Publishers, 2001.
2. Mohammad Shahid ehpour and Muwaffaq alomoush, Restructured Electrical Power Systems, Marcel Dekker, Inc., 2001.

REFERENCE BOOK (S):

1. Loi Lei Lai, Power System Restructuring and Deregulation, John Wiley & Sons Ltd., England.

20EE41007–POWER SYSTEM OPERATION AND CONTROL

(Professional Elective - IV)

B.Tech. EEE – IV Year I Sem.

L	T	P/	C
3	-	-/-	3

Prerequisite(s):20EE22001 - Generation and Utilization of Electrical Energy
20EE31001 - Electrical Power Transmission Systems
20EE32001 - Power System Analysis

Course Objectives: Develop ability to

1. Understand Economic operation and control of power System.
2. Model power frequency dynamics.
3. Model excitation systems
4. Model reactive power–voltage interactions.
5. Determine the unit commitment and error in power system state estimation

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

CO1. Explain the need of computers in power system and SCADA
CO2. Describe Automatic voltage regulators and Automatic load frequency control
CO3. Design turbine and excitation systems.
CO4. Assess the importance of reactive power injection.
CO5. Perform system state estimation and explore its importance and unit commitment.

UNIT-I

Generation control of Power Systems: Power system control and operating states, expression for tie-line flow and frequency deviation, parallel operation of generators, load shedding area lumped dynamic model. Introduction to SCADA, Standard SCADA Configurations

UNIT-II

Automatic Voltage Regulator: Basic generator control loops, Exciter types, Exciter modeling, Generator modeling, Static performance of AVR loops.

Automatic Load Frequency Control: Automatic Load frequency control of single area systems, Speed governing system, Concept of control area, Modeling the Tie-Line, Block Diagram representation of Two-Area system, Static response of Two-Area system and Tie-Line Bias control,

UNIT-III

Modeling of turbine: Modeling of Turbine, First order Turbine model, Block diagram representation of steam turbines and approximate linear models.

Modeling of Governor: Mathematical Modeling of Speed Governing System – Derivation of small signal transfer function.

Modeling of Excitation System: Fundamental Characteristics of an Excitation System, Transfer function, Block Diagram Representation of IEEE Type – 1 Model.

UNIT–IV

Control of Voltage and Reactive Power: Introduction, generation and absorption of reactive power, single machine infinite bus systems, methods of voltage control, tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control

UNIT – V

Optimal System Operation and Unit Commitment: Introduction, Optimal operation of generators on a bus bar, Unit commitment -Forward Dynamic Programming method (excluding problem) Introduction to power system state estimation (PSSE). System security and emergency control.

TEXT BOOKS:

1. Power System Operation and control- S.Sivanagaraju, G. Sreenivasan, Pearson First Edition,2009.
2. Power System Analysis, Operation and Control, Abhijit Chakrabarti and Sunita Halder, PHI, Second Edition,2009

REFERENCE BOOKS:

1. Power System Operation and Control, Dr. K. Uma Rao, Wiley India Pvt.Ltd.
2. Modern Power System Analysis- I J Nagarath and D P Kothari, TMH, 3rd Edition, 2003
3. Electrical Energy Systems Theory, O.J Elgerd,TMH,2008.
4. Electric Power Systems- B.M.Weedy and B.J. Cory, Wiley student edition, 1999

20EC41014 – MICROCONTROLLERS AND EMBEDDED SYSTEMS

(Professional Elective - IV)

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

B.Tech. EEE- IV Year I Sem.

Prerequisite(s): 20EC32007 - 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. Explain the hardware requirements of an Embedded System Design for various applications.
CO2. Explain the Architecture and features of 8051 and programming of 8051.
CO3. Explain the operation of the interrupts, timers/ counters and serial communication interface for 8051 Microcontrollers.
CO4. Explain the functions and features of ARM Processors.
CO5. Justify the role of Real Time Operating System and its function in Embedded System.

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 BOOK(S):

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.

REFERENCE BOOK(S):

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.

20EE41008 – CONTROL SYSTEMS DESIGN
(Professional Elective - IV)

B.Tech. EEE - IV Year I Sem.

L	T	P/D	C
3	-	--	3

Pre requisites: 20EE32002 - Control Systems

Course Objectives: Develop ability to
1. Design compensators to reduce steady state error and improve transient response
2. Design using frequency domain and time domain techniques.
3. Design in state space
4. Implement the techniques to practical applications

Course Outcomes: At the end of the semester the student would be able to
CO1. Identify time domain and frequency domain techniques to design stable systems
CO2. Improve the steady state and transient response of system using compensators and controllers.
CO3. Design stable systems using root locus and frequency plots
CO4. Design controllers using state space technique
CO5. Implement the design techniques to applications

UNIT–I
Review of Control system design methods: Review - First and second order systems – Time domain analysis – Frequency domain analysis – Numerical problems

UNIT–II
Design by Root locus method: – Introduction – Improving steady state error and transient response via cascade compensation – Pole Placement - Feedback compensation – Physical realization of compensation-Numerical problems

UNIT-III
Design by Frequency response: – Introduction –Lag compensation – Lead compensation – Lag-lead compensation-numerical problems

UNIT–IV
Design by State Space: – Introduction to State Space Analysis – Controllability – Alternative approaches to controller design –Alternative approaches to test systems observability - Observability – Numerical Problems

UNIT–V
Case Study: Antenna control - Disk drive system – Traction drive control system – Automobile Engine control

TEXTBOOK(S):

1. Control Systems Engineering – 4th Edition, Norman Nise, John Wiley and sons
2. Modern Control Engineering – 9th Edition, Katsuhiko Ogata, Pearson Education Inc.

REFERENCE BOOK(S):

1. Modern Control Systems – 12th Edition, Richard Dorf, Robert. H. Bishop, Prentice Hall.
2. Control Systems: Principles and Design – Fourth Edition, M. Gopal, Tata Mc Graw Hill.
3. Design of Feedback control systems – 4th Edition, Stefani, Shahian, Savant, Hostettter, Oxford University Press.

20CE41071 – GREEN BUILDINGS
(Open Elective - II)

B.Tech. EEE- 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. Describe the need for green buildings.
CO2. Explain green building process and assessment.
CO3. Explain various approaches like land scaping, storm water and energy management for green buildings.
CO4. Explain energy policies, water supply and waste water strategies, and materials in the field of Civil Engineering construction used for green buildings.
CO5. Explain the implementation of green buildings and its future scope.

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.

TEXT BOOK(S):

1. Sustainable Construction: Green Building Design and Delivery, Charles. J.Kibert, John Wiley & Sons, New Jersey, 2016
2. Green Building: Guide book for Sustainable Architecture, M. Bauer, P. Mosleand M.Schwarz, Springer, Verlag Berlin Heidelberg, 2010.

REFERENCE BOOK(S):

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 Home 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/

20ME41073 – DIGITAL FABRICATION
(Open Elective - II)

B.Tech. EEE - IV Year I Sem.

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

Prerequisites: 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: At the end of the course, student would be able to
CO1. Select an appropriate geometric modelling scheme required for manufacturing
CO2. Interpret machining operations required in subtractive manufacturing
CO3. Compare additive manufacturing methods and comprehend on the process to be adopted
CO4. Illustrate the robotic applications in manufacturing and assembly
CO5. Select an appropriate polymer by comparing properties and manufacturing requirements

UNIT I
Geometric modeling: 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-Planning, 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 (poly oxy methylene), ABS, (Acrilo nitrile-Butadiene-Suyrene), polycarbonates, polyphenylene ethers and oxides, polyamides (nylons); and thermoplastic poly esters.

TEXT BOOK(S):

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

20EC41074 – PRINCIPLES OF COMMUNICATION SYSTEMS
(Open Elective - II)

B. Tech. EEE – IV Year I Sem

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

Pre requisite(s): Nil

Note: Only Block Diagram Approach with Qualitative Treatment of the topics is required. Detailed mathematical treatment is not required.

Course Objectives: Develop ability to
1. Introduce the students to modulation and various analog and digital modulation schemes.
2. They can have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

Course Outcomes: At the end of the course, the student would be able to
CO1. Distinguish various types of modulations.
CO2. Explain different communication modules and their implementation.
CO3. Distinguish various wireless and cellular, mobile and telephone communication systems.

UNIT I
Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

UNIT II
Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, AM Radio, FM Radio, Transmitters and Receivers

Unit III
Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony.
Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

UNIT IV
Satellite Communication: Satellite Orbits, Satellite communication systems, Satellite subsystems, Ground Stations, Satellite Applications, Global Positioning systems.
Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT V
Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, WCDMA.
Wireless Technologies: Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

TEXT BOOK(S):

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, Mc Graw Hill publications, 2008.
2. Kennedy, Davis, Electronic Communications Systems, 4e, TMH, 1999

REFERENCE BOOKS:

1. Tarmo Anttalainen, Introduction to Telecommunications Network Engineering, Artech House
2. Theodore Rappaport, Wireless Communications-Principles and practice, Prentice Hall, 2002.
3. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
4. Wayne Tomasi, Introduction to data communications and networking, Pearson Education, 2005.

20CS41075 – KNOWLEDGE MANAGEMENT
(Open Elective - II)

B.Tech. EEE - IV Year I Sem.

Prerequisites: None

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

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. Evaluate and Implement Knowledge Management Systems to facilitate individual and group work.
CO2. Develop a thorough review of Knowledge Management Concepts, both historical and speculative.
CO3. Originate and distribute research on a Knowledge Management System topic.
CO4. Analyze and design KM processes and Systems.
CO5. Apply Knowledge Management objectives in projects across diverse fields.

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, Anjo Anjewierden, 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.

20MB41076 – SUPPLY CHAIN MANAGEMENT
(Open Elective - II)

B.Tech. EEE- 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. Understand the role of an Engineer as well as Manager in Supply chain management
CO2. Appreciate the importance of logistics in integrating different functional areas.
CO3. Integrate operations with functional areas.
CO4. Visualize the role of logistics and distribution as supply chain drivers
CO5. Understand the importance of supplier and customer relationship 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 BOOK(S):

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.

20EC41L03 – ELECTRONIC DESIGN LAB

B.Tech. EEE- IV Year, I Sem

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

Prerequisite(s): 20EC32L04 - Microprocessors and Assembly Language Programming Lab

Course Objectives: Develop ability to

1. 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. Program to verify Timer/Counter in 8051 using Keil.
2. Verification of UART operation in 8051 using Keil.
3. Interfacing Keyboard.
4. Automatic Street Light Controller.

Using ARM7

5. Voice controlled DC motors.
6. Automatic Railway gate control system.

Using Arduino

7. Home appliances control using Bluetooth.
8. Automatic vehicle accident-avoidance system using Ultrasonic Sensor.
9. Gas leakage detection and automatic control system.

Using Raspberry Pi

10. Image capturing using eye blink detection.
11. Alcohol detection system.
12. Switching on lights based on human movement detection.

Using NodeMCU

13. Patient health monitoring using IoT.
14. Weather monitoring using IoT.

20EE41L01 – INSTRUMENTATION AND MEASUREMENT TECHNIQUES LAB

B. Tech. EEE – IV Year I Sem

L	T	P/D	C
-	-	2	1

Prerequisite(s):20EE41002 - Instrumentation & Measurement Techniques
20EE31L01 - Electrical Machines-II Lab

Course Objectives: Develop ability to

1. Verify the basic principles measuring instruments.
2. Become familiar with various electrical instruments like potentiometers, instrument transformers, power factor meter, AC and DC bridges and transducers.
3. Use different methods to measure resistance, inductance, capacitance, voltage, current, power factor, power and energy.

Course Outcomes (COs): On completion of this course, student would be able to

CO1. Distinguish the basic types of meters used for measurements.
CO2. Determine the standardization values of potentiometer.
CO3. Calculate the phase angle and ratio errors of instrument transformers.
CO4. Compute active and reactive powers in balanced and unbalanced systems.
CO5. Calculate unknown resistance, inductance and capacitance of DC and AC bridges
CO6. Compute the breakdown strength of transformer oil.
CO7. Distinguish the types of transducers

LIST OF EXPERIMENTS

1. Calibration and testing of single-phase energy meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC Ammeter and PMMC Voltmeter
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Schering bridge & Anderson bridge.
6. Measurement of 3 phase reactive power with single-phase wattmeter.
7. Measurement of parameters of a choke coil using 3 voltmeter and 3 ammeter methods.
8. Calibration LPF wattmeter – by Phantom testing
9. LVDT and Capacitance pickup – characteristics and Calibration
10. Resistance strain gauge – strain measurements and Calibration

ADDITIONAL EXPERIMENTS

1. Testing of dielectric of transformer oil using H.T. testing Kit
2. Measurement of % ratio error and phase angle of given C.T.

B.Tech. (EEE)
IV Year II Sem.
Detailed Syllabus

20MB42005 – PROJECT MANAGEMENT AND FINANCE

B.Tech. EEE - 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 Project Management process, project selection methods based on financial criteria.
CO2 Estimate project duration and completion time, estimate the cost and develop a project plan.
CO3 Know Risk management process.
CO4 Financing of project.
CO5 Concept of Venture capital.

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.

TEXT BOOKS:

1. Project management- The managerial process, Clifford F Gray, Erik W Larsom, Gautam V. Desai, 4ed, THM

REFERENCE BOOKS:

1. Project- Planning, analysis, selection, financing, implementation and review, Prasanna Chandra, 6ed, TMH
2. Project Management- Achieving competitive advantage, Jeffrey K Pinto, 1st ed, PHP

20EE42001 – POWER QUALITY

(Professional Elective - V)

B. Tech EEE – IV Year II Sem.

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

Prerequisites: 20EE41003 - HVDC and FACTS
20EE32006 Electrical Distribution Systems
20EE31001 Electrical Power Transmission Systems

Course Objectives: Develop ability to

1. Define power quality and different terms of power quality.
2. Study voltage power quality issue–short and long interruption.
3. Study characteristics of voltage sag
4. Know the behaviour of power electronics loads; induction motors, synchronous motor etc., by the power quality issues.
5. Study mitigation of power quality issues by the VSI converters.

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

CO1. Know the severity of power quality problems in distribution system

CO2. Understand the concept of voltage sag transformation from up-stream (higher voltages) to downstream (lower voltage)

CO3. Improve the power quality to sensitive load by various mitigating custom power devices

UNIT–I

Introduction: Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage, Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring.

UNIT–II

Long & Short Interruptions: Interruptions–Definition–Difference between failures, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions – Limits for the Interruption frequency–Limits for the interruption duration–costs of Interruption–Overview of Reliability evaluation to power quality, comparison of observations and reliability evaluation.

Short interruptions: definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events, single phase tripping – voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

UNIT–III

Single and Three Phase Voltage Sag Characterization: Voltage sag – definition, causes of voltage sag, voltage sag magnitude, and monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems,

and voltage sag duration. Three phase faults, phase angle jumps, magnitude and phase angle jump for three phase unbalanced sags, load influence on voltage sags.

UNIT–IV

Power Quality Considerations in Industrial Power Systems: Voltage sag – equipment behavior of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

UNIT-V

Mitigation of Interruptions & Voltage Sags: Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. System equipment interface – voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.

Power Quality and EMC Standards: Introduction to standardization, IEC Electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

TEXTBOOK(S):

1. "Math HJ Bollen", "Understanding Power Quality Problems",IEEE Press,2000.
2. "R.Sastry Vedamand Mulukutla S. Sarma", "Power Quality VAR Compensation in Power Systems" CRC Press,2008.

REFERENCEBOOK(S):

1. C.Sankaran, Power Quality, CRCPress2001.
2. Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Electrical Power Systems Quality, Tata Mc Graw Hill Education Private Ltd, 3rd Edition 2012.

20EE42002 – DESIGN OF PHOTOVOLTAIC SYSTEMS

(Professional Elective - V)

B.Tech. EEE - IV Year II Sem.

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

Prerequisite(s): 20EE31004 – Renewable Energy Systems

Course Objectives:

1. To familiar with basics of solar PV
2. To familiar with various PV performance measure terminologies.
3. To understand about manufacturing of PV cells & sizing aspects of PV systems.
4. To understand about PV system components and apply them in installation practices & associated trouble shootings.
5. To understand about PV system applications & associated safety measures

Course Outcomes:

CO1. Understand the principle of direct solar energy conversion to power using PV
CO2. Contrast the performance measures of PV
CO3. Infer on various solar cells & design aspects of solar PV
CO4. Identify various PV components & construct few systems
CO5. Develop ideas for working on solar PV systems & associated safety practices

UNIT - I

The PV Cell: Model of PV cell and its characteristics, Datasheet study, Cell efficiency, Effect of temperature, Fill factor, PV cell simulation

Series and Parallel Interconnection: Identical cells in series, Load line, Non-identical cells in series, Protecting cells in series, Interconnecting modules in series, Identical cells in parallel, Non-identical cells in parallel, Protecting cells in parallel, Interconnecting modules

UNIT - II

Incident Energy Estimation: Energy on a tilted flat plate, Energy plots in octave, Atmospheric effects, Airmass, Energy with atmospheric effects, Clearness index, Clearness index and energy scripts in Octave

Sizing of PV Cell: Sizing PV for applications with and without batteries, Examples

UNIT - III

Batteries: Introduction, Capacity, C-rate, Efficiency, Energy and power densities, Comparison

Battery selection, Other energy storage methods,

PV system design: Load profile, Days of autonomy and recharge, Battery size, PV array size,

UNIT - IV

Maximum Power Point Tracking: MPPT concept, Input impedance of DC-DC converters – Buck, Boost, Buck - Boost converter, Input impedance of DC-DC converters -PV module and DC-DC interface in SPICE.

MPPT Algorithms: Impedance control methods, Reference cell - voltage scaling, current scaling, Reference cell - Sampling method, Power slope methods 1and2, Hill climbing

method, Practical points - Housekeeping power supply, Gate driver, MPPT for non-resistive loads, Simulation - MPPT

UNIT - V

PV-Battery Interfaces: Direct PV-battery connection, Charge controller, Battery charger - Understanding current control, slope compensation, simulation of current control, Batteries in series - charge equalization, Batteries in parallel,

PV-Grid Interface: Grid connection principle, PV to grid topologies Part-I, II &III, 3ph d-q controlled grid connection, dq-axis theory, AC to DC transformations, DC to AC transformations, Complete 3ph grid connection, 1ph d-q controlled grid connection, 3ph PV-Grid interface.

TEXT BOOK (S):

1. Gilbert M. Masters: Renewable and Efficient Electric Power Systems. John Wiley &Sons, 2004
2. Roger A. Messenger & Jerry Ventre: Photovoltaic Systems Engineering. CRC Press,2004, 2nded.

REFERENCE BOOK(S):

1. Solanki: Solar Photovoltaics: Fundamentals, Technologies and Applications. PHI Learning Pvt Ltd, 2009
2. S. P. Sukhatme, Solar Energy - Principles of thermal collection and storage, second edition, Tata McGraw-Hil, New Delhi, 1996
3. 2. J. A. Duffie and W. A. Beckman, Solar Engineering of Thermal Processes, second edition, John Wiley, New York, 1991
4. D. Y. Goswami, F. Kreith and J. F. Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia, 2000
5. M. S. Sodha, N. K. Bansal, P. K. Bansal, A. Kumar and M. A. S. Malik, Solar Passive Building: science and design, Pergamon Press, New York, 1986

20EE42003 – DISTRIBUTION SYSTEMS PLANNING AND AUTOMATION

(Professional Elective - V)

B.Tech. EEE - IV Year II Sem.

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

Prerequisite(s): 20EE32006 – Electrical Distribution Systems

Course Objectives:

1. To gain the awareness of the problems and challenges of the existing distribution system
2. To understand the need for Distribution Automation (DA) and appreciate its role in overcoming existing problems of distribution system
3. To gain the knowledge of various aspects of Distribution Automation (SCADA, Substation/ Feeder Automation, Remote Metering)
4. To attain the knowledge of Demand Side Management and appreciate its role in improving performance of Demand Side Management.

Course Outcomes

CO1. Understand and distinguish characteristics of distribution systems from transmission systems
CO2. To design, analyze and evaluate distribution system design based on forecasted data
CO3. Identify and select appropriate sub–station location
CO4. Design and evaluate a distribution system for a given geographical service area from alternate design alternatives

UNIT – I

Distribution System Planning: Problems of existing Distribution System, Planning and forecasting techniques – Present and future – Role of computers- Load Characteristics- Load forecasting using ANN – Load management – tariffs and metering of energy.

Distribution Transformers: Types – Three phase and single-phase transformers – connections – causes and types of failures in distribution transformers

UNIT – II

Primary distribution systems and Distribution Sub–Stations: Distribution substations – Bus schemes –comparison of switching schemes- Substation location and rating- Types of feeders – voltage levels.

Voltage Drop and Power Loss Calculations: Three phase primary lines – Copper loss – Distribution feeder costs – Loss reduction and Voltage improvement in rural networks.

UNIT – III

Distribution System Automation: Reforms in power sector – Methods of improvement – Reconfiguration –Automation – Communication systems – Sensors –Basic architecture of Distribution automation system – software and open architecture – RTU and Data communication – SCADA requirement and application functions –Communication media for distribution system automation- Communication protocols for Distribution systems – IEC 61850 and IEEE 802.3 standards.

UNIT – IV

Substation Automation: Introduction, Definition of Substation Automation, Functions of Substation Automation System, State and Trends of Substation Automation, Intelligent Affordable Substation Monitoring and Control, Advantages of an EEM (Enterprise Energy Management) Substation Automation Solution

UNIT – V

Feeder Automation: Losses in Distribution Systems, System Losses and Loss Reduction, Network Reconfiguration, Improvement in Voltage Profile, Capacitor Placement in Distribution System for Reactive Power Compensation

TEXT BOOK (S):

1. Dr M K Khedkar and Dr G M Dhole, "*A Textbook of Electric Power Distribution Automation*", University Science Press (Laxmi Publications Pvt. Ltd.), 2011
2. James Northcote-Green, Robert Wilson, *"Control and Automation of Electrical Power Distribution Systems"* CRC Press, Taylor and Francis Group, 607

REFERENCES BOOKS:

1. D. Bassett, K. Clinard, J. Grainger, S. Purucker, and D. Ward, *"Tutorial Course: Distribution Automation"*, *IEEE Tutorial Publication 88EH0280-8-PWR*, 1988.
2. Turan Gonen : Electric Power Distribution Engg., Mc-Graw Hill,1986.
3. James A Momoh: Electric Power Distribution, Automation, Protection and Control, CRC press.
4. A. S. PABLA : Electric Power Distribution, TMH,2000.

20EE42004 – HYBRID ELECTRIC VEHICLES

(Professional Elective - V)

B.Tech. EEE – IV Year II Sem

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

Prerequisite(s):20EE31001 - Electrical Machines-II
20EE32002 - Control Systems

Course Objectives:

1. To study the concepts and drive train configurations of electric drive vehicles
2. To provide different electric propulsion systems and energy storage devices
3. To explain the technology, design methodologies and control strategy of hybrid electric vehicles
4. To emphasize battery charger topologies for plug in hybrid electric vehicles

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

CO1. Outline the fundamentals of EVs and vehicle dynamics concepts
CO2. Identify and compare electric vehicle power train components
CO3. Differentiate hybrid vehicle architectures and configurations
CO4. Size batteries for EVs
CO5. Explain vehicle technologies like battery chargers, ultra-capacitors

UNIT I

Introduction to Sustainable Transportation – Importance of different transportation development Strategies - Introduction and history of Hybrid Electric Vehicles and Electric Vehicles- General description of vehicle movement- vehicle resistance- tractive effort-vehicle performance -types of vehicle transmission

UNIT II

Electric vehicle power train-configurations -electric propulsion systems- DC and AC motor for vehicles- EV motor sizing - performance of electric vehicles-tractive effort-energy consumption-drive cycle

UNIT III

Hybrid Electric Vehicles - HEV Fundamentals and power train components -Architectures of HEVs- trains - Concept of Hybridization-Plug-in Hybrid Electric Vehicles Control- Fuel Cell Hybrid Electric Drive Train.

UNIT IV

Introduction to energy storage technologies in electric vehicles – types of electric vehicle batteries, battery capacity, battery sizing- C-rate- battery discharging- types of battery charging

UNIT V

Advanced topics - Battery Charger Topologies, Charging Power Levels, and Infrastructure for Plug-in Electric and Hybrid Vehicles - Sizing Ultra capacitors for Hybrid Electric Vehicles.

TEXTBOOK(S):

1.Modern Electric, Hybrid Electric and Fuel Cell Vehicles – Fundamentals, Theory and Design– Mehrdad Ehsani, Uimin Gao and Ali Emadi - Second Edition - CRC Press, 2010.
2.Electric Power train – Energy systems, power electronics & drives for hybrid, electric and fuel cell vehicles – John G Hayes & G.Abas Goodarzi, John Wiley & sons, 2018.

REFERENCE BOOK(S):

1. Hybrid electric Vehicles Principles and applications with practical perspectives -Chris Mi, Dearborn - M. Abul Masrur, David Wenzhong Gao - A John Wiley &Sons, Ltd., -2011.
2. Electric Vehicle Technology Explained - James Larminie, John Lowry - John Wiley & Sons Ltd, -2003.
3. ElectricVehicleBatterySystems–SandeepDhameja–Newnes-NewDelhi–2002.
4. The Impact of Plug-in Hybrid Electric Vehicles on Distribution Networks: a Review and Outlook - Robert C. Green II, Lingfeng Wang and Mansoor Alam - 2010 IEEE.
5. Sizing Ultracapacitors for Hybrid Electric Vehicles - H. Douglas P Pillay -2005 IEEE.

20CE42081 – DISASTER MANAGEMENT
(Open Elective - III)

B.Tech. EEE - 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 the different types of disasters.
CO2. Evaluate the impact of disasters on the community.
CO3. Suggest suitable monitoring techniques for disasters.
CO4. Recommend appropriate vulnerability reduction strategy and risk techniques.
CO5. Estimate the disaster infrastructure development and role of NGO's, Government bodies and Public in the disaster mitigation and management.

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.

20ME42083 – PRINCIPLES OF AUTOMOBILE ENGINEERING
(Open Elective - III)

B.Tech. EEE - IV Year II Sem.

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

Prerequisite(s): 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: Demonstrate the basic lay-out of an automobile.
CO2: Distinguish between SI and CI engine's fuel system and cooling systems.
CO3: Classify the principles of fuel ignition systems.
CO4: Infer and select transmission system of an automobile
CO5: Differentiate the steering systems

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.

20EC42084 – BIOMEDICAL INSTRUMENTATION
(Open Elective - III)

B.Tech. EEE - IV Year II Sem

Prerequisite(s): None

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

Note: No detailed mathematical treatment is required and only elementary treatment is sufficient.

Course Objectives: Develop ability to
1. Learn the basics of human physiology
2. Understand the basics of bio-medical transducers and recorders.
3. Understand the applications of measuring, recording and monitoring instruments.
4. Understand the concepts of various medical instruments and supporting systems.

Course Outcomes: At the end of the course, student would be able to
CO 1: Explain the functioning of different human physiological systems.
CO 2: Explain the operations of transducers and recorders used for bio-medical applications.
CO 3: Explain the principles of medical imaging systems.
CO 4: Explain the principles of monitoring instruments used for bio-medical application
CO 5: Explain the need for health supporting systems

UNIT I
Human Physiology: Introduction to generalized medical instrumentation system, components of instrumentation system, physiological system of human body, cardiovascular system. Respiratory system, Nervous system, generation of bioelectric potentials, Action potential, resting potential, Neuronal communication.

UNIT II
Bio- Potential Electrodes, Transducers and Recorders: The electrode – electrolyte interface, Polarization, Ag/AgCl Electrodes, Body surface electrodes, Internal Electrodes. Transducers in general, Pressure Transducers, Temperature transducers, pulse sensors, Basic recording systems.

UNIT III
Medical Imaging Systems: Basics of medical imaging systems, block diagrams and applications of - X-ray machine, Computer Tomography, Magnetic Resonance Imaging systems, Ultrasonic Imaging systems.

UNIT IV
Monitoring Systems: Basic principles of -Stethoscope, BP measuring Instrument, Electro cardiography (ECG), Electro encephalography (EEG) and Electromyography (EMG) recorders,

UNIT V
Supporting Systems: Basic principles of Pacemaker system, Transcutaneous Electrical Nerve stimulation (TENS), surgical diathermy, Heart lung machine, Hemo Dialysis, Lithotripsy.

TEXT BOOK(S):

1. Cromwell, “Bio-Medical Instruments and Measurements”, Prentice Hall of India, 1990.
2. Dr. Arumugam, “Bio-Medical Instrumentation”, Anuradha Agencies, 1994.

REFERENCE BOOKS:

1. Prof.Venkataram.S.K, “Bio-Medical Electronics & Instrumentation”, Galgotia Publications, 2000.
2. John. Can. Brown, “Introduction to Bio Medical Equipment Technology”, Pearson Education of ASIA, 2001.
3. Khandpur.R.S, “Hand book of Bio-Medical Instrumentation”, Tata McGraw –Hill, 1987

20CS42085 – DATABASE SYSTEMS
(Open Elective - III)

B.Tech. EEE - IV Year II Sem.

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

Prerequisites: None

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. Demonstrate the basic elements of a relational database management system.
CO2. Design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
CO3. Apply normalization for the development of application software.
CO4. Implement Transaction and Query processing techniques for data storage and retrieval.
CO5. Implement data storage structures and access through special databases.

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.

20MB42086 – ENTREPRENEURSHIP
(Open Elective - III)

B.Tech. EEE - 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 Frame work.
5. Apply strategic perspectives in entrepreneurship.

Course Outcomes: At the end of the course, the student would be able to
CO1: Explore and identify the entrepreneurial traits.
CO2: Identify various funding agencies and role of IPR.
CO3: Imagine and identify opportunities to launch new ventures.
CO4: Address entrepreneurial challenges.
CO5: Develop strategies for bringing stability and growth in business.

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 BOOK(S):

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.
3. Nandan H, Fundamentals of Entrepreneurship, PHI, 2013.