Academic Regulations & Detailed Syllabus

CHOICE BASED CREDIT SYSTEM

R25

ELECTRICAL AND ELECTRONICS ENGINEERING

Bachelor of Technology (B. Tech)

B. Tech. - Regular Four-Year Degree Programme

(For batches admitted from the academic year 2025 - 2026)

&

B. Tech. - Lateral Entry Scheme

(For batches admitted from the academic year 2026 - 2027)

MARRI LAXMAN REDDY GROUP OF INSTITUTIONS

MLR Institute of Technology

(Autonomous)

Laxman Reddy Avenue, Dundigal Hyderabad – 500043,
Telangana State

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ACADEMIC REGULATIONS
R25

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ACADEMIC REGULATIONS (R25)

B. Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2025-26)

1.0 For pursuing four year Under Graduate Degree Programme of study in Engineering & Technology (UGP in E&T) offered by MLR Institute of Technology under Autonomous status is herein referred to as MLRIT (Autonomous):

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2025-26 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for MLR Institute of Technology (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, MLR Institute of Technology shall be the chairman Academic Council.

2.0 Eligibility for Admission

2.1 Admissions to the undergraduate (UG) programme shall be made either on the basis of the merit rank obtained by the qualified students at the entrance test conducted by Telangana Government (EAPCET) or the college or on the basis of any other order of merit approved by the college, subject to reservations as prescribed by the government from time to time.

2.2 The medium of instruction for the entire undergraduate programme in Engineering & Technology will be **English** only.

3.0 B.Tech. Programme Structure

3.1 A student after securing admission shall complete the B.Tech. programme in a minimum period of **four** academic years and a maximum period of **eight** academic years starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech. course. Each student has to secure a minimum of 160 credits out of 164 credits for successful 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.

3.2.1 Semester Scheme

The undergraduate programme is of four academic years and there shall be two semesters in each academic year. There shall be a minimum of 15 weeks of instruction, excluding the mid- term and semester-end exams. Around 15 instruction hours, 30 instruction hours and 45 hours of learning need to be followed per one credit of theory course, practical course and project/field-based learning respectively. In each semester, there shall be 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under Choice Based Credit System (CBCS). The curriculum/course structure suggested by AICTE is followed as a reference document.

3.2.2 Credit Courses

All courses offered in each semester are to be registered by the student. Against each course in the course structure, the L: T: P: C (lecture periods: tutorial periods: practical periods: credits) pattern has been defined.

- One credit is allocated for one hour per week in a semester for lecture (L) or Tutorial (T) session.
- One credit is allocated for two hours per week in a semester for Laboratory/ Practical (P) session.
- One credit is allocated for three hours per week in a semester for Project/Mini-Project session.

For example, a theory course with three credit weightage requires three hours of classroom instruction per week, totaling approximately 45 hours of instruction over the entire semester.

3.2.3 Subject Course Classification

All subjects/courses offered for the undergraduate programme in E&T (B.Tech. degree programmes) are broadly classified as follows.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry courses
2		ES - Engineering Sciences	Includes Fundamental Engineering Courses
3		HS – Humanities and Social Sciences	Includes courses related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PC – Professional Core	Includes core courses related to the parent branch of Engineering.
5	Elective Courses (EℓC)	PE – Professional Electives	Includes elective courses related to the parent branch of Engineering.
6		OE – Open Electives	Elective courses which include inter-disciplinary courses or courses in an area outside the parent branch of Engineering.
7	Project Core	Project Work	B.Tech. Project Work
7	Other Core Courses (OCC)	Industry Training/ Internship/ Industry Oriented Mini-project/Skill Development Courses	Industry Training/ Internship/ Industry Oriented Mini-Project/Skill Development Courses
8			
9		Seminar	Seminar based on core contents related to parent branch of Engineering.
10	Skill Development Courses (SDC)	-	Courses designed to help individuals gain, improve, or refine specific skills
11	Value Added Courses (VAC)	-	Courses to build professional values, traditional knowledge and sensitization of societal issues

4.0 Mandatory Induction Programme

An induction program of one week duration for the UG students entering the institution, right at the start shall be implemented. Normal classes commence only after the induction programme is conducted. Following activities could be part of the induction programme: i) Physical Activity,
ii) Creative Arts, iii) Imparting Universal Human Values, iv) Literary Activities, v) Lectures by Eminent People, vi) Visits to Local Areas and vii) Familiarization to department as well as entire institute and viii) Making students understand Innovative practices at the college premises etc.

5.0 Course Registration

5.1 A faculty advisor / mentor shall be assigned to a group of around 20 students, who will advise the students about the undergraduate programme, its course structure and curriculum, choices/options of the courses, based on their competence, progress, pre-requisites and interest.

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

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

5.4 A student shall register for all the courses offered in a semester as specified in the course structure.

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

5.6 The Head of the Department / Course Coordinator should review vacant slots in the timetable of each section once in every week or fortnight. The vacant slots in the time-table may be allocated to the subject teachers who could not take classes in proportion to the number of weeks completed from the commencement of the semester.

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

Students have the flexibility to choose from the list of professional electives offered by the Institute or opt to register for the equivalent Massive Open Online Courses (MOOCs) as listed from time to time by the college.

5.8 **Open Electives**: Students have to choose three Open Electives (OE-I, II & III) from three baskets of Open Electives given by other than the parent department. However, the student can opt for an Open Elective course offered by his parent department, if the student has not studied that course so far. Similarly, Open Elective courses being studied should not match with any courses of the forthcoming semesters.

5.9 Provision for Early Registration of MOOCs:

For a professional elective in a semester, students are allowed to register for an equivalent MOOCs course listed from time to time by the college one semester in advance. For example, a Professional Elective of III Year II Sem shall be allowed to register under MOOCs platform in III year I Sem.

The credits earned in one semester in advance can be submitted in the subsequent semester for the assessment.

The students who have registered in advance in an equivalent MOOCs course and fail to secure any pass grade in the MOOCs course, can register for the regular course offered in the following semester of their course structure.

5.10 **Conversion of Marks Secured in MOOCs into Grades**: Marks secured in the internal and external evaluations of a MOOCs course shall be scaled to 40 and 60 marks respectively. The sum of these two components shall be considered as the total marks out of 100. The corresponding grade shall then be determined as per the marks-to-grades conversion rules specified in Clause 10.3.

5.11 MOOCs are allowed only for professional elective courses and for a few Minors & Honors courses

5.12 **Additional learning resources:**

Students are encouraged to acquire additional course-related knowledge by auditing learning resources from MOOCs platforms for each course offered in their course structure. These additional courses are not meant for earning credits but are intended to enhance knowledge. The college shall notify such courses from time to time through their portals for the benefit of students. They are categorized into three types: prerequisite, reinforcement, and aspirational. Prerequisite courses help students gain familiarity and provide sufficient background. Reinforcement courses aim to offer different perspectives on learning, while aspirational courses focus on next-level or advanced learning.

6.0 **Rules to offer Elective courses**

6.1 An elective course may be offered to the students, only if a minimum of 25% of class strength opts for it.

6.2 Same elective course for different sections may be offered by different faculty members. The selection of elective course by students will be based on first come first serve and / or CGPA criterion.

6.3 If the number of students registrations are more than the strength of one section, then it is choice of the concerned Department to offer the same course for more than one section based on the resources available in the department.

7.0 **Attendance requirements:**

7.1 A student shall be eligible to appear for the semester-end examinations, if the student acquires a minimum of 75% of aggregate attendance of all the courses for that semester.

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

7.3 A stipulated fee shall be payable for condoning of shortage of attendance as notified in the respective college websites.

7.4 **Two hours** of attendance for each theory course shall be considered, if the student appears for the mid-term examination of that course.

7.5 Shortage of attendance below 65% in aggregate shall in **no** case be condoned.

7.6 Students whose shortage of attendance is not condoned in any semester, are not eligible to take their semester-end examinations of that semester. They get detained and will not be promoted to the next semester. Their registration for that semester shall stand cancelled, including internal marks. They may seek re-registration for that semester in the next academic year.

7.7 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same semester

8.0 Criteria for Earning of Credits in a Course

8.1 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% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that course.

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

8.3 A student eligible to appear in the semester-end examination for any course, is absent from it or failed (thereby failing to secure **'C'** grade or above) may re-appear for that course in the supplementary examination as and when it is conducted. In such cases, internal marks assessed in continuous internal evaluation (CIE) earlier for that course will be carried over, and added to the marks obtained in the SEE supplementary/make-up examination. If the student secures sufficient marks for passing, **'C'** grade or above shall be awarded as specified in clause 10.3.

9.0 Distribution of Marks and Evaluation

9.1 The performance of a student in every course (including Value Added Courses and Skill Development Courses, Laboratory/Practical and Project Work) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination), irrespective of the credits allocated.

9.2 Continuous Internal Evaluation (CIE)

9.2.1 Theory Courses:

For theory courses, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks, totaling to 30 marks. Total duration of mid-term examination is two hours.

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

The objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks.

The descriptive paper shall contain 6 questions out of which, the student has to answer 4 questions, each carrying 5 marks. The **average of the two Mid Term Examinations** shall be taken as the final marks for Mid Term Examination (for 30 marks).

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus. Questions will be drawn from the mid-term exam syllabus, ensuring uniform coverage of all topics.

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

2. Five marks for the assignment for 5 marks. Student shall submit two assignments and the **average of 2 Assignments** each for 5 marks shall be taken. The first assignment should be submitted before the conduct of the first mid-term examination, and the

second assignment should be submitted before the conduct of the second mid-term examination.

3. Five marks for the Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject. This assessment shall be completed before II Mid-Term Examination. The HODs shall schedule these sessions in their semester plan.

9.2.2 Engineering Drawing and Computer Aided Drafting Course:

For this course, 20 marks will be allocated for day-to-day assessments conducted during drawing practice sessions, and another 20 marks will be allocated for the mid-term examination. In the mid-term examination, students shall attempt any four out of six given questions

A **Computer-Based Test (CBT**) in each course is available for students who either:

1. Missed one of the two mid-term examinations due to unavoidable circumstances, or
2. Attended both mid-term examinations but wish to improve their internal marks.

The CBT will be conducted at the end of the semester and will carry a total of 30 marks. The marks obtained in the CBT will be considered equivalent to those obtained in one mid-term examination. Zero marks will be awarded to students who are absent from the mid-term examination. The average of the best two scores from the three exams (the two mid-term exams and the CBT), combined with other internal assessment components, will constitute the Continuous Internal Improvement (CII) marks for that specific course. C B T exams shall be conducted by the College.

9.3 Semester End Examination for theory courses

9.3.1 Theory Courses:

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

- Part-A is compulsory, consists of five short answer questions covering all units of syllabus; each question carries two marks.
- Part-B consists of five questions carrying 10 marks each. There shall be two questions asked in the question paper from each unit with either-or choice and the student should answer either of the two questions. The student shall answer one question from each of five units.

9.3.2 Engineering Drawing and Computer Aided Drafting Course:

Question paper consists of five questions carrying 12 marks each. There shall be two questions asked in the question paper from each unit with either-or choice and the student should answer either of the two questions. The student shall answer one question from each of five units.

There shall be no section with short answer questions.

9.3.3 Duration of SEE:

The duration of Semester End Examination of theory and drawing courses is 3 hours.

9.4 Semester End Examination for Practical Courses

For practical courses there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and semester-end examination for 60 marks. The breakup of the continuous internal evaluation for 40 marks is as follows:

1. 10 marks for a write-up on day-to-day experiments in the laboratory (in terms of aim, components/procedure, expected outcome).
2. 10 marks for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.

3. 10 marks for the internal practical examination conducted by the laboratory teacher concerned.
4. The remaining 10 marks are for Laboratory Report/Project and Presentation, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination for practical courses shall be conducted with an external examiner and the laboratory course teacher. The external examiner shall be appointed from the college outside their cluster and not from a group colleges.

In the Semester End Examination for practical courses held for 3 hours, rubrics of evaluation for 60 marks is as given below:

1. 10 marks for write-up
2. 15 for experiment/program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment/program in the same laboratory course and
5. 10 marks for viva-voce on concerned laboratory course.

For any change of experiment, 5 marks will be deducted from the total of 60 marks. If second time change of experiment is requested, another five marks will be deducted from the 60 marks. No third change will be permitted.

9.5 Field-based Research Project:

There shall be a Field-based Research Project in the intervening summer between II-II and III- I Semesters. Students will register for this project immediately after II Year II Semester examinations and pursue it during summer vacation. The Field-based Research Project shall be submitted in a report form and presented before the committee in III year I semester. It shall be evaluated for 100 external marks. The evaluation committee shall consist of an External Examiner, Head of the Department, Supervisor of the Project and a Senior Faculty Member of the department. There shall be no internal marks for Field-based Research Project. Student shall have to earn 40% marks, i.e 40 marks out of 100 marks. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the committee as per schedule, or (iii) secures less than 40% marks in this course.

9.6 Internship/Industry Oriented Mini Project:

There shall be an Internship/Industry Oriented Mini Project in collaboration with an industry from their specialization. Students shall register for this project immediately after III Year II Semester Examinations and pursue it during summer vacation. Internship should be carried out at an organization (or) Industry. The Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in IV Year I Semester before the semester end examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project/Internship, and a Senior Faculty Member of the Department.

9.6.1 For evaluating industry-oriented mini-projects, it is preferable to appoint an external examiner from the industry, ideally from one of the organizations/ industries with which the institute has established / proposing to establish collaborations.

9.7 UG Project Work:

9.7.1 The UG project work shall be initiated at the beginning of the IV Year II Semester and the duration of the project work is one semester. The student must present in consultation with his/her supervisor, the title, objective and plan of action of his/her Project work to the departmental committee for approval within two weeks from the commencement of IV Year II

Semester. Only after obtaining the approval of the departmental committee, the student can start his/her project work.

9.7.2 Student has to submit project work report at the end of IV Year II Semester. The project work shall be evaluated for 100 marks. Out of which 40 marks and 60 marks are allocated for CIE and External Evaluation respectively.

9.7.3 For internal evaluation, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 40 marks. The distribution of marks is as follows:

- Objective(s) of the work done - 05 Marks
- Methodology adopted - 15 Marks
- Results and Discussions - 15 Marks
- Conclusions and Outcomes - 05 Marks

Total - 40 Marks

9.7.4 The External Evaluation shall be conducted by the external examiner for a total of 60 marks. It shall comprise the presentation of the work, communication skills, and viva-voce, with a weightage of 20 marks, 15 marks, and 25 marks respectively.

The topics for main Project shall be different from the topic of Industry Oriented Mini Project/ Internship/SDC. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

9.7.5 For conducting viva-voce exam of project work, principal appoints an external examiner. The external examiner may be selected from the list of experts submitted by the HOD of the college.

9.7.6 A student who has failed, may re-appear once for the above evaluation, when it is scheduled again; if student fails in such 'one re-appearance' evaluation also, he/she has to appear for the same in the next subsequent year, as and when it is scheduled.

9.8 Skill Development Courses:

Four Skill Development Courses are included in the Curriculum in II-1, II-2, III-1 and III-2 semesters. Each Skill Development Course carries one credit. The evaluation pattern will be same as that of a laboratory course including the internal and external assessments.

The objective of Skill Courses is to develop the cognitive skills as well as the psycho-motor skills.

9.9 Value-Added Courses:

The evaluation of Value-Added Courses shall be similar to that of theory courses. However, the scheduling of these mid-term exams and semester-end examinations may not be combined with main-stream examinations. One hour /45 mins proctored mid-term examination shall be conducted in the regular class by the same subject teacher. It should not impact the conduct of other classes on that day.
The scheduling of the semester-end examinations shall also be intimated by the College time to time.

10.0 Grading Procedure

10.1 Absolute grading system is followed for awarding the grades to each course.

10.2 Grades will be awarded to indicate the performance of students in each Theory, Laboratory, Industry-Oriented Mini Project/ Internship/ Skill development course and Project Work. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End

Examination, both taken together) as specified in clause 8 above, a letter grade shall be given as explained in the following clause.

10.3 To measure the performance of a student, a 10-point grading system is followed. The mapping between the percentage of marks secured and the corresponding letter grade is as follows:

Range of % of Marks Secured in a Course	Letter Grade	Grade Points (GP)
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

10.4 A student shall be declared successful or 'passed' in a semester, if he/she secures **'C'** grade or above in every course (ie GP ≥ 5)

10.5 A student who has obtained an '**F**' grade in any course shall be deemed to have '**failed'** and is required to re-appear for a supplementary exam as and when conducted. In such cases, internal marks in those courses will remain the same as those obtained earlier.

10.6 To a student who has not appeared for an examination in any course, '**Ab'** grade will be allocated in that course, and he/she is deemed to have '**Failed'**. Such student will be required to re-appear for supplementary/make-up exam as and when conducted. The internal marks in those courses will remain the same as those obtained earlier.

10.7 The students earn a Grade Point (G) in each course, on the basis of letter grade secured in that course. Every student who passes a course will receive grade point **GP** ≥ **5** ('C' grade or above).

10.8 The 'Credit Points' (C) are computed by multiplying the grade point with credits for a given course.

Credit Points (C) = Grade Point (G) x Credits

10.9 The Semester Grade Point Average (SGPA) is calculated only when all the courses offered in a semester are cleared by a student. It is calculated by dividing the sum of credit points (ΣCG) secured from all courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA for each semester is thus computed as

$$\text{SGPA} = \{ \sum_{i=} \; \; \} / \{ \sum \; \; \}$$

where 'i' is the course indicator index (considering all courses in a semester), 'N' is the no. of courses registered for the semester (as listed under the course structure of the branch), C_i is the no. of credits allotted to the i^{th} course, and G_i represents the grade points corresponding to the letter grade awarded for that i^{th} course.

10.10 If a student earns more than 160 credits, only the courses corresponding to the best 160 credits shall be considered for the computation of CGPA of B.Tech. degree.

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

$$\text{CGPA} = \{ \sum_{i=} \; \; \} / \{ \sum_{i=} \; \; \}$$

where '**M**' is the total no. of courses corresponding to the best 160 credits from the courses registered in all eight semesters, 'j' is the course indicator index (takes into account all courses from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} course, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} course.

Illustration of the Calculation of SGPA:

Course	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8 = 32
Course 2	3	O	10	3 x 10 = 30
Course 3	3	C	5	3 x 5 = 15
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A	8	3 x 8 = 24
Course 6	2	A+	9	2 x 9 = 18
Course 7	1	C	5	1 x 5 = 5
Course 8	1	O	10	1 x 10 = 10
	20			152

SGPA = 152/20 = 7.6

The CGPA of the entire B.Tech. programme shall be calculated considering the best 160 credits earned by the student.

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

10.13 SGPA of a semester will be mentioned in the semester Memorandum of Grades if all courses of that semester are cleared in first attempt. Otherwise, the SGPA shall be mentioned only on the Memorandum of Grades in which sitting he passed his last exam in that semester.

11.0 Declaration of Results and issue of Grade Memo

11.1 While declaring the results, the web-version should display the marks earned by the students with the internal and external marks break-up. However, in the memorandum of grades, the marks need not be shown.

11.2 After the completion of each semester, a certificate of memorandum of grades shall be issued to all the registered students, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, course title, no. of credits), letter grade and credits earned.

12.0 Withholding of Results

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

13.0 Supplementary Examinations:

13.1 At the end of each semester, along with regular semester examinations, supplementary examinations shall be conducted for the students who have back-log subjects.

13.2 Advanced supplementary examinations in IV Year II Semester courses may be conducted for those who failed in any course offered in IV Year II Semester. It may enable the students to receive their B.Tech. provisional certificate at an early date. Advanced supply examinations may be scheduled within one month period after the declaration of the final semester results.

There shall be no supplementary examination in the successive semester. The students who could not secure any pass grade in advance supplementary examinations have to wait for regular series examination of next batch to write their back-log examination.

14.0 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 and fulfilment of attendance requirement.
2	First year second semester to Second year first semester	(i) Regular course of study of first year second semester and fulfilment of attendance requirement (ii) **Must have secured at least 25% of the total** credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3.	Second year first semester to Second year second semester	Regular course of study of second year first semester and fulfilment of attendance requirement.
4	Second year second semester to Third year first semester	(i) Regular course of study of second year second semester and fulfilment of attendance requirement. (ii) **Must have secured at least 25% of the total credits** up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to Third year second semester	Regular course of study of third year first semester and fulfilment of attendance requirement.
6	Third year second semester to Fourth year first semester	Regular course of study of third year second semester and fulfilment of attendance requirement.
7	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester and fulfilment of attendance requirement.

15.0 Re-admission after Detention

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

ii) A student detained due to shortage of attendance shall be admitted in the same semester in the successive academic years.

iii) When a student is readmitted in the following academic years, the academic regulations under which the student seeks re-admission shall only be applicable to this student, not the academic regulations in which he got admitted in his/her first year of study.

16.0 Credit Exemption

A student (i) shall register for all courses covering 164 credits as specified and listed in the course structure and (ii) earn 160 or more credits to successfully complete the undergraduate programme.

- Best 160 credits shall be considered for CGPA computation. The student can avail exemption of courses ***totaling up to 4 credits*** other than Professional core courses, Laboratory Courses, Seminars, Project Work and Field Based Research Project / Industry Oriented Mini Project / Internship, for optional drop out from these 164 credits registered;
- The semester grade point average (SGPA) of each semester shall be mentioned at the bottom of the grade card, when all the subjects in that semester have been passed by the student.
- Credits earned by the student in either a Minor or Honors program cannot be counted towards the required 160 credits for the award of the B.Tech. degree.

17.0 Award of Degree

17.1 A student who registers for all the courses specified in the course structure and secures the required number of 160 credits within 8 academic years from the date of commencement of the first academic year, shall be declared to have qualified for the award of B.Tech. degree in the branch of Engineering selected at the time of admission.

17.2 A student who qualifies for award of the degree as listed in item 17.1 shall be placed in the following classes.

17.3 A student with final CGPA (at the end of the undergraduate programme) ≥ 7.5, and fulfilling the following conditions - shall be placed in '**First Class with Distinction'**:

(i) Should have passed all the courses in '**First Appearance'**.

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

A student not fulfilling any of the above conditions with final CGPA ≥ 7.5 shall be placed in **'First Class'.**

17.4 Students with final CGPA (at the end of the undergraduate programme) ≥ 6.5 but < 7.5 shall be placed in **'First Class'.**

17.5 Students with final CGPA (at the end of the undergraduate programme) ≥ 5.5 but < 6.5, shall be placed in '**Second Class'**.

17.6 All other students who qualify for the award of the degree (as per item 17.1), with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 5.5, shall be placed in '**pass class**'.

17.7 Grace Marks

Grace marks shall be given to those students who complete the course work of four year B. Tech. degree, not secured pass grade in not more than three subjects and adding a specified grace marks enables the student to pass the subject(s) as well as gets eligibility to receive the provisional degree certificate.

Grace marks for students admitted under the R-25 Academic Regulations should not exceed **0.15%** of the total maximum marks in all eight semesters (excluding the marks allocated for value added courses and skill development courses).

18.0 Award of Gold Medals

18.1 Students fulfilling the conditions listed under item 17.3 alone will be eligible for award of '**Gold Medal**'.

18.2 If more than one student secures the same highest CGPA, then the following tie resolution criteria, in the same order of preference shall be followed for selecting the Gold Medal winner,

until the tie is resolved: 1) more number of times secured highest SGPAs, ii) more number of O and A+ grades in that order and iii) highest SGPA in the order of first semester to eight semester.

19.0 Conversion of CGPA into equivalent Percentage of Marks

19.1 The following formula shall be used for the conversion of CGPA into equivalent marks, whenever it is necessary

Percentage (%) of Marks = (Final CGPA – 0.5) x 10

20.0 Honours and Minor Degree Programs

Honours and Minor Degree programs will be available in all branches of B.Tech. degree. Minor Degree programs will commence from II Year II Semester and continue till IV Year I semester and Honours Degree programs will commence from III Year I Semester and continue till IV Year II semester.

21.0 Multiple Entry Multiple Exit Scheme (MEME)

21.1 Exit Option after Second Year:

Students enrolled in the 4-Year B.Tech. program are permitted to exit the program after successful completion of the second year (B.Tech. II Year II Semester). The students who desire to exit after the II year shall formally inform the exit plan one semester in advance i.e. at the commencement of II Year II Semester itself. Such students need to fulfil the additional requirements as specified in Clause 21.2 described below.

Upon fulfilling the requirements like earning all the credits up to II Year II Semester and successfully completing the additional requirements, the students will be awarded a 2-Year Undergraduate (UG) Diploma in the concerned engineering branch.

21.2 Additional Requirements for Diploma Award

To qualify for the diploma under the exit option, students must also complete 2 additional credits through one of the following college-prescribed pathways:

Work-based Vocational Course:

Participation in a practical, hands-on vocational training program relevant to the engineering field, typically conducted during the summer term.

Internship/Apprenticeship:

Completion of a minimum 8-week internship or apprenticeship in their related field to gain practical industry exposure.

In addition, students must clear any associated course(s) and submit the internship/ apprenticeship report as per the college's schedule and guidelines.

21.3 Re-entry into the B.Tech. Program

Students who have exited the B.Tech. program with a 2-Year UG Diploma may apply for re- entry into the Third Year (Fifth Semester) of the B.Tech. program. Re-entry is subject to the following conditions:

- The student must surrender the awarded UG Diploma Certificate.
- Students who wish to rejoin in III Year must join the same B.Tech. program and same college from which the student exited. Before rejoining, students should check for continuation of the same branch at the college. If the specific branch is closed in college, then student should consult the college for the possible alternative solutions.
- Re-registered students will be governed by the academic regulations in effect at the time of re-entry, regardless of the original regulations under which they were admitted.
- If a student opts to continue his/her studies without a gap after being awarded the diploma,

they must register for the third-year courses before the commencement of classwork.

21.4 Break in Study and Maximum Duration

Students are allowed to take a break of up to four years after completion of II Year II Semester with prior college permission through the Principal of the college.

Re-entry after such a break is subject to the condition that the student completes all academic requirements within twice the duration of the program (i.e., within 8 years for a 4-year B.Tech. program).

22.0 Transitory Regulations for the students re-admitted in R-25 Regulations:

22.1 Transitory regulations are applicable to the students detained due to shortage of attendance as well as detained due to the shortage of credits and seek permission to re-join the B.Tech. programme, where R-25 regulations are in force.

22.2 A student detained due to shortage of attendance and re-admitted in R-25 regulations: Such students shall be permitted to join the same semester, but in R-25 Regulations.

22.3 A student detained due to shortage of credits and re-admitted in R-25 regulations: Such students shall be promoted to the next semester in R-25 regulations, only after acquiring the required number of credits as per the corresponding regulations of his/her previous semester.

22.4 A student who has failed in any course in a specific regulation has to pass those courses in the same regulations.

22.5 If a student is readmitted to R-25 Regulations and has any course with 80% of syllabus common with his/her previous regulations, that particular course in R-25 Regulations will be substituted by an equivalent course of R-22 regulations by the college. All these details are summarized in a set of look-up Table; one set for each B. Tech. branch.

22.6 The R-25 Academic Regulations are applicable to a student from the year of re-admission. However, the student is required to complete the study of B.Tech. degree within the stipulated period of eight academic years from the year of first admission.

23.0 Student Transfers

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

23.2 The students seeking transfer to college from various other Universities/institutions is having back-logs at the previous University/institute, have to pass the courses offered at MLRIT/JNTUH which are equivalent to the failed courses at the previous University/institute.

23.3 The transferred students from other Universities/Institutions to MLRIT, shall be given a chance to write CBTs for getting CIE component in the **equivalent course(s).**

24.0 Value Added Courses

24.1 Faculty members who have received a certificate in Innovation and Entrepreneurship / Entrepreneurship from a reputed foundation/organization may be given preference to teach the "Innovation and Entrepreneurship" course. This certificate course should include an assessment. Total training duration (online or physical), excluding assessment, should be at least 30 hours. Faculty members from all disciplines with innovative mindset and aptitude to co-create an entrepreneurial ecosystem are eligible to teach this subject.

24.2 Faculty members who have credited a course on Intellectual Property Rights in their UG or PG programme or credited an equivalent course in MOOCs platform/ reputed foundation/ organization in which assessment is a part, may be given preference to teach the elective course on Intellectual Property Rights.

24.3 To ensure quality delivery and standardization in teaching the **Indian Knowledge System (IKS)** and other value-added courses, the following guidelines must be adhered to: i) faculty members must undergo a Faculty Development Program (FDP) organized by UGC-MMTTC.(Malaviya

Mission Teacher Training Centre), **or** Any other recognized and competent institution/organization offering similar certified programs, ii) the total instructional duration of the FDP should be a around 32 hours or more, III) all sessions in the FDP must be conducted by certified and qualified resource persons with recognized expertise in the respective domains, iv) A formal assessment component must be included as part of the FDP.

25.0 Mapping with the Sustainable Development Goals

All the courses specified in the course structure of every programme are mapped with the one or more sustainable development goals.

26.0 Scope

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

26.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the chairman, academic council is final.

26.3 The college may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the college authorities.

26.4 Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

27.0 **Malpractice Prevention Committee**

A malpractice prevention committee shall be constituted to examine and punish the students who involve in malpractice / indiscipline in examinations. The committee shall consist of:

a) Controller of examinations - Chairman
b) Addl. Controller of examinations.- Member Convener
c) Subject expert - member
d) Head of the department of which the student belongs to. - Member
e) The invigilator concerned - member

The committee shall conduct the meeting after taking explanation of the student and punishment will be awarded by following the malpractice rules meticulously.

Any action on the part of candidate at the examination like trying to get undue advantage in the performance at examinations or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations, in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and will be recommended for appropriate punishment after thorough enquiry.

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MLR Institute of Technology

ACADEMIC REGULATIONS FOR B.TECH. (LATERAL ENTRY SCHEME) FROM THE AY 2026-27

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

1. The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.
2. The student shall register for 123 credits and secure 120 credits with CGPA ≥ 5 from II year to IV-year B.Tech. programme (LES) for the award of B.Tech. degree.
3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.
4. The attendance requirements of B.Tech. (Regular) shall be applicable to B.Tech. (LES).
5. Promotion rule

S. No	Promotion	Conditions to be fulfilled
1	Second year first semester to Second year second semester	Regular course of study of second year first semester and fulfilment of attendance requirement.
2	Second year second semester to Third year first semester	(i) Regular course of study of second year second semester and fulfilment of attendance requirement. (ii) Must have secured at least 25% of the total credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to Third year second semester	Regular course of study of third year first semester and fulfilment of attendance requirement.
4	Third year second semester to Fourth year first semester	Regular course of study of third year second semester and fulfilment of attendance requirement.
5	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester and fulfilment of attendance requirement.

6. All the other regulations as applicable to B.Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).
7. LES students are not permitted to exit the B.Tech. program after completion of second year (B.Tech. II Year II Semester).

Malpractices Rules

Disciplinary Action For / Improper Conduct in Examinations

Rule	Nature of Malpractices/ Improper conduct	Punishment
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination).	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or anyother form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles 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 subject and all the other subjects the student 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 student is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/COE/ACoE/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 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 subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student 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 student is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student 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 student is also debarred and forfeits the seat.

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

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.
2. Punishment for staff: (if the squad reports that the staff is also involved in encouraging malpractices)
   a. A show-cause notice shall be issued to the staff.
   b. Impose a suitable fine on the staff.

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COURSE STRUCTURE

R25										
	I B.Tech-I SEMESTER									
				Hours per Week				Scheme of Examination Maximum Marks		
S.NO.	Course Code	Course Title	Course Area	L	T	P	Credits	Internal (CIE)	External (SEE)	Total
1	A7BS01	Matrices and Calculus	BSC	3	1	0	4	40	60	100
2	A7BS08	Advanced Engineering Physics	BSC	3	0	0	3	40	60	100
3	A7CS01	Programming for Problem Solving	ESC	3	0	0	3	40	60	100
4	A7ME02	Computer Aided Engineering Drawing	ESC	2	0	2	3	40	60	100
5	A7EE01	Electrical Circuits-1	ESC	2	0	0	2	40	60	100
6	A7HS01	English for Skill Enhancement	HSC	3	0	0	3	40	60	100
7	A7BS09	Advanced Engineering Physics Lab	BSC	0	0	2	1	40	60	100
8	A7CS02	Programming for Problem Solving Lab	ESC	0	0	2	1	40	60	100
9	A7HS02	English Language and Communication Skills Lab	HSC	0	0	2	1	40	60	100
		Induction Program								
	TOTAL			16	1	8	21	360	540	900

	I B.Tech-II SEMESTER									
				Hours per Week				Scheme of Examination Maximum Marks		
S.NO.	Course Code	Course Title	Course Area	L	T	P	Credits	Internal (CIE)	External (SEE)	Total
1	A7BS02	Ordinary Differential Equations and Vector Calculus	BSC	3	0	0	3	40	60	100
2	A7BS10	Engineering Chemistry	BSC	3	0	0	3	40	60	100
3	A7CS58	Python Programming	ESC	3	0	0	3	40	60	100
4	A7CS03	Data Structures	ESC	3	0	0	3	40	60	100
5	A7EE02	Electrical Circuits-II	ESC	3	0	0	3	40	60	100
6	A7ME03	Engineering Work shop	ESC	0	0	2	1	40	60	100
7	A7BS11	Engineering Chemistry Lab	BSC	0	0	2	1	40	60	100
8	A7CS05	Python Programming Lab	ESC	0	0	2	1	40	60	100
9	A7CS04	Data Structures Lab	ESC	0	0	2	1	40	60	100
10	A7EE03	Electrical Circuits Lab	ESC	0	0	2	1	40	60	100
	TOTAL			15	0	10	20	400	600	1000

	II B.Tech-I SEMESTER									
				Hours per Week				Scheme of Examination Maximum Marks		
S.NO.	Course Code	Course Title	Course Area	L	T	P	Credits	Internal (CIE)	External (SEE)	Total
1	A7EE11	Electromagnetic fields	PCC	3	0	0	3	40	60	100
2	A7EE12	Electrical Machines - I	PCC	3	0	0	3	40	60	100
3	A7EC05	Electronic Devices and Circuits	PCC	3	0	0	3	40	60	100
4	A7EE13	Power Systems - I	PCC	3	0	0	3	40	60	100
5	A7EE14	Electrical Measurements and Sensors	PCC	2	0	0	2	40	60	100
6	A7HS08	Innovation and Entrepreneurship	HSC	2	0	0	2	40	60	100
7	A7EE15	Electrical Machines - I Lab	PCC	0	0	2	1	40	60	100
8	A7EE16	Electrical Measurements and Instrumentation Lab	PCC	0	0	2	1	40	60	100
9	A7EC11	Electronic Devices and Circuits Lab	PCC	0	0	2	1	40	60	100
10	A7EE17	Design of Electrical Systems using AutoCAD	SDC	0	0	2	1	40	60	100
11	A7BS12	Environmental Science	BSC	1	0	0	1	40	60	100
	TOTAL			17	0	8	21	440	660	1100

	II B.Tech-II SEMESTER									
				Hours per Week				Scheme of Examination Maximum Marks		
S.NO	Course Code	Course Title	Course Area	L	T	P	Credits	Internal (CIE)	External (SEE)	Total
1	A7BS06	Numerical Methods and Complex Variables	BSC	3	0	0	3	40	60	100
2	A7EE18	Electrical Machines - II	PCC	3	0	0	3	40	60	100
3	A7EE19	Power Systems - II	PCC	3	0	0	3	40	60	100
4	A7EC22	Digital Electronics	PCC	3	0	0	3	40	60	100
5	A7EE20	Control Systems	PCC	3	0	0	3	40	60	100
6	A7BS07	Computational Mathematics Lab	PCC	0	0	2	1	40	60	100
7	A7EE21	Electrical Machines - II Lab	PCC	0	0	2	1	40	60	100
8	A7EE22	Control Systems Lab	PCC	0	0	2	1	40	60	100
9	A7EC23	Digital Electronics Lab	PCC	0	0	2	1	40	60	100
10	A7EE23	PCB Design	SDC	0	0	2	1	40	60	100
	TOTAL			15	0	10	20	400	600	1000

III YEAR I SEMESTER

				Hours Per Week				Scheme of Examination Maximum Marks		
S.No.	**Course Code**	**Course Title**	**Course Area**	**L**	**T**	**P**	**Credits**	**Internal (CIE)**	**External (SEE)**	**Total**
1.	A7EE24	Power Electronics	PCC	3	0	0	3	40	60	100
2.		Microprocessors and Microcontrollers	PCC	3	0	0	3	40	60	100
3.	A7EE25	Power System Protection	PCC	3	0	0	3	40	60	100
4.		Professional Elective-I	PEC	3	0	0	3	40	60	100
5.		Open Elective-I	OEC	2	0	0	2	40	60	100
6.	A7EE26	Power Electronics Laboratory	PCC	0	0	2	1	40	60	100
7.	A7EE27	Power System Laboratory	PCC	0	0	2	1	40	60	100
8.		Microprocessors and Microcontrollers Lab	PCC	0	0	2	1	40	60	100
9.	A7EE28	Field-Based Project/Internship	PEE	0	0	4	2	40	60	100
10.	A7EE29	Robotics and Automation	SDC	0	0	2	1	40	60	100
11.		Indian Knowledge System	MC	1	0	0	1	40	60	100
		Total Credits		**15**	**0**	**12**	**21**	**440**	**660**	**1100**

III YEAR II SEMESTER

				Hours Per Week				Scheme of Examination Maximum Marks		
S.No	**Course Code**	**Course Title**	**Course Area**	**L**	**T**	**P**	**Credits**	**Internal (CIE)**	**External (SEE)**	**Total**
1.	A7EE30	Power System Operation and Control	PCC	3	0	0	3	40	60	100
2.	A7EE31	Signals and Systems	PCC	3	0	0	3	40	60	100
3.		Business Economics and Financial Analysis	HSC	3	0	0	3	40	60	100
4.		Professional Elective-II	PEC	3	0	0	3	40	60	100
5.		Open Elective - II	OEC	2	0	0	2	40	60	100
6.	A7EE32	Modeling and Simulation Lab	PCC	0	0	2	1	40	60	100
7.	A7EE33	Power System Simulation Lab	PCC	0	0	2	1	40	60	100
8.	A7EE34	Electrical and Electronics Design Lab	PCC	0	0	2	1	40	60	100
9.		English for Employability Skills Lab	HSC	0	0	2	1	40	60	100
10.	A7EE35	Design of Solar Power System	SDC	0	0	2	1	40	60	100
11.		Gender Sensitization*/ Human Values and Professional Ethics*	MC	1	0	0	0.5+0.5		100	100
		Total Credits		**15**	**0**	**10**	**20**	**400**	**700**	**1100**

***Note:** For the courses Gender Sensitization and Human Values and Professional Ethics - one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitization is conducted this week, then a one-hour class for Constitution of India will be conducted in the following week.

IV YEAR I SEMESTER

				Hours Per Week				Scheme of Examination Maximum Marks		
S. No.	**Course Code**	**Course Title**	**Course Area**	**L**	**T**	**P**	**Credits**	**Internal (CIE)**	**External (SEE)**	**Total**
1.	A7EE36	Power Semiconductor Drives	PCC	3	0	0	3	40	60	100
2.	A7EE37	AI&ML for Electrical Engineering Application	PCC	3	0	0	3	40	60	100
3.		Fundamentals of Management	HSC	3	0	0	3	40	60	100
4.		Professional Elective - III	PEC	3	0	0	3	40	60	100
5.		Professional Elective – IV	PEC	3	0	0	3	40	60	100
6.		Open Elective – III	OEC	2	0	0	2	40	60	100
7.	A7EE38	Power Semiconductors Drives Lab	PCC	0	0	2	1	40	60	100
8.		Internet of Things Laboratory	PCC	0	0	2	1	40	60	100
9.	A7EE39	Industry Oriented Mini Project/ Internship	PW	0	0	4	2		100	100
		Total Credits		**17**	**0**	**08**	**21**	**320**	**580**	**900**

IV YEAR II SEMESTER

				Hours Per Week				Scheme of Examination Maximum Marks		
S. No.	**Course Code**	**Course Title**	**Course Area**	**L**	**T**	**P**	**Credits**	**Internal (CIE)**	**External (SEE)**	**Total**
1.		Professional Elective – V	PEC	3	0	0	3	40	60	100
2.		Professional Elective – VI	PEC	3	0	0	3	40	60	100
3.		Project Work	PW	0	0	42	14	40	60	100
		Total Credits		**06**	**0**	**42**	**20**	**120**	**180**	**300**

***Note:** Students who wish to exit after II Year II Semester has to register for this optional course and acquire the credits allotted by doing 6 weeks Work-based Vocational Course/ Internship or Apprenticeship. Please refer R25 Academic Regulations for more information.

Professional Elective - I

A7EE40	Renewable Energy Systems
	Programmable Logic Controllers
A7EE41	Energy Storage Systems

Professional Elective – II Utilization of Electrical Energy

A7EE42	Smart Grid Technologies
	VLSI Design
A7EE43	Fundamentals of Electric Vehicles

Professional Elective-III

A7EE44	Power Quality
	Digital Signal Processing
A7EE45	Hybrid Electric Vehicles

Professional Elective-IV

A7EE46	Electrical Distribution and Automation
	Embedded Systems
A7EE47	Battery Management Systems

Professional Elective-V

	Smart Metering and Communication Protocols
	Low Power VLSI
A7EE48	EV Charging Infra Structure

Professional Elective-VI

A7EE49	Energy Conservation and Audit
A7EE50	Industrial Automation and Control
A7EE51	Autonomous and Connected Vehicles

OPEN ELECTIVES

Open Elective-I:

A7EE52	Energy Storage Systems
A7EE53	Industrial Automation and Control

Open Elective-II:

A7EE54	Fundamental of Electric Vehicles
A7EE55	Applications of Electrical Energy

Open Elective-III:

A7EE56	Battery Management System
A7EE57	Sustainable Energy Technologies

I B.TECH I SEMESTER SYLLABUS

MATRICES AND CALCULUS

I B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7BS01	BSC	3	1	0	4	40	60	100

Pre-requisites: Mathematical Knowledge at pre-university level

Objectives: To learn

1. Applying basic operations on matrices and their properties.
2. Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
3. Concept of eigen values and eigen vectors and to reduce the quadratic form to canonical form
4. Geometrical approach to the mean value theorems and their application to the mathematical problems
5. Finding maxima and minima of functions of two and three variables.
6. Evaluation of multiple integrals and their applications.

Course outcomes: After learning the contents of this paper, the student must be able to

1. Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations
2. Find the Eigen values and Eigen vectors
3. Reduce the quadratic form to canonical form using orthogonal transformations.
4. Solve the applications of the mean value theorems.
5. Find the extreme values of functions of two variables with/ without constraints.
6. Evaluate the multiple integrals and apply the concept to find areas, volumes.

UNIT-I: Matrices

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

UNIT-II: Eigen values and Eigen vectors

Linear Transformation and Orthogonal Transformation: Eigen values – Eigen vectors and their properties – Diagonalization of a matrix - Cayley-Hamilton Theorem (without proof) - Fnding inverse and power of a matrix by Cayley-Hamilton Theorem. Quadratic forms and Nature of the Quadratic Forms - Reduction of Quadratic form to canonical form by Orthogonal Transformation.

UNIT-III: Single Variable Calculus

Limit and Continuous of functions and its properties. Mean value theorems: Rolle's theorem – Lagrange's Mean value theorem with their Geometrical Interpretation and applications - Cauchy's Mean value Theorem – Taylor's Series (All the theorems without proof).

Curve Tracing: Curve tracing in cartesian coordinates.

UNIT-IV: Multivariable Calculus (Partial Differentiation and applications)

Definitions of Limit and continuity – Partial Differentiation: Euler's Theorem – Total derivative – Jacobian – Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration)

Evaluation of Double Integrals (Cartesian and polar coordinates) – change of order of integration (only Cartesian form) - Change of variables for double integrals (Cartesian to polar). Evaluation of Triple Integrals – Change of variables for triple integrals (Cartesian to Spherical and Cylindrical polar coordinates). Applications: Areas by double integrals and volumes by triple integrals.

TEXT BOOKS:

1.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

2.R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Editon, 2016

REFERENCE BOOKS:

1.Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

2.G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

3.N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

ADVANCED ENGINEERING PHYSICS

I B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
A7BS08	BSC	L	T	P	C	CIE	SEE	TOTAL
		3	0	0	3	40	60	100

Pre-requisites: 10+2 Physics

Course Objectives:

1. To study crystal structures, defects, and material characterization techniques like XRD and SEM.
2. To understand fundamental concepts of quantum mechanics and their applications in solids and nanomaterials.
3. To introduce quantum computing principles, quantum gates, and basic quantum algorithms.
4. To learn the properties and applications of magnetic and dielectric materials.
5. To explore the working and applications of lasers and fibre optics in modern technology.

Course Outcomes:

1. **CO1**: Analyze crystal structures, identify defects, and apply XRD and SEM techniques for material characterization.
2. **CO2**: Apply quantum mechanical principles to explain particle behaviour and energy band formation in solids.
3. **CO3**: Understand quantum computing concepts, use quantum gates, and explain basic quantum algorithms.
4. **CO4**: Classify magnetic and dielectric materials and explain their properties, synthesis, and applications.
5. **CO5**: Explain the principles of lasers and fibre optics and their applications in communication and sensing.

UNIT - I: Crystallography & Materials Characterization

Introduction: Unit cell, space lattice, basis, lattice parameters; crystal structures, Bravais lattices, packing factor: SC, BCC, FCC; Miller indices, inter-planar distance; defects in crystals (Qualitative): point defects, line defects, surface defects and volume defects. concept of nanomaterials: surface to volume ratio, X - ray diffraction: Bragg's law, powder method, calculation of average crystallite size using Debye Scherrer's formula, scanning electron microscopy (SEM): block diagram, working principle.

UNIT - II: Quantum Mechanics

Introduction, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of wave function, postulates of quantum mechanics: operators in quantum mechanics, eigen values and eigen functions, expectation value; Schrödinger's time independent wave equation, particle in a 1D box, Bloch's theorem (qualitative), Kronig-Penney model (qualitative): E-k diagram, effective mass of electron, formation of energy bands, origin of bandgap, classification of solids, concept of discrete energy levels and quantum confinement in nanomaterials.

UNIT - III: Quantum Computing

Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits, multiple Qubit system, quantum computing system for information processing, evolution of quantum systems, quantum measurements, entanglement, quantum gates, challenges and advantages of quantum computing over classical computation, quantum algorithms: Deutsch-Jozsa, Shor, Grover.

UNIT - IV: Magnetic and Dielectric Materials

Introduction to magnetic materials, origin of magnetic moment-classification of magnetic materials, hysteresis, Weiss domain theory of ferromagnetism, soft and hard magnetic materials, synthesis of ferrimagnetic materials using sol-gel method, applications: magnetic hyperthermia for cancer treatment, magnets for EV, Giant Magneto Resistance (GMR) device.

Introduction to dielectric materials, types of polarization (qualitative): electronics, ionic & orientation; ferroelectric, piezoelectric, pyroelectric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM), load cell and fire sensor.

UNIT - V: Laser and Fibre Optics

Introduction to laser, characteristics of laser, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, CO_2 laser, semiconductor diode laser, applications: Bar code scanner, LIDAR for autonomous vehicle.
Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres, losses in optical fibre, applications: optical fibre for communication system, sensor for structural health monitoring.

TEXT BOOKS:

1.Walter Borchardt-Ott, *Crystallography: An Introduction*, Springer.

2.Charles Kittel, *Introduction to Solid State Physics*, John Wiley & Sons, Inc.

3.Thomas G. Wong, *Introduction to Classical and Quantum Computing*, Rooted Grove

REFERENCE BOOKS:

1.Jozef Gruska, *Quantum Computing*, McGraw Hill

2.Michael A. Nielsen & Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press.

3.John M. Senior, *Optical Fiber Communications Principles and Practice*, Pearson Education Limited.

Useful Links

- https://shijuinpallotti.wordpress.com/wp-content/uploads/2019/07/optical-fiber-communications- principles-and-pr.pdf
- https://www.geokniga.org/bookfiles/geokniga-crystallography_0.pdf
- https://dpbck.ac.in/wp-content/uploads/2022/10/Introduction-to-Solid-State-PhysicsCharles-Kittel.pdf
- https://www.thomaswong.net/introduction-to-classical-and-quantum-computing-1e4p.pdf
- https://www.fi.muni.cz/usr/gruska/qbook1.pdf
- https://profmcruz.wordpress.com/wp-content/uploads/2017/08/quantum-computation-and-quantum- information-nielsen-chuang.pdf

PROGRAMMING FOR PROBLEM SOLVING

I B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7CS01	ESC	3	0	0	3	40	60	100

Course Objectives:

1. To familiarize with the syntax and semantics of C programming language.
2. To learn the usage of structured programming approach in solving problems.
3. To use arrays, pointers, strings and structures in solving problems.
4. To understand how to solve problems related to matrices, Searching and sorting.
5. To understand how to use files to perform read and write operations.

Course Outcomes:

1) To demonstrate the ability to write and understand basic C programs using language elements, variable declarations, arithmetic expressions, and selection structures.
2) Develop computer programs using programming constructs and control structures and to use arrays to develop C programs
3) Decompose a problem into functions to develop modular reusable code and to use pointers to solve complex problems.
4) To utilize string manipulation functions and user-defined structures and unions to design and implement algorithms in C.

To perform file operations and implement sorting algorithms.

UNIT-I	OVERVIEW OF C AND SELECTION STRUCTURES	Classes: 10

Overview of C: C Language Elements, Variable Declarations and Data Types, Executable Statements, General Form of a C Program, Arithmetic Expressions, Formatting Numbers in Program Output.
Selection Structures: Control Structures, Conditions, if Statement, if Statements with Compound Statements, Decision Steps in Algorithms.

UNIT-II	REPETITION, LOOP STATEMENTS AND ARRAYS	Classes: 10

Repetition and Loop Statements: Repetition in Programs, Counting Loops and the while Statement, computing a Sum or Product in a Loop, for Statement, Conditional Loops, Loop Design, Nested Loops, do-while Statement.
Arrays: Declaring and Referencing Arrays, Array Subscripts, Using for Loops for Sequential Access, Array Arguments, Parallel Arrays and Enumerated Types, Multidimensional Arrays.

UNIT-III	FUNCTIONS AND POINTERS	Classes: 10

Top-Down Design with Functions: Library Functions, Top-Down Design and Structure Charts, Functions without Arguments, Using Array Elements as Function Arguments, Parameter Passing Techniques: Call by Value, Call by Reference, Functions with Input Arguments.
Recursion: The Nature of Recursion, Tracing a Recursive Function, Recursive Mathematical Functions, storage classes.
Pointers and Modular Programming: Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, Functions returning pointers, Dynamic memory allocation.

UNIT-IV	STRINGS AND USER DEFINED DATA TYPES	Classes: 10

Strings: String Basics, String Library Functions: Assignment and Substrings, Longer Strings: Concatenation and Whole-Line Input, String Comparison, Arrays of strings.
Structure and Union Types: User- Defined Structure Types, Structure Type Data as Input and Output Parameters, Functions with Structured Result Values, Union Types.

UNIT-V	FILE HANDLING, SORTING	Classes: 10

File Handling: Command Line Arguments, File Modes, Basic File Operations Read, Write and Append, Example Programs. Random Access Using fseek, ftell and rewind Functions.

Basic Sorting Algorithms: Bubble Sort, Insertion Sort, Selection Sort and their time complexities.

TEXT BOOKS:

1) Jeri R. Hanly and Elliot B.Koffman, Problem solving and Program Design in C 7th Edition, Pearson
2) B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

REFERENCE BOOKS:

1) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2) E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGrawHill
3) Yashavant Kanetkar, Let Us C, 18th Edition, BPB
4) R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
5) Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6) Herbert Schildt, C: The Complete Reference, McGraw-Hill, 4th Edition
7) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/Computational_thinking
2. https://nptel.ac.in/courses/106/104/106104128/
3. https://en.cppreference.com/w/c/language
4. https://www.learn-c.org/

E-TEXT BOOKS:

1. https://slidelegend.com/queue/computational-thinking-for-the-modern-problem solver_59d6f01e1723ddb0c7a0df47.html
2. http://www.freebookcentre.net/Language/Free-C-Programming-Books-Download.html

MOOCS:

1) https://www.coursera.org/learn/computational-thinking-problem-solving
2) https://onlinecourses.nptel.ac.in/noc18_cs33/preview
3) https://www.alison.com/courses/Introduction-to-Programming-in-c

http://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s096-effective programming-in-c-and-c-january-iap-2014/index.html

A7ME02: COMPUTER AIDED ENGINEERING DRAWING

(Common to all Branches)

B.Tech. I Year I Sem.

L	T	P	C
2	0	2	3

Course Objectives:

1. To develop foundational knowledge in engineering drawing, projection systems, and CAD applications
2. To build skills in drawing engineering curves and in representing projections of points, lines and planes
3. To enable students to prepare and analyze technical drawings using computer-aided design tools
4. To develop an understanding of standard dimensioning methods and drafting conventions
5. To enhance the ability to visualize engineering components in three dimensions

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

1. Explain various commands and create 2D Engineering Drawings using AutoCAD.
2. Construct the various curves used for engineering applications
3. Prepare orthographic projections of lines, planes by visualizing them in different positions.
4. Solve the problems of projections of solids and development of surfaces for industrial needs.
5. Construct the isometric view into orthographic views and vice versa.

UNIT – I: Introduction to Engineering Drawing and Computer Aided Drafting Introduction to Engineering Drawing: Principles and their significance,

Introduction to Computer Aided Drafting: Initial Setup Commands, Draw Commands, Modify Commands, 2D Drawings - Simple Exercises.

UNIT - II: Engineering Curves

Engineering Curves: Ellipse, Parabola, and Hyperbola (General Method only).

Special curves: Cycloid, Epi-cycloid, Hypocycloid and Involutes (simple Exercises).

UNIT – III: Projections of Points, Lines and Planes

Principles of Orthographic Projections: Conventions, First and Third angle projections. Projections of points, Projection of Lines inclined to both the planes.

Projections of Planes: Projections of regular planes inclined to both planes.

UNIT – IV: Projections of Solids and Development of Surfaces

Projection of Solids: Regular Solids inclined to both planes (Prisms, Pyramids, Cylinders and Cone). **Development Of Surfaces:** Theory of development, development of lateral surface with base (Prisms, Pyramids, Cylinders and Cone).

UNIT – V: Isometric and Orthographic Projections

Principles of Isometric Projection, Isometric Scale, Isometric Views, Conventions, Isometric Views of Lines, Plane Figures, Simple and Compound Solids, Isometric Projection of objects having non, isometric lines. Isometric Projection of Spherical Parts.

Conversion of Isometric view to Orthographic views and Orthographic views to isometric view.

TEXT BOOKS:

1. Engineering Drawing, N. D. Bhatt, Charotar, 54th Edition, 2023.
2. Engineering Drawing and graphics Using AutoCAD, T. Jeyapoovan and Vikas, S. Chand and company Ltd., 3rdEdition, 2010.

REFERENCE BOOKS:

1. Engineering Drawing, Basant Agrawal and C.M. Agrawal, McGraw Hill, 3rd Edition, 2019.
2. Engineering Graphics and Design, WILEY, John Wiley and Sons Inc, 3rdEdition, 2020.
3. Engineering Drawing, M. B. Shah and B.C. Rane, Pearson, 2nd Edition, 2009.

ELECTRICAL CIRCUITS - I

I B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE01	ESC	2	0	0	2	40	60	100

Prerequisites: Mathematics

Course Objectives:

1. To gain knowledge in circuits and to understand the fundamentals of derived circuit laws.
2. To learn steady state analysis of single-phase and three-phase circuits.
3. To understand Theorems and concepts of magnetic coupled circuits.

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

1. Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits.
2. Solve the complex AC & DC electric circuits by applying suitable principles and theorems.
3. Analyze electric circuits using network theorems and concepts of magnetic coupled circuits.

UNIT-I NETWORK ELEMENTS & LAWS:

Active elements, Independent and dependent sources. Passive elements – R, L and C, Energy stored in inductance and capacitance, Kirchhoff's laws, Source transformation, Node voltage method, Mesh current method including super node and super mesh analysis and Star-delta transformation.

UNIT-II SINGLE-PHASE CIRCUITS:

RMS and average values of periodic sinusoidal and non-sinusoidal waveforms, Phasor representation, J-Notation, Steady-state analysis of series, parallel and series-parallel circuits. Impedance, Active and Reactive Powers, Complex Power, Admittance.

UNIT-III NETWORK THEOREMS (AC & DC):

Superposition theorem, Thevinin's theorem, Norton's theorem, Maximum power transfer theorem, Milliman's theorem and Reciprocity theorem. Resonance: Series and parallel circuits, Bandwidth and Q-factor.

UNIT-IV POLY-PHASE CIRCUITS:

Analysis of balanced and unbalanced 3-phase circuits, Star and delta connections, Measurement of three-phase power for balanced and unbalanced loads.

UNIT-V COUPLED CIRCUITS:

Concept of self and mutual inductance, Dot convention, Coefficient of coupling, Analysis of circuits with mutual inductance.

TEXT BOOKS:

1.Van Valkenburg M.E, "Network Analysis", Prentice Hall of India, 3rd Edition, 2000.

2.Ravish R Singh, "Network Analysis and Synthesis", McGraw Hill, 2nd Edition, 2019.

REFERENCE BOOKS:

1.A Sudhakar, Shyammohan S Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 5th Edition, 2017.

2.Jagan N.C, Lakshrninarayana C., "Network Analysis", B.S. Publications, 3rd Edition, 2014

A7EE01: ELECTRICAL CIRCUITS – I

B.Tech. I Year I Sem.

L	T	P	C
2	0	0	2

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To gain knowledge in circuits and to understand the fundamentals of derived circuit laws.	3	2	2	1	1	-	-	1	-	-	-	1
To learn steady state analysis of single-phase and three-phase circuits.	3	2	1	1	1	-	-	1	-	-	-	1
To understand Theorems and concepts of magnetic coupled circuits.	3	1	1	1	1	-	-	1	-	-	-	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits.	3	2	2	1	1	-	-	1	-	-	-	1
Solve the complex AC & DC electric circuits by applying suitable principles and theorems.	3	2	1	1	1	-	-	1	-	-	-	1
Analyze electric circuits using network	3	1	1	1	1	-	-	1	-	-	-	1

theorems and concepts of magnetic coupled circuits.												

ENGLISH FOR SKILL ENHANCEMENT

I B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7HS01	HSC	3	0	0	3	40	60	100

INTRODUCTION

National Education Policy-2020 aims at preparing students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. It also emphasizes language study and promotion of languages through understanding and proper interpretation. English language is central to the educational eco system. The importance of language as medium of communication for personal, social, official and professional needs to be emphasized for clear and concise expression. Teaching and learning of receptive and productive skills viz., Listening, Speaking, Reading and Writing (LSRW) are to be taught and learnt effectively in the undergraduate Engineering programs. Learners should be encouraged to engage in a rigorous process of learning to become proficient users of English language by adopting a deeply focused and yet flexible approach as opposed to rote learning.

In this connection, suitable syllabus, effective pedagogy, continuous assessments and students' involvement result in productive learning. This course supports the latest knowledge and skill requirements and shall meet specified learning outcomes. The main objectives of English language teaching and learning as medium of communication and for promotion of cultural values are embedded in this syllabus. Efforts are being made in providing a holistic approach towards value-based language learning which equips the learner with receptive as well as productive skills.

The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed textbook for detailed study. The students should be encouraged to read the texts leading to reading comprehension. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material.

LEARNING OBJECTIVES: This course will enable the students to:

a. Improve their vocabulary.
b. Use appropriate sentence structures in their oral and written communication.
c. Develop their reading and study skills.
d. Equip students to write paragraphs, essays, précis and draft letters.
e. Acquire skills for Technical report writing.

COURSE OUTCOMES: Students will be able to:

a. Choose appropriate vocabulary in their oral and written communication.
b. Demonstrate their understanding of the rules of functional grammar and sentence structures.
c. Develop comprehension skills from known and unknown passages.
d. Write paragraphs, essays, précis and draft letters.
e. Write abstracts and reports in various contexts.

SYLLABUS: The course content / study material is divided into **Five Units**

UNIT-I

Theme: **Perspectives**

Lesson on 'The Generation Gap' by Benjamin M. Spock from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan Pvt. Ltd.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Words Often Misspelt - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Parts of Speech particularly Articles and Prepositions – Degrees of Comparison

Reading: Reading and Its Importance- Sub Skills of Reading – Skimming and Scanning.

Writing: Sentence Structures and Types -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing Precisely –Nature and Style of Formal Writing.

UNIT-II

Theme: **Digital Transformation**
Lesson on '*Emerging Technologies*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Reading Strategies-Guessing Meaning from Context – Identifying Main Ideas – Exercises for Practice

Writing: Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence – Linkers and Connectives - Organizing Principles in a Paragraph – Defining- Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence - Essay Writing - Writing Introduction and Conclusion.

UNIT-III

Theme: **Attitude and Gratitude**
Poems on '*Leisure*' by William Henry Davies and '*Be Thankful*' - Unknown Author from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English. **Grammar:** Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses. **Reading:** Sub-Skills of Reading – Identifying Topic Sentence and Providing Supporting Ideas - Exercises for Practice.

Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Job Application with CV/Resume –Difference between Writing a Letter and an Email - Email Etiquette.

UNIT-IV

Theme: **Entrepreneurship**
Lesson on '*Why a Start-Up Needs to Find its Customers First*' by Pranav Jain from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Standard Abbreviations in English – Inferring Meanings of Words through Context – Phrasal Verbs – Idioms.

Grammar: Redundancies and Clichés in Written Communication – Converting Passive to Active Voice and Vice-Versa.

Reading: Prompt Engineering Techniques- Comprehending and Generating Appropriate Prompts - Exercises for Practice

Writing: Writing Practices- Note Making-Précis Writing.

UNIT-V

Theme: **Integrity and Professionalism**
Lesson on '*Professional Ethics*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Technical Vocabulary and their Usage- One Word Substitutes - Collocations.

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

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) – Inferring the Meaning and Evaluating a Text- Exercises for Practice

Writing: ***Report Writing - Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Technical Report.***

Note: ***Listening and Speaking skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.***

(**Note**: As the syllabus of English given in AICTE *Model Curriculum-2018 for B.Tech. First Year is* ***Open- ended,*** besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.)

TEXT BOOKS:

1.Board of Editors. *2025. English for the Young in the Digital World.* Orient Black Swan Pvt. Ltd.

REFERENCE BOOKS:

1.Swan, Michael. (2016). *Practical English Usage.* Oxford University Press. New Edition.

2.Karal, Rajeevan. 2023. English Grammar Just for You. Oxford University Press. New Delh

3.2024. *Empowering with Language: Communicative English for Undergraduates.* Cengage Learning India Pvt. Ltd. New Delhi

4.Sanjay Kumar & Pushp Lata. 2022. *Communication Skills – A Workbook.* Oxford University Press. New Delhi

5.Wood,F.T. (2007). *Remedial English Grammar.* Macmillan.

6.Vishwamohan, Aysha. (2013). *English for Technical Communication for Engineering Students.* Mc Graw-Hill Education India Pvt. Ltd.

ADVANCED ENGINEERING PHYSICS LAB

I B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7BS09	BSC	0	0	2	1	40	60	100

Course Objectives:

1. To provide practical exposure to advanced concepts in solid-state and modern physics.
2. To synthesize and study the physical properties of materials like semiconductors, ferromagnetic, and ferroelectric substances.
3. To perform semiconductor characterization using Hall effect and band gap experiments.
4. To explore the working principles of lasers and optical fibers through hands-on experiments.
5. To develop skills in data analysis, interpretation, and scientific reporting.

Course Outcomes:

1. **CO1:** Synthesize and analyze nanomaterials such as magnetite (Fe_3O_4) using chemical methods.
2. **CO2:** Determine key electrical, magnetic, and optical properties of semiconductors and other functional materials.
3. **CO3:** Characterize semiconductors using Hall effect and energy gap measurement techniques.
4. **CO4:** Demonstrate working knowledge of laser systems and optical fiber parameters through experimental study.
5. **CO5:** Apply scientific methods for accurate data collection, analysis, and technical report writing.

List of experiments

1. Synthesis of magnetite (Fe_3O_4) powder using sol-gel method.
2. Determination of energy gap of a semiconductor
3. Determination of Hall coefficient and carrier concentration of a given semiconductor.
4. Determination of magnetic moment of a bar magnet and horizontal earth magnetic field.
5. Study of B-H curve of a Ferro magnetic material.
6. Study of P-E loop of a given ferroelectric crystal.
7. Determination of dielectric constant of a given material.
8. Determination of Curie's temperature of a given ferroelectric material.
9. A) Determination of wavelength of a laser using diffraction grating.
   B) Study of V-I & L-I characteristics of a given laser diode.
10. A) Determination of numerical aperture of a given optical fibre.
    B) Determination of bending losses of a given optical fibre.

Note: Any 8 experiments are to be performed.

PROGRAMMING FOR PROBLEM SOLVING LAB

I B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7CS02	BSC	0	0	2	1	40	60	100

COURSE OBJECTIVES:

1) To be familiarize with basic programs to solve simple problems
2) To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
3) To develop modularized, reusable and readable C Programs using the concepts like functions, arrays, strings, pointers and structures.
4) To develop programs to perform read and write operations on files.

COURSE OUTCOMES:

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

1) Solve simple mathematical problems using basic c programs.
2) Correct syntax errors as reported by the compilers and logical errors encountered at run time and develop programs by using decision making and looping constructs.
3) Implement real time applications using the concept of array, pointers, functions and structures.

Develop programs to perform different operations on files in c.

LIST OF EXPERIMENTS

Week-1	BASIC PROGRAMS

1.You are working on an Academic Performance Engine (APE) that decides student eligibility for semester continuation based on the following conditions:

2. In an automated hospital assessment system, a patient's condition is analyzed to determine the appropriate department for admission.

Week-2	BASIC DATA TYPES

1. In a rural banking ATM, due to power fluctuations, the server sometimes receives an incorrect denomination order. You're tasked to:

- Take two amounts a and b, where a is expected to be the withdrawal amount, but due to signal reversal, values may be swapped.
- Without using any extra variables, restore the actual order such that the larger number becomes the withdrawal amount (a should store larger value, b the smaller one).
- If they're equal, leave them unchanged.

2. You're building a personal health tracker. The app calculates a **Health Risk Index (HRI)** for a user based on three readings:

- x: Heart Rate Variability (HRV)
- y: Average Sleep Hours

- `z`: Stress Level Index

You must calculate:

1. HRI Score = `(x + y + z) / (x - y - z)`
2. Sleep-Adjusted Average = `(x + y + z) / 3`
3. Recovery Index = `(x + y) × (x - y) × (y - z)`

However, there's a rule:

If the denominator in expression 1 is 0, print: Invalid HRI Score

Week-3	**OPERATORS**

1. An industrial machine's heat dissipation unit generates a circular heat zone, and a monitoring system is used to evaluate safety.

The system should:

1. Accept:
   - Radius of the heat zone (r)
   - Temperature (T) in Celsius
2. Compute:
   - Area = $\pi \times r^2$
   - Perimeter = $2 \times \pi \times r$
   - Use $\pi = 3.1416$
3. Based on area and temperature:
   - If T > 100AND area > 500 → "Critical Risk"
   - If T > 80OR perimeter > 150 → "Warning"
   - Else → "Safe"

2. In a smart electricity billing system, industrial customers are billed dynamically based on their usage slab.

You must:

1. Accept:
   - Consumer ID (consumer_id)
   - Units consumed (units)
   - Cost per unit (cost)
2. Compute:
   - Base amount = units × cost
   - Apply surcharge:
     - If units > 1000 → 18% surcharge

- If 501–1000 → 10% surcharge
- If 200–500 → 5% surcharge
- Else → No surcharge

- Final bill = base + surcharge

Round the bill to nearest integer

Week-4	CONDITIONAL STATEMENTS

1.A multinational company has developed a multi-criteria evaluation system to automate candidate shortlisting. For a given applicant, the system records the following:

- score (integer): Test score (out of 100)
- exp (integer): Years of experience
- tier (integer): Tier of college (1 – Top, 2 – Mid, 3 – Other)

Based on the inputs, classify the candidate:

Logic:

- If score < 50 → "Rejected: Failed Assessment"
- Else if score ≥ 50:
  - If exp = 0 AND tier = 3 → "Rejected: Fresh from Tier 3"
  - If exp < 2 AND score < 75 → "Waitlist: Needs More Experience"
  - If tier = 1 AND score ≥ 90 → "Accepted: Fast Track"
  - If score ≥ 70 AND (exp ≥ 2 OR tier = 1) → "Accepted: Standard Track"
  - Otherwise → "Waitlist: Borderline Profile"

2. A company tracks the monthly sales performance of its three regional branches: North, South, and East.

You are tasked to:

- Accept the sales (in rupees) of each branch
- Determine which branch had the highest sales
- If two or more branches have the same highest sales, print: "Tie"

Otherwise, print the name of the branch with the highest sales

Week-5	LOOPING STATEMENTS

1.A smart city dashboard is simulating population growth over a number of years. The logic is adaptive:

- You are given:
  - Initial population (positive integer)
  - Growth rate percentage (float)
  - Number of years to simulate (integer)

- For each year:
  - Population increases by the growth rate on the current year's population
  - If in any year, the population crosses 1 million, stop simulation and print Population Limit Reached at Year X

Required:

- Print population year-wise up to the given year OR until the limit is reached.
- Output rounded to nearest integer.

2.You're working on an authentication layer for a secure login system. It accepts a number and does the following:

- Reverse the number using a loop
- Check:
  - If the number and reverse are equal → Palindrome
  - If the difference between number and its reverse is divisible by 11 → Near Palindrome

Otherwise → Not a Palindrome

Week-6	**NESTED LOOPING STATEMENTS**

1. You're building the seat map logic for a railway reservation system. Each compartment has:

- r rows
- c columns
- A few reserved seats (you'll receive their positions)
- You must generate a grid where:
  - R = Reserved seat
  - A = Available seat
- Rows are labeled from 1 to r
- Columns from 1 to c

2. In a warehouse, items are stacked in a number pyramid to maximize space. Each row has more boxes than the last.

You are given the number of rows n, and your system must:

- Print the item ID starting from 1001 and increasing across rows
- Format the rows like a pyramid — each row contains i items in row i

Week-7	**ARRAYS**

1. A warehouse stores product IDs in an inventory list.

You are required to:

- Accept n product IDs (integers) into an array

- Accept one search ID
- Check whether that ID exists in the array
- If found, print its position (starting from 1)
- If not found, print "Not Available"

2.A smart building tracks temperature across multiple rooms using a **square grid of sensors**.

You are given:

- Two square matrices `A` and `B` of size `n × n`, where each element represents the temperature reading of a room at **two different times**.

You must:

1. Read both matrices
2. Compute a **third matrix C**, where each element is:
   - The **maximum** of the corresponding values in A and B *(i.e., latest temperature reading per room)*
3. Print the final matrix C row by row.

Week-8	**FUNCTIONS**

1.You are building a backend evaluation service for a university grading server that computes factorials for different modules.

- The system offers two modes of evaluation:
  1. Recursive mode – used by the Mathematics Department
  2. Non-recursive mode – used by the Physics Department
- Your job is to:
  - Accept a student ID and module code (MATH or PHYS)
  - Accept an integer n ($0 \leq n \leq 20$)
  - Use:
    - Recursive function if module is MATH
    - Non-recursive function if module is PHYS
  - Output the factorial result (only the number)

The server does not print the method used — it only returns the final number. The complexity lies in your logic to select and compute the factorial correctly based on module.

2.You are developing a C-based control system that supports power and GCD calculations for signal processing in embedded hardware.

- The system receives:
  - a, b, c — all positive integers ≤ 100

- You must:
    1. Compute a^b using a custom power function (non-library)
    2. Compute GCD of b and c using recursion
- Output the power and GCD on two separate lines

No status messages or logic branching is shown — just exact numbers. Internally though, students must build and invoke multiple functions appropriately.

Week-9	STRINGS

1. In a multi-cloud setup, user IDs are fetched from different cloud providers. These IDs are inconsistent in format and need normalization before merging.

You are asked to design a function that does the following:

- Accept one user ID string (mixed case, up to 100 characters)
- Convert all letters to **lowercase**
- If the string contains more than 12 characters, **truncate it to 12 characters**
- Print the normalized user ID

2. In a dual-environment (production and testing) login system, credentials are fetched from two different databases. You need to ensure that both IDs match **exactly**, or raise an alert.

Your task:

- Accept two user ID strings
- Compare them using a case-sensitive match
- If they are equal, access is granted
- If not, deny access and alert

Week-10	POINTERS

1. An embedded serial buffer receives n integer bytes. Due to a wiring issue, the last received byte appears first, and the rest in reverse. Your job is to:

- Accept the n integers using a pointer
- Reverse the array using pointer arithmetic (no array indexing allowed)
- Output the corrected stream

2. A hardware diagnostic utility reads two system boot values (`a` and `b`) from memory. Before system startup, these values must be swapped for security validation.

The utility performs:

- Dynamic memory allocation for both values
- Swapping using **only pointers**
- Then prints the updated values in the new memory locations

Week-11	STRUCTURES

1. A satellite sends two 2D signal points from its tracking system. Each signal point has:

- x coordinate (int)
- y coordinate (int)

You must:

- Store both signal points using a structure
- Calculate:
  - Midpoint of the two coordinates
  - Distance between the points
  - If distance > 100 → "Signal Drift Detected"
  - Else → "Signal Stable"

2. A multinational corporation wants to audit salary data for HR, TECH, and OPS departments using a structured system.

Each employee record includes:

- ID (int)
- Name (string)
- Department (string)
- Basic, HRA, DA (float)

You must:

- Accept records for `n` employees
- Compute gross salary
- Apply tags based on rules:
  - If gross > 80000 and department = TECH → `High Tech Earner`
  - If gross < 30000 and department = OPS → `Review Required`
  - If HRA > 50% of basic → `HRA Flagged`

Print all tags for each employee if applicable

Week-12	FILE HANDLING

1.An enterprise app stores user activity logs in a file called `activity.txt`. Each line records: <user_id> <event_code> <status>

You are required to:

- Read all lines from the file
- Count the number of events with status `"FAIL"`
- Print the **total number of lines** and **number of failures**

2. A university system maintains student records in a file named `students.txt`. Each line contains: <student_id> <name> <subject_code> <mark>

The audit system performs:

1. Reads all student records from the file
2. Validates that `mark` is between 0 and 100 (skip invalid lines)
3. Classifies passed students (`mark ≥ 50`) into:
   - `Excellent` if mark ≥ 85
   - `Good` if 70 ≤ mark < 85
   - `Average` if 50 ≤ mark < 70
4. Writes only **passed students** and their **grade band** to a new file `report.txt`

Displays how many students fall into each band

Text Books:

1) Riley DD, Hunt K.A. Computational Thinking for the Modern Problem Solver. CRC press, 2014 Mar 27.
2) B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition) Yashavant Kanetkar, "Let Us C", BPB Publications, New Delhi, 13th Edition, 2012.

Reference Books:

1) Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer; 2018
2) King KN, "C Programming: A Modern Approach", Atlantic Publishers, 2nd Edition, 2015.
3) Kochan Stephen G, "Programming in C: A Complete Introduction to the C Programming Language", Sam's Publishers, 3rd Edition, 2004.
4) Linden Peter V, "Expert C Programming: Deep C Secrets", Pearson India, 1st Edition, 1994.

Web References:

1. http://www.sanfoundry.com/c-programming-examples
2. http://www.geeksforgeeks.org/c
3. http://www.cprogramming.com/tutorial/c

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

I B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7HS02	BSC	0	0	2	1	40	60	100

The **English Language and Communication Skills (ELCS) Lab** focuses on listening and speaking skills, particularly on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Listening Skills:
Objectives

1. To enable students develop their active listening skills
2. To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds

Speaking Skills:

3. To improve their pronunciation and neutralize accent
4. To enable students express themselves fluently and appropriately
5. To practise speaking in social and professional contexts

Learning Outcomes: Students will be able to:

1. Listen actively and identify important information in spoken texts
2. Interpret the speech and infer the intention of the speaker
3. Improve their accent for intelligibility
4. Speak fluently with clarity and confidence
5. Use the language in real life situations

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

a. **Computer Assisted Language Learning (CALL) Lab which focusses on listening skills**
b. **Interactive Communication Skills (ICS) Lab which focusses on speaking skills**

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

Exercise – I

CALL Lab:
Instruction: Speech Sounds-Listening Skill - Importance - Purpose - Types- Barriers- Active Listening
Practice: Listening to Distinguish Speech Sounds (Minimal Pairs) **-** *Testing Exercises*

ICS Lab:
❖ **Diagnostic Test – Activity titled '*Express Your View*'**
Instruction: Spoken and Written language - Formal and Informal English - Greetings - Introducing Oneself and Others

Practice: Any Ice-Breaking Activity

Exercise - II
Call lab:

Instruction: Listening vs. Hearing - Barriers to Listening

Practice: Listening for General Information - Multiple Choice Questions - *Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)*

ICS Lab:
Instruction: Features of Good Conversation – Strategies for Effective Communication
Practice: Role Play Activity - Situational Dialogues –Expressions used in Various Situations –Making Requests and Seeking Permissions – Taking Leave - Telephone Etiquette

Exercise - III
Call lab:
Instruction: Errors in Pronunciation - Tips for Neutralizing Mother Tongue Influence (MTI)
Practice: Differences between British and American Pronunciation –*Listening Comprehension Exercises*

ICS Lab:
Instruction: Describing Objects, Situations, Places, People and Events
Practice: Picture Description Activity – Looking at a Picture and Describing Objects, Situations, Places, People and Events *(A wide range of Materials / Handouts are to be made available in the lab.)*

Exercise - IV
Call lab:
Instruction: Techniques for *Effective* Listening

Practice: Listening for Specific Details - Listening - Gap Fill Exercises - *Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)*

ICS Lab:
Instruction: How to Tell a Good Story - Story Star- Sequencing-Creativity
Practice: Activity on Telling and Retelling Stories - Collage

Exercise - V
Call lab:

Instruction: Identifying the literal and implied meaning
Practice: Listening for Evaluation - Write the Summary – Listening Comprehension Exercises *(It is essential to identify a suitable passage with exercises for practice.)*

ICS Lab:
Instruction: Understanding Non-Verbal Communication
Practice: Silent Speech - Dumb Charades Activity

- **Post-Assessment Test on 'Express Your View'**

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):
Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration
ii) High Fidelity Headphones

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio & video system and camcorder etc.

✍ **Note: English Language Teachers are requested to prepare Materials / Handouts for each Activity for the Use of those Materials in CALL & ICS Labs.**

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).

REFERENCE BOOKS:

1. Shobha, KN & Rayen, J. Lourdes. (2019). *Communicative English – A workbook.* Cambridge University Press
2. Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities.* Orient BlackSwan Pvt. Ltd.
3. Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach.* Cambridge University Press
4. (2022). *English Language Communication Skills – Lab Manual cum Workbook.* Cengage Learning India Pvt. Ltd.
5. Ur, Penny and Wright, Andrew. 2022. *Five Minute Activities – A Resource Book for Language Teachers.* Cambridge University Press.

I B.TECH II SEMESTER SYLLABUS

ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

I B. Tech II Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7BS02	ESC	3	0	0	3	40	60	100

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: To learn

1. Methods of solving the differential equations of first and higher order.
2. Concept, properties of Laplace transforms.
3. Solving ordinary differential equations using Laplace transforms techniques.
4. The physical quantities involved in engineering field related to vector valued functions
5. The basic properties of vector valued functions and their applications to line, surface and volume integrals

Course outcomes: After learning the contents of this paper, the student must be able to

1. Identify whether the given differential equation of first order is exact or not
2. Solve higher differential equation and apply the concept of differential equation to real world problems.
3. Use the Laplace Transforms techniques for solving Ordinary Differential Equations.
4. Evaluate the Line, Surface and Volume integrals and converting them from one to another

UNIT-I: First Order Ordinary Differential Equations

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

UNIT-II: Ordinary Differential Equations of Higher Order

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

UNIT-III: Laplace Transforms

Laplace Transforms: Laplace Transform of standard functions - First shifting theorem - Laplace transforms of functions multiplied by 't' and divided by 't' - Laplace transforms of derivatives and integrals of function - Evaluation of integrals by Laplace transforms - Laplace transform of periodic functions - Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation

Vector point functions and scalar point functions - Gradient - Divergence and Curl - Directional derivatives - Vector Identities - Scalar potential functions - Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration

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

TEXT BOOKS:

1.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

2.R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

REFERENCE BOOKS:

1.Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

2.G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

3.N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

4.H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

ENGINEERING CHEMISTRY

I B. Tech II Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7BS10	ESC	3	0	0	3	40	60	100

Course Objectives:

1. To develop adaptability to new advances in Engineering Chemistry and acquire the essential skills to become a competent engineering professional.
2. To understand the industrial significance of water treatment, fundamental principles of battery chemistry, and the impact of corrosion along with its control methods for structural protection.
3. To impart foundational knowledge of various energy sources and their practical applications in engineering.
4. To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

Course Outcomes:

1. Students will be able to understand the fundamental properties of water and its applications in both domestic and industrial purposes.
2. Students will gain basic knowledge of electrochemical processes and their relevance to corrosion and its control methods.
3. Students will comprehend the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs.
4. Students will learn the basic concepts and properties of polymers and other engineering materials.
5. Students will be able to apply the principles of UV-Visible, IR spectroscopy and Raman spectroscopy in analyzing pollutants in dye industries and biomedical applications.

UNIT-I: Water and its treatment:

Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break-point chlorination. Defluoridation - Nalgonda technique.
Boiler troubles: Scales, Sludges and Caustic embrittlement. Internal treatment of boiler feed water - Calgon conditioning, Phosphate conditioning, Colloidal conditioning. External treatment methods - Softening of water by ion- exchange processes. Desalination of brackish water – Reverse osmosis.

UNIT-II: Electrochemistry and Corrosion:

Introduction- Electrode potential, standard electrode potential, Nernst equation (no derivation), electrochemical cell - Galvanic cell, cell representation, EMF of cell - Numerical problems. Types of electrodes, reference electrodes - Primary reference electrode - Standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode. Construction, working and determination of pH of unknown solution using SHE and Calomel electrode.

Corrosion: Introduction- Definition, causes and effects of corrosion – Theories of corrosion, chemical and electrochemical theories of corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion - Nature of the metal, Nature of the corroding environment. Corrosion control methods - Cathodic protection Methods - Sacrificial anode and impressed current methods.

UNIT–III: Energy sources:

Batteries: Introduction – Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Zn-air and Lithium ion battery. Fuel Cells – Differences between a battery and a fuel cell, Construction and applications of Direct Methanol Fuel Cell (DMFC).
Fuels: Introduction and characteristics of a good fuel, Calorific value – Units - HCV, LCV- Dulongs formula - Numerical problems.
Fossil fuels: Introduction, Classification, Petroleum - Refining of Crude oil, Cracking - Types of cracking - Moving bed catalytic cracking. LPG and CNG composition and uses.
Synthetic Fuels: Fischer-Tropsch process, Introduction and applications of Hythane and Green Hydrogen.

UNIT - IV: Polymers:

Definition - Classification of polymers: Based on origin and tacticity with examples – Types of polymerization- Addition (free radical addition mechanism) and condensation polymerization. Plastics, Elastomers and Fibers: Definition and applications (PVC, Buna-S, Nylon-6,6). Differences between themoplastics and thermo setting plastics, Fiber reinforced plastics (FRP). Conducting polymers: Definition and Classification with examples - Mechanism of conduction in trans-poly- acetylene and applications of conducting polymers.
Biodegradable polymers: Polylactic acid and its applications.

UNIT-V- Advanced Functional Materials:

Smart materials: Introduction, Classification with examples - Shape Memory Alloys – Nitinol, Piezoelectric materials – quartz and their engineering applications. Biosensor - Definition, Amperometric Glucose monitor sensor. Interpretative spectroscopic applications of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Pollution Under Control- CO sensor (Passive Infrared detection), Raman spectroscopy (application) - Tumour detection in medical applications.

TEXT BOOKS:

1.Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2.Engineering Chemistry by Rama Devi, Dr. P. Aparna and Rath, Cengage learning, 2025.

REFERENCE BOOKS:

1.Engineering Chemistry: by Thirumala Chary Laxminarayana & Shashikala, Pearson Publications (2020)
2.Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi 2011.
3.Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi 2015.
4.Engineering Analysis of Smart Material Systems by Donald J. Leo, Wiley, 2007.
5.Challenges and Opportunities in Green Hydrogen by Editors: Paramvir Singh, Avinash Kumar Agarwal, Anupma Thakur, R.K Sinha.
6.Raman Spectroscopy in Human Health and Biomedicine, https://www.worldscientific.com/ doi/epdf/10.1142/13094
7. E-Content- https://doi.org/10.1142/13094 | October 2023
8. E-books: https://archive.org/details/EngineeringChemistryByShashiChawla/page/n11/mode/2u

PYTHON PROGRAMMING

I B. Tech II Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7CS58	ESC	3	0	0	3	40	60	100

Prerequisites: Basic knowledge of computer fundamentals, C programming.

Course Objectives:

Introduce the fundamentals of Python programming for problem-solving.

1. Develop skills to write structured, modular, and efficient Python code.
2. Enable students to use Python's built-in data structures and libraries effectively.
3. Provide knowledge on file handling, exception handling, and object-oriented programming in Python.
4. Equip students with the ability to apply Python for real-world applications including data processing and automation.

Course Outcomes:

1. Write Python programs using variables, operators, expressions, and control structures.
2. Implement Python programs using built-in data structures like lists, tuples, sets, and dictionaries.
3. Apply modular and object-oriented programming principles in Python.
4. Handle files, exceptions, and apply Python libraries for problem-solving.
5. Develop small-scale applications in Python for automation and data manipulation.

UNIT-1 – Introduction to Python and Basics of Programming

Introduction to Python: Features, Applications, Installation, IDEs, Python Syntax, Indentation, Comments, Variables, Data Types, Type Casting, Operators: Arithmetic, Relational, Logical, Assignment, Membership, Identity, Bitwise, Input/Output functions (input(), print()), Control Structures: if, if-else, if-elif-else, Nested Conditions, Looping: for, while, Nested Loops, break, continue, pass.

UNIT-2 – Data Structures in Python

Strings: Creation, Indexing, Slicing, Methods, String Formatting, Lists: Creation, Indexing, Slicing, List Comprehension, Methods, Tuples: Properties, Indexing, Methods, Sets: Creation, Operations, Methods, Dictionaries: Creation, Access, Methods, Dictionary Comprehension, Iterating over data structures.

UNIT-3 – Functions and Modules

Functions: Defining, Calling, Parameters, Return Values, Types of Arguments: Positional, Keyword, Default, Variable Length, Scope of Variables: Local and Global, Lambda Functions, Map, Filter, Reduce, Recursion in Python, Modules: Importing, Creating User-defined Modules, Standard Modules (math, random, datetime), Packages in Python.

UNIT-4 – File Handling and Exception Handling

File Handling: Opening, Reading, Writing, Appending, File Modes, File Methods, Working with CSV and JSON Files, Exception Handling: try, except, else, finally, Built-in Exceptions, Raising Exceptions, Introduction to Regular Expressions (re module).

UNIT-5 – Object-Oriented Programming and Applications

OOP Basics: Classes, Objects, Attributes, Methods, Constructor (__init__), self-keyword, Inheritance: Single, Multiple, Multilevel, Hierarchical, Method Overriding, Method Overloading (conceptual), Encapsulation and Polymorphism, Application Development: Data Processing Script, Basic Calculator, File Organizer, Simple Data Analysis with pandas.

TEXT BOOKS:

1.Python Programming: Using Problem Solving Approach by Reema Thareja.

2.Python Crash Course by Eric Matthes, Learning Python by Mark Lutz.

REFERENCE BOOKS:

1.Introduction to Python Programming by Gowrishankar S., Veena A.

2.Python Cookbook by David Beazley and Brian K. Jones.

3.Fluent Python by Luciano Ramalho, Automate the Boring Stuff with Python by Al Sweigart.

PYTHON PROGRAMMING

CO–PO Mapping

CO → / PO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	1	0	0	2	2	1	3
CO2	3	3	3	2	3	1	0	0	2	2	1	3
CO3	3	3	3	2	3	1	0	1	2	2	1	3
CO4	3	3	2	2	3	1	0	1	2	2	1	3
CO5	3	3	3	2	3	1	1	1	3	3	2	3

DATA STRUCTURES

I B. Tech II Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7CS03	ESC	3	0	0	3	40	60	100

Course Objectives:

1. Impart the basic concepts of structures, pointers and data structures.
2. Understand concepts linked lists and their applications.
3. Understand basic concepts about stacks, queues and their applications.
4. Understand basic concepts of trees, graphs and their applications.
5. Enable them to write algorithms for sorting and searching.

COURSE OUTCOMES:

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

1. Use arrays, pointers and structures to formulate algorithms and programs.
2. Design and implement applications of Linked List.
3. Design and implement Stack ADT using Array and Linked List.
4. Design and implement Queue ADT using Array and Linked List.
5. Solve problems involving graphs and trees.
6. Analyze searching and sorting techniques based on time and space complexity.

UNIT-I

Introduction to Data Structures- Definition, Linear Data Structures, Non-Linear Data Structures,
Representation of single, two dimensional arrays, sparse matrices and their representation.
Singly Linked Lists-Operations-Insertion, Deletion, Concatenating singly linked lists, Circularly linked lists- Operations-Insertion, Deletion, Doubly Linked Lists- Operations- Insertion, Deletion

UNIT-II

Stacks-Stack ADT, definition, operations, array and linked implementations in C,
Applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation.

UNIT-III

Queues-Queue ADT, definition and operations ,array and linked Implementations in C, Circular queues- array and linked implementations in C, Dequeue (Double ended queue)ADT, array and linked implementations in C.

UNIT-IV

Searching- Linear Search, Binary Search, **Sorting**- Bubble Sort, Insertion Sort, Selection Sort, Quick sort, Merge Sort, Comparison of Sorting methods based on their complexities.

UNIT-V

Non-Linear Data Structures- Trees – Introduction, Definition, Terminology, Applications, Tree Representations- List Representation, Left Child – Right Sibling Representation. **Graphs -** Introduction, Definition, Terminology, Applications, Graph Representations- Adjacency matrix, Adjacency lists

TEXT BOOKS:

1. Data Structures using C, R.Thareja 2nd Edition, Oxford Press.
2. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

REFERENCE BOOKS:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.

Web References:

1. https://hackr.io/tutorials/learn-data-structures-algorithms
2. https://www.geeksforgeeks.org/fundamentals-of-algorithms/
3. https://www.udemy.com/introduction-to-algorithms-and-data-structures-in-c/
4. https://leetcode.com

E-Text Books:

1. 1. http://www.freetechbooks.com/algorithm-analysis-and-design-t1030.html
2. http://www.freetechbooks.com/algorithmic-problem-solving-t373.html
3. http://www.freetechbooks.com/algorithms-and-data-structures-the-basic-toolbox-t871.html

MOOC Course

1. https://www.coursera.org/specializations/data-structures-algorithms
2. https://onlinecourses.nptel.ac.in/noc16_cs06/preview

ELECTRICAL CIRCUITS – II

I B. Tech II Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE02	ESC	3	0	0	3	40	60	100

Prerequisites: Matrices and Calculus and Electrical Circuits - I

Course Objectives:

1. To study the transient and steady state analysis of RL, RC and RLC circuits (Series and Parallel)
2. To understand the applications of Laplace transform.
3. To learn about two-port networks and concept of filters.

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

1. Observe the response of transient and steady state analysis of RL, RC and RLC circuits (Series and Parallel).
2. Examine the behavior of circuits using Laplace transforms
3. Obtain two port network parameters and design of various passive filters.

UNIT-I TRANSIENT ANALYSIS:

Transient response of R, L & C circuits, Formulation of integral differential equations, Initial conditions, Transient Response of RL, RC and RLC (series and parallel) networks- Response to step and sinusoidal excitations.

UNIT-II APPLICATIONS OF LAPLACE TRANSFORMS:

Introduction, RL, RC and RLC (series and parallel) Networks for impulse, step, ramp, exponential and sinusoidal excitations.

UNIT-III NETWORK TOPOLOGY:

Graph, tree, chord, Tie-set, cut-set, incident matrix, Problems on Tie-set and cut-set.

UNIT-IV TWO PORT NETWORK PARAMETERS:

Open circuit impedance, short-circuit admittance, Transmission, Hybrid parameters & inter-relationships, Series, parallel and cascade connection of two port networks, System function, Impedance and admittance functions.

UNIT-V FILTERS:

Classification of filters – Low pass, High pass, Band pass and Band Elimination, Constant-k and M-derived filters-Low pass and High pass Filters, Band pass and Band elimination filters (Elementary treatment only).

TEXT BOOKS:

1.Van Valkenburg M.E, “Network Analysis”, Prentice Hall of India, 3rd Edition, 2000.

2.Ravish R Singh, “Network Analysis and Synthesis”, McGraw Hill, 2nd Edition, 2019.

REFERENCE BOOKS:

1.B. Subramanyam, “Electric Circuit Analysis”, Dream tech Press & Wiley, 2021.

2.A Sudhakar, Shyammohan S Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill, 5th Edition, 2017.

A7EE02: ELECTRICAL CIRCUITS – II

B.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To study the transient and steady state analysis of RL, RC and RLC circuits (Series and Parallel)	3	2	2	3	2	-	-	1	-	-	-	1
To understand the applications of Laplace transform.	3	2	2	2	2	-	-	1	-	-	-	1
To learn about two-port networks and concept of filters.	3	2	2	3	2	-	-	1	-	-	-	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Observe the response of transient and steady state analysis of RL, RC and RLC circuits (Series and Parallel).	3	2	2	3	2	-	-	1	-	-	-	1
Examine the behavior of circuits using Laplace transforms	3	2	2	2	2	-	-	1	-	-	-	1
Obtain two port network parameters and applications and design of various filters.	3	2	2	3	2	-	-	1	-	-	-	1

A7ME03 : ENGINEERING WORKSHOP

(Common to all Branches)

B.Tech. I Year II Sem

L	T	P	C
0	0	2	1

Prerequisites: Practical skill

Course Objectives:

1. To introduce students to basic manufacturing processes and workshop practices.
2. To provide hands-on training in carpentry, fitting and sheet metal.
3. To develop skills in using hand tools and measuring instruments.
4. To enhance safety awareness and proper handling of workshop equipment.
5. To build a foundational understanding of industrial production and fabrication.

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

1. Understand the basic manufacturing processes and operations.
2. Use hand tools and equipment safely and efficiently.
3. Perform basic operations in carpentry, fitting and sheet metal work.
4. Read and interpret workshop drawings
5. Develop teamwork, time management, and quality awareness in a workshop environment.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

i. **Carpentry:** T- Lap Joint, Dovetail Joint, Mortise and Tenon Joint
ii. **Fitting:** V- Fit, Dovetail Fit and L - fit
iii. **Tin Smithy**: Square Tin, Rectangular Tray and Conical Funnel
iv. **Soldering**: Parallel and Series, Wheat stone bridge circuit.
v. **House wiring**: Parallel and Series, Two-way Switch and Tube Light

2. TRADES FOR DEMONSTRATION AND EXPOSURE:

Black Smithy: Round to Square and S – Hook

Plumbing: PVC Pipe Fittings

TEXT BOOKS:

1. Workshop Practice, B. L. Juneja, Cengage Learning India, 1st edition, 2015.
2. Workshop Practice Manual, K. Venkata Reddy, BS Publication,6th Edition, Rpt.2025.

REFERENCE BOOKS:

1. Workshop Manual, K. Venugopal, Anuradha Publications, 12th edition, 2012.

ENGINEERING CHEMISTRY LAB

I B. Tech II Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7BS11	ESC	0	0	2	1	40	60	100

Course Description: The course includes experiments based on fundamental principles of chemistry essential for engineering students, aiming to develop practical skills and reinforce theoretical concepts.

Course Objectives

1. Students will understand and perform experiments based on core chemical principles relevant to engineering applications.
2. Students will learn to estimate the hardness of water to assess its suitability for drinking purposes.
3. Students will acquire the ability to perform acid-base titrations using instrumental methods such as conductometry, potentiometry, and pH metry.
4. Students will gain hands-on experience in synthesizing polymers like Bakelite and Nylon – 6, 6 in the laboratory.
5. Students will learn to determine the unknown concentration of potassium permanganate (KMnO4) using a calibration curve.

Course Outcomes:

1. Students will develop practical skills through hands-on chemistry experiments relevant to engineering.
2. Students will learn to determine important parameters such as water hardness and the corrosion rate of mild steel under various conditions.
3. Students will be able to apply techniques like conductometry, potentiometry, and pH metry to determine concentrations or equivalence points in acid-base reactions.
4. Students will gain experience in synthesizing polymers such as Bakelite and Nylon-6,6.
5. Students will understand the working principle of colorimetry and the relationship between absorbance and concentration (Beer-Lambert Law).

LIST OF EXPERIMENTS

I.Volumetric Analysis: Estimation of Hardness of water by EDTA Complexometry method.

II.Conductometry:

1.Estimation of the concentration of strong acid by Conductometry.

2.Estimation of the concentration of strong and weak acid in an acid mixture by Conductometry.

III.Potentiometry:

1.Estimation of concentration of Fe^{+2}ion by Potentiometry using $KMnO_4$.

2.Estimation of concentration of strong acid with strong base by Potentiometry using quinhydrone

IV.pH Metry: Determination of an acid concentration using pH meter.

V.Colorimetry: Verification of Lambert-Beer's law using $KMnO_4$.

VI. Preparations:

1.Preparation of Bakelite.

2.Preparation Nylon – 6, 6.

VII.Corrosion: Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.

VIII.Virtual lab experiments:

1.Construction of Fuel cell and it's working.

2.Smart materials for Biomedical applications

3.Batteries for electrical vehicles.

4.Functioning of solar cell and its applications.

REFERENCE BOOKS:

1.Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)

2.Vogel's text book of practical organic chemistry 5th edition

3.Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.

4.College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).

PYTHON PROGRAMMING LAB

I B. Tech II Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7CS05	ESC	0	0	2	1	40	60	100

COURSE OBJECTIVES:

1. To install and run the Python interpreter
2. To learn control structures.
3. To Understand Lists, Dictionaries in python
4. To Handle Strings and Files in Python

COURSE OUTCOMES:

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

1. Develop the application specific codes using python.
2. Understand Strings, Lists, Tuples and Dictionaries in Python
3. Verify programs using modular approach, file I/O, Python standard library Implement Digital Systems using Python

LIST OF EXPERIMENTS

WEEK - I

1. i) Use a web browser to go to the Python website http://python.org. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.

ii)Start the Python interpreter and type help() to start the online help utility.

2. Start a Python interpreter and use it as a Calculator.

WEEK - 2

1. Write a program to calculate compound interest when principal, rate and number of periods are given.
2. Read the name, address, email and phone number of a person through the keyboard and print the details.
3. Print the below triangle using for loop. 5

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

WEEK - 3

1. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character(use 'if-else-if' ladder)
2. Python program to print all prime numbers in a given interval (use break)

Write a program to convert a list and tuple into arrays.

WEEK - 4

1. Write a program to find common values between two arrays.
2. Write a function called palindrome that takes a string argument and returnsTrue if it is a palindrome and False otherwise. Remember that you can use the built-in function len to check the length of a string.

Write a function called is_sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.

WEEK - 5

1. Write a function called has_duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.
2. Write a function called remove_duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.

The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.

WEEK - 6

1. Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.
2. Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'

Remove the given word in all the places in a string?

Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?

WEEK - 7

1. Writes a recursive function that generates all binary strings of n-bit length
2. Write a python program that defines a matrix and prints

Write a python program to perform multiplication of two square matrices

WEEK - 8

1. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
2. Use the structure of exception handling all general-purpose exceptions.

Write a function called draw_rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.

WEEK - 9

1. Add an attribute named color to your Rectangle objects and modify draw_rectangle so that it uses the color attribute as the fill color.
2. Write a function called draw_point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.

Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw_circle that draws circles on the canvas.

WEEK - 10

1. Write a python code to read a phone number and email-id from the user and validate it for correctness.
2. Write a Python code to merge two given file contents into a third file.

Write a Python code to open a given file and construct a function to check for given words present in it and display on found.

WEEK - 11

1. Write a Python code to Read text from a text file, find the word with most number of occurrences
2. Write a function that reads a file *file1*and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.

Import numpy, Plotpy and Scipy and explore their functionalities.

WEEK - 12
5. Install NumPy package with pip and explore it. **6.** Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.
TEXT BOOKS
1. Supercharged Python: Take your code to the next level, Overland Learning Python, Mark Lutz, O'reilly
REFERENCE BOOKS
1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson 2. Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Sheetal Taneja, Naveen Kumar, Pearson 3. Introduction to Python Programming, Gowrishakar S, Veena A, CRC Press 4. Programming with Python, A User's Book, Michael Dawson, Cengage Learning, India Edition 5. Python for Data Science, Dr. Mohd Abdul Hameed, Wiley publications 6. Core Python Programming, Dr. R. Nageswara Rao, Dreamtech press Introduction to Python, Gowrishankar S, Veena A., CRC Press

DATA STRUCTURES LAB

I B. Tech II Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7CS04	ESC	0	0	2	1	40	60	100

Prerequisites: 1. A Course on "Programming for problem solving".

Course Objectives:

1. It covers various concepts of C programming language
2. It introduces searching and sorting algorithms
3. It provides an understanding of data structures such as stacks and queues.

Course Outcomes:

1. Ability to develop C programs for computing and real-life applications using basic elements like control statements, arrays, functions, pointers and strings, and data structures like stacks, queues and linked lists.
2. Ability to Implement searching and sorting algorithms

LIST OF EXPERIMENTS

1.Write a program that uses functions to perform the following operations on singly linked list.:
i) Creation ii) Insertion iii) Deletion iv) Traversal

2.Write a program that uses functions to perform the following operations on doubly linked list.: i)Creation
ii) Insertion iii) Deletion iv) Traversal

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

4.Write a program that implement stack (its operations) using
i) Arrays ii) ADT

5.Write a program that implement Queue (its operations) using
ii)Arrays ii) ADT

6.Write a program that implements the following sorting methods to sort a given list of integers in ascending order
i)Radix Sort, ii) Heap sort, iii) Shell Sort, iv) Tree Sort

7.Write a program to implement the tree traversal methods (Recursive and Non-Recursive).

8.Write a program to implement
i) Binary Search tree ii) B Trees iii) B+ Trees iv) AVL trees v) Red - Black trees

9.Write a program to implement the graph traversal methods.

10.Write a program to implement the following Hash Functions: i) Division Method, ii) Multiplication Method, iii) Mid-square Method, iv) Folding Method

TEXT BOOKS:

1.Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.

2.Data Structures using C – A. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, PHI/Pearson Education.

REFERENCE BOOKS:

1.Data Structures: A Pseudocode Approach with C, 2nd Edition, R. F. Gilberg and B. A. Forouzan, Cengage Learning.

ELECTRICAL CIRCUITS LAB

I B. Tech II Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE03	ESC	0	0	2	1	40	60	100

Prerequisites: Electrical Circuits - I

Course Objectives:

1. To design electrical systems and analyze them by applying various Network Theorems
2. To measure three phase Active and Reactive power.
3. To understand the concept of resonance.

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

1. Analyze complex DC and AC linear circuits
2. Apply concepts of electrical circuits across engineering
3. Evaluate response of a given network by using theorems.

LIST OF EXPERIMENTS

The following experiments are required to be conducted compulsorily:

1.Determination of Time response of first order RL and RC circuit for periodic non – sinusoidal inputs – Time Constant and Steady-state error using any circuit simulation software (LT Spice etc...).

2.Frequency domain analysis of Low-pass filter and High-pass filters using circuit simulation software (LT Spice etc...).

3.Verification of Superposition and Maximum Power Transfer theorems using any circuit simulation software (LT Spice etc...).

4.Verification of Thevenin's theorem using any circuit simulation software (LT Spice etc...).

5.Verification of Norton's theorem using any circuit simulation software (LT Spice etc...).

6.Verification of Series and Parallel Resonance.

7.Determination of Two port network parameters - Z, Y parameters.

8.Measurement of relationship between phase voltage and line voltage in a star-connected (Y-connected) three-phase transformer

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

1.Determination of Two port network parameters – Transmission and Hybrid parameters.

2.Measurement of relationship between phase voltage and line voltage in a delta-connected (Δ-connected) three-phase transformer.

3.Determination of Time response of first order RL, RC circuit for periodic non - sinusoidal inputs - Time Constant and Steady state error.

4.Verification of Compensation theorem

TEXT BOOKS:

1.Van Valkenburg M.E, "Network Analysis", Prentice Hall of India, 3rd Edition, 2000.

2.Ravish R Singh, "Network Analysis and Synthesis", McGrawHill, 2nd Edition, 2019.

REFERENCE BOOKS:

1.B. Subramanyam, "Electric Circuit Analysis", Dreamtech Press & Wiley, 2021.

2.James W.Nilsson, Susan A. Riedel, "Electric Circuits", Pearson, 11th Edition, 2020.

3.A Sudhakar, Shyammohan S Palli, "Circuits and Networks: Analysis and Synthesis", McGrawHill, 5th Edition, 2017.

4.Jagan N.C, Lakshrninarayana C., "Network Analysis", B.S. Publications, 3rd Edition, 2014.

5.William Hayt H, Kimmerly Jack E. and Steven Durbin M, "Engineering Circuit Analysis", McGrawHill, 6th Edition, 2002.

6.Chakravarthy A., "Circuit Theory", Dhanpat Rai & Co., First Edition, 1999.

A7EE03: ELECTRICAL CIRCUITS LAB

B.Tech. I Year II Sem.

L	T	P	C
0	0	2	1

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To design electrical systems and analyse them by applying various Network Theorems	3	2	2	3	3	-	-	1	2	2	2	1
To understand the concept of resonance.	3	2	2	3	3	-	-	1	2	2	2	1
Analyse complex DC and AC linear circuits.	3	2	2	3	3	-	-	1	2	2	2	1
Apply concepts of electrical circuits across engineering	3	2	2	2	3	-	-	1	2	2	2	1

Online Recourses:

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/108/106/108106172/
3. https://ocw.mit.edu/search/ocwsearch.htm?q=laboratory

II B. TECH I SEMESTER

ELECTROMAGNETIC FIELDS

II B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE11	ESC	3	0	0	3	40	60	100

Prerequisites: Mathematics & Physics

Course Objectives:

1. To introduce the concepts of electric field and magnetic field.
2. To know Applications of electric and magnetic fields in the development of the theory for power transmission lines and electrical machines.
3. To study about electromagnetic waves.

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

1. Understand the basic laws of electromagnetism and their applications.
2. Analyze time varying electric and magnetic fields.
3. Understand the propagation of EM waves.

UNIT-I: Static Electric Field:

Review of conversion of a vector from one coordinate system to another coordinate system, Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

UNIT-II: Conductors, Dielectrics and Capacitance:

Current and current density, Ohms Law in Point form, Continuity equation, Boundary conditions of conductors and dielectric materials. Capacitance, Capacitance of a two-wire line, Poisson's equation, Laplace's equation.

UNIT-III: Static Magnetic Fields and Magnetic Forces:

Biot-Savart Law, Ampere Circuital Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Magnetic circuits, Self-inductances and mutual inductances.

UNIT-IV: Time Varying Fields and Maxwell's Equations:

Faraday's laws of Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces.

UNIT-V: Electromagnetic Waves:

Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane wave in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors. Poynting theorem.

TEXT BOOKS:

1.M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.

2.W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

REFERENCE BOOKS:

1.A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.

2.G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.

3.W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980

4.W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.

5.E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.

6.B.D.Popovic, "IntroductoryEngineeringElectromagnetics",Addison-Wesley Educational Publishers,International Edition, 1971.

7.A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.

Online Recourses:

1. https://nptel.ac.in/courses/108/106/108106073/
2. https://nptel.ac.in/courses/115/101/115101005/
3. https://nptel.ac.in/courses/108/106/108106023/

EE301PC: ELECTROMAGNETIC FIELDS

B.Tech. II Year I Sem.

L T P C
3 0 0 3

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To introduce the concepts of electric field and magnetic field	3	3	2	1	2	-	-	-	-	-	-	2
To know Applications of electric and magnetic fields in the development of the theory for power transmission lines and electrical machines.	3	3	1	2	2	-	-	-	-	-	-	2
To study about electromagnetic waves	3	3	1	1	2	-	-	-	-	-	-	2

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
Understand the basic laws of electromagnetism and their applications	3	3	3	2	2	-	-	-	-	-	-	2
Analyze time varying electric and magnetic fields.	3	3	3	1	2	-	-	-	-	-	-	2
Understand the propagation of EM waves	3	2	2	1	1	-	-	-	-	-	-	2

ELECTRICAL MACHINES - I

II B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE12	ESC	3	0	0	3	40	60	100

Prerequisites: Electrical Circuits -I & II

Course Objectives:

1. To study and understand different types of DC machines and their performance evaluation through various testing methods.
2. To understand the operation of single-phase and Three-phase Transformers
3. To analyze the performance of transformers through various testing methods.

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

1. Identify different parts of a DC machines & understand their operation.
2. Carry out different excitation, starting, speed control methods and testing of DC machines.
3. Analyze single & three phase transformers and their performance through various testing methods.

UNIT -I: D.C. Generators:

Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings (elementary treatment only) – EMF Equation. Concept of Armature reaction and commutation – Cross magnetizing and de-magnetizing AT/pole. Methods of Excitation – separately excited and self-excited generators – build-up of EMF - critical field resistance and critical speed. Performance Characteristics of shunt, series and compound generators and applications.

UNIT -II: DC Motors:

Principle of operation – Back EMF. - Torque equation – characteristics and application of shunt, series and compound motors.

3-point starter, Speed control of DC shunt and series motors - Armature voltage and field flux control methods. Losses – Constant & Variable losses -calculation of efficiency – condition for maximum efficiency.

Testing of DC Machines: Methods of Testing - Direct, Indirect, and Regenerative Testing - Brake Test -Swinburne's Test - Hopkinson's Test.

UNIT -III: Single Phase Transformers

Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no-load and on load - phasor diagrams and Applications.

UNIT -IV:

Equivalent circuit - losses and efficiency – regulation - All day efficiency - effect of variations of frequency & supply voltage on iron losses.

Testing of Transformers: Open Circuit and Short Circuit tests - Sumpner's Test - predetermination of efficiency and regulation-separation of losses test.

UNIT -V:

Parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers.

Poly-phase transformers – Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Scott connection and Applications.

TEXT BOOKS:

1.P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, Revised Edition, 2021.

2.I.J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCE BOOKS:

1.Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.

2.M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002

3.A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.

4.A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

ELECTRICAL MACHINES - I

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To study and understand different types of DC machines and their performance evaluation through various testing methods.	3	3	3	2	-	2	1	-	2	-	1	1
To understand the operation of single-phase and three-phase Transformers	3	3	3	2	-	2	1	-	2	-	1	1
To analyse the performance of transformers through various testing methods	3	3	3	2	-	2	1	-	2	-	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Identify different parts of a DC machines & understand their operation	3	3	3	2	-	2	1	-	2	-	1	1
Carry out different excitation, starting, speed control methods and testing of DC machines	3	3	3	2	-	2	1	-	2	-	1	1
Analyse single & three phase transformers and their performance through testing	3	3	3	2	-	2	1	-	2	-	1	1

ELECTRONIC DEVICES AND CIRCUITS

II B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EC05	ESC	3	0	0	3	40	60	100

Course Overview: This course introduces fundamental semiconductor devices and their behavior, including diodes, BJTs, and FETs. It covers their characteristics, applications, and the analysis of basic electronic circuits. The course also explores rectifiers, voltage regulation, amplifier design, and advanced semiconductor technologies like FinFETs and CNTFETs. Emphasis is placed on developing a strong foundation for analog circuit design and understanding modern device technologies in electronics.

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

CO1: Analyze the electrical characteristics and models of semiconductor diodes and apply them in rectifier and clipping circuits.
CO2: Evaluate the operation and configurations of Bipolar Junction Transistors (BJTs) and analyze their input and output characteristics.
CO3: Design appropriate biasing networks for BJTs and determine the operating point for amplifier applications.
CO4: Analyze transistor amplifier circuits using h-parameter models and assess performance for various configurations.
CO5: Analyze the structure, working, and characteristics of JFETs, MOSFETs, and advanced devices like FinFETs and CNTFETs, and compare modern device technologies.

UNIT - I: Diode Characteristics and Applications:

PN junction diode – I-V characteristics, Diode resistance and capacitance, Diode models (Ideal, Simplified, Piecewise Linear), Rectifiers - Half-wave, Full-wave (Center-tap and bridge), Capacitor filter for rectifiers, Clippers and clampers, Zener diode - I-V characteristics and voltage regulation.

UNIT - II: Bipolar Junction Transistor (BJT):

Structure and working principle of BJT, Current components and transistor action, Configurations: Common Base (CB), Common Emitter (CE), Common Collector (CC), Input and output characteristics, Determination of h-parameters from transistor characteristics.

UNIT - III: BJT Biasing:

Need for biasing and stabilization, Load line and operating point, Biasing techniques: Fixed bias, Collector-to-base bias, Voltage divider bias, Stability factors and thermal runaway

UNIT - IV: Transistor Amplifiers:

Transistor as a small-signal amplifier, h-parameter equivalent circuit, CE, CB, CC amplifier analysis using h-parameters, Approximate CE model - with and without emitter bypass capacitor.

UNIT - V: Special Purpose Diodes & FET's:

Principle of Operation of - SCR, Tunnel Diode, Varactor Diode, Photo Diode, Solar Cell, LED and Schottky Diode

Field Effect Transistors and Advanced Devices: JFET: Structure, operation, and characteristics, MOSFET: Enhancement and Depletion modes – Structure, operation, and characteristics, Advanced Devices: FinFETs 3D structure, Scaling advantages, CNTFETs - Structure, ballistic transport, fabrication, Comparison: CMOS vs. FinFET vs. CNTFET.

TEXT BOOKS:

1.Millman, Jacob, and Christos C. Halkias. *Electronic Devices and Circuits*. Tata McGraw-Hill, 1991.

2.Boylestad, Robert L., and Louis Nashelsky. *Electronic Devices and Circuit Theory*. Pearson, 11th ed., 2013.
3.Sedra, Adel S., and Kenneth C. Smith. *Microelectronic Circuits*. Oxford University Press, 7th ed., 2014.
REFERENCE BOOKS:
1.Bell, David A. *Electronic Devices and Circuits*. Oxford University Press, 5th ed., 2008.
2.Neamen, Donald A. *Electronic Circuit Analysis and Design*. McGraw-Hill, 2nd ed., 2001.
3.Salivahanan, S., and N. Suresh Kumar. *Electronic Devices and Circuits*. McGraw-Hill Education, 4th ed., 2017.
4.Razavi, Behzad. *Fundamentals of Microelectronics*. Wiley, 2nd ed., 2013.
5.Taur, Yuan, and Tak H. Ning. *Fundamentals of Modern VLSI Devices*. Cambridge University Press, 2nd ed., 2009.

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Course Articulation Matrix

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

POWER SYSTEM - I

II B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE13	ESC	3	0	0	3	40	60	100

Prerequisite: Electrical Circuits-I &II

Course Objectives:

1. To understand the power generation through conventional and non-conventional sources
2. To illustrate the economic aspects of power generation and tariff methods
3. To know about substations and distribution systems

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

1. Understand the operation of conventional and renewable electrical power generating stations
2. Evaluate the power tariff methods and Economics associated with power generation
3. Analyze the operations of AIS & GIS and Distribution systems

UNIT – I Generation of Electric Power:

Operation of Hydel, Thermal and Nuclear Power plant with layouts - Description of components-Choice of site - advantages and disadvantages, Introduction and description of components- renewable energy sources and plants (solar and wind).(Elementary Treatment Only)

UNIT - II: Economics of Power Generation:

Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load curve, Load duration curve. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariffs.

UNIT - III: Air Insulated Substations (AIS):

Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Selection of site for substation. Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

Gas Insulated Substations (GIS): Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, bus bar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT – IV Overhead Transmission Lines:

Line conductors, Composite conductors, bundled conductors, Inductance and capacitance of single phase and three phase lines with symmetrical spacing, and effect of earth on capacitance, skin and proximity effects.

Overhead Line Insulators: Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators, Sag and Tension calculations.

UNIT - V: Performance of Lines:

Representation of lines, short transmission lines, medium length lines, nominal T and PI-representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, and D constants, Ferranti Effect.

Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Advantages and Disadvantages of corona, interference between power and Communication lines

TEXT BOOKS:

1.C. L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", 2nd Edition, New Age International, 2009.

2.J. B. Gupta, A Course in Power Systems" Katson Books, 11th Edition, 2016.

3.A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, "A Text book on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.

REFERENCE BOOKS:

1.C.L. Wadhwa, "Electrical Power Systems", 5th Edition, New Age International, 2009.

2.M.V. Deshpande, "Elements of Electrical Power Station Design", 3rd Edition, Wheeler Pub. 1998

3.H. Cotton & H. Barber, "The Transmission and Distribution of Electrical Energy", 3rd Edition, 1970.

4.W. D. Stevenson, "Elements of Power System Analysis", 4th Edition, McGraw Hill, 1984.

5.V. K. Mehta and Rohit Mehta, "Principles of Power Systems", S. Chand & Company Ltd, New Delhi, 2004.

Online Recourses:

1. https://nptel.ac.in/courses/108/102/108102047/
2. https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-2(TB)(ET) ((EE)NPTEL).pdf
3. https://onlinecourses.nptel.ac.in/noc20_ee67/preview

EE304PC: POWER SYSTEM – I

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To understand the power generation through conventional and non-conventional sources	3	3	3	2	-	2	1	-	2	-	1	1
To illustrate the economic aspects of power generation and tariff methods	3	3	3	2	-	2	1	-	2	-	1	1
To know about substations and distribution systems	3	3	3	2	-	2	1	-	2	-	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand the operation of conventional and renewable electrical power generating stations	3	3	3	2	-	2	1	-	2	-	1	1
Evaluate the power tariff methods and Economics associated with power generation	3	3	3	2	-	2	1	-	2	-	1	1
Analyze the operations of AIS & GIS, and Distribution systems	3	3	3	2	-	2	1	-	2	-	1	1

ELECTRICAL MEASUREMENTS AND SENSORS

II B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE14	ESC	2	0	0	2	40	60	100

Prerequisites: Electrical Circuits-I &II, Analog Electronics and Electromagnetic Fields.

Course Objectives:

1. To introduce the basic principles of all measuring instruments.
2. To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.
3. To understand the basic concepts of smart and digital metering.

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

1. Understand different types of measuring instruments, their construction, operation and characteristics and identify the instruments suitable for typical measurements.
2. Apply the knowledge about transducers and instrument transformers to use them effectively.
3. Apply the knowledge of smart and digital metering for industrial applications.

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-electrometer type and attracted disc type - extension of range of Electrostatic Voltmeters.

UNIT - II: Potentiometers & Instrument Transformers:

Principle and operation of DC Crompton's potentiometer - standardization - Measurement of unknown resistance, current, voltage. AC Potentiometers: polar and coordinate type's standardization - applications. CT and PT - Ratio and phase angle errors (Qualitative approach).

UNIT - III: Measurement of Power & Energy:

Single phase dynamometer wattmeter, LPF and UPF, Double element and three element 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.

Single phase induction type energy meter - driving and braking torques - errors and compensations - testing by phantom loading using RSS meter. Three phase energy meter - trivector meter, maximum demand meters (Qualitative approach).

UNIT - IV: DC & AC Bridges:

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

Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson's bridge. Measurement of capacitance and loss angle -De Sauty's Bridge - Wien's bridge - Schering Bridge. (Qualitative approach)

UNIT - V: Sensors

Classification of transducers- Temperature sensors- Proximity sensor- Pressure sensor- IR sensors- Motion detection sensors- Ultrasonic sensors- Rotor Position Sensors, Operation of Strain Gauge- Thermocouples, construction and working of LVDT, Piezo electric transducers, photovoltaic, photo conductive cells, and photo diodes-Applications.

Smart instruments: Intelligent transducer, self-diagnosis and remote calibration features, HART communication, MEMS, non-linearity compensation; smart energy meter components, working principle; Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI) environments.

TEXT BOOKS:

1.A. K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications,2005.

2.Dr. Rajendra Prasad, "Electrical Measurements & Measuring Instruments", Khanna Publishers 1989

REFERENCE BOOKS:

1.G. K. Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016.
2.R. K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd.,2007.
3.S. C. Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2012.
4.Buckingham and Price, "Electrical Measurements", Prentice – Hall, 1988.
5.Reissland, M. U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
6.E.W. Golding and F. C. Widdis, "Electrical Measurements and measuring Instruments", fifth Edition,Wheeler Publishing, 2011.
Online Recourses: 1. https://nptel.ac.in/courses/108/105/108105153/ 2. https://www.cdac.in/index.aspx?id=pe_pe_PEG_SMARTENERGY

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ELECTRICAL MEASUREMENTS AND SENSORS

B.Tech. II Year I Sem.

L	T	P	C
2	0	0	2

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To introduce the basic principles of all measuring instruments	3	3	2	2	2	-	-	-	1	-	-	1
To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.	3	3	2	2	2	-	-	-	1	-	-	1
To understand the basic concepts of smart and digital metering	3	3	2	2	2	-	-	-	1	-	-	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand different types of measuring instruments, their construction, operation and characteristics and identify the instruments suitable for typical measurements	3	3	2	2	2	-	-	-	1	-	-	1
Apply the knowledge about transducers and instrument transformers to use them effectively	3	3	2	2	2	-	-	-	1	-	-	1
Apply the knowledge of smart and digital metering for industrial applications	3	3	2	2	2	-	-	-	1	-	-	1

INNOVATION AND ENTREPRENEURSHIP

II B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7HS08	HSC	2	0	0	2	40	60	100

Course Objectives:

1. To familiarize on the basic concepts of innovation, entrepreneurship and its importance.
2. To Identify and analyze the process of problem-opportunity identification, market segmentation, and idea generation techniques.
3. To initiate prototype development and understand minimum viable product.
4. To develop initial Business and financial planning and Go-to-Market strategies
5. To impart knowledge on establishing startups, venture pitching and IPR

Course Outcomes:

1. Understand the entrepreneurship and the entrepreneurial process and its significance in economic development.
2. Assess the problem from an industry perspective and generate solutions using the design thinking principles.
3. Assess market competition, estimate market size, and develop a prototype.
4. Analyze Business and financial planning models and Go-to-Market strategies.
5. Able to build a start-up, register IP and identify funding opportunities.

Unit I: Fundamentals of Innovation and Entrepreneurship

Innovation: Introduction, need for innovation, Features, Types of innovations, innovations in manufacturing and service sectors, fostering a culture of innovation, planning for innovation. Entrepreneurship: Introduction, types of entrepreneurship attributes, mindset of entrepreneurial and intrapreneurial leadership, Role of entrepreneurs in economic development. Woman Entrepreneurship, Importance of on-campus startups. Understanding to build entrepreneurial mindset, attributes and networks individuals while on campus.
Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity.

Unit II: Problem and Customer Identification

Identification of gap, problem, analyzing the problem from a industry perspective, real-world problems, market and customer segmentation, validation of customer problem fit, Iterating problem-customer fit, Competition and Industry trends mapping and assessing initial opportunity, Porter's Five Force Model.
Idea generation, Ideation techniques: Brainstorming, Brain writing, Round robin, and SCAMPER, Design thinking principles, Mapping of solution to problem.
Core Teaching Tool: Several types of activities including: Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

Unit III: Opportunity assessment and Prototype development

Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Assessing scope and potential scale for the opportunity.
Understanding prototyping and Minimum Viable Product (MVP). Developing a prototype: Testing, and validation.
Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

Unit IV: Business & Financial Models

Introduction to Business Model and types, Lean Canvas Approach: 9-block lean canvas model, building lean canvas for your startup. Business planning: components of Business plan- Sales plan, People plan and financial plan, Financial Planning: Types of costs, preparing

a financial plan for profitability using a financial template, understanding the basics of Unit economics, Economies of Scale and analyzing financial performance. Go-To-Market (GTM) approach – Selecting the Right Channel, creating digital presence, and building customer acquisition strategy. Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.
Unit V: Startups and IPR
Startup requirements, building founding team members and mentors, pitch preparation, start-up registration process, funding opportunities and schemes, institutional support to entrepreneurs, startup lifecycle, documentation, legal aspects in startup, venture pitching readiness, National Innovation Startup Policy (NISP) and its features. Patents, Designs, Patentability, Procedure for grants of patents. Indian Scenario of Patenting, International Scenario: International cooperation on Intellectual Property. Patent Rights: Scope of Patent Rights. Copyright, trademark, and GI. Licensing and transfer of technology. Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.
Suggested Readings:
1.John R Bessant, Joe Tidd, Innovation and Entrepreneurship, 4E, Wiley, Latest Edition.
2.Ajay Batra, The Stratup Launch Book- A Practical Guide for Launching Customer Centric Ventures, Wiley, 2020. (For Core Teaching Tool).
3.Entrepreneurship Development and Small Business Enterprises, Poornima M Charantimath, 3E, Pearson, 2018.
4.D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.
5.Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.
6.NISP -Brochure inside pages - startup_policy_2019.pdf

ELECTRICAL MACHINES - I LAB

II B. Tech I Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE15	ESC	0	0	2	1	40	60	100

Prerequisites: Electrical machines - I

Course Objectives:

1. To uncover the students to the operation of DC Generators.
2. To know the operation of various types of DC Motors.
3. To examine the performance of Single and Three Phase Transformers.

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

1. Start and control the Different DC Machines.
2. Assess the performance of different machines using different testing methods
3. Evaluate the performance of different Transformers using different testing methods

LIST OF EXPERIMENTS

The following experiments are required to be conducted compulsory experiments:

1.Magnetization characteristics of DC shunt generator (Determination of critical field resistance and critical speed)

2.Load test on DC shunt generator (Determination of characteristics)

3.Load test on DC series generator (Determination of characteristics)

4.Hopkinson's test on DC shunt machines (Predetermination of efficiency)

5.Swinburne's test (Predetermination of efficiency)

6.Brake test on DC compound motor (Determination of performance curves)

7.OC and SC Test on Single Phase Transformer

8.Brake Test on DC shunt motor (Determination of performance curves)

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

1.Load Test on DC compound generator (Determination of characteristics).

2.Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer

3.Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)

4.Speed control of DC shunt motor

5.Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star)

6.Modeling of DC Machine using simulation tools.

7.Equivalent circuit of Transformer using simulation tools.

TEXT BOOKS:

1.P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

2.I.J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCE BOOKS:

1.Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.

2.M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

3.A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.

4.A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

ELECTRICAL MACHINES - I LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To uncover the students to the operation of DC Generators	3	3	3	2	-	2	1	-	2	-	1	1
To know the operation of various types of DC Motors.	3	3	3	2	-	2	1	-	2	-	1	1
To examine the performance of Single and Three Phase Transformers	3	3	3	2	-	2	1	-	2	-	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Start and control the Different DC Machines	3	3	3	2	-	2	1	-	2	-	1	1
Assess the performance of different machines using different testing methods	3	3	3	2	-	2	1	-	2	-	1	1
Evaluate the performance of different Transformers using different testing methods	3	3	3	2	-	2	1	-	2	-	1	1

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LAB

II B. Tech I Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE16	ESC	0	0	2	1	40	60	100

Prerequisites: Electrical Circuits –I & II

Course Objectives:

1. To calibrate Watt, Energy and PF Meter and determination of three phase active & reactive powers.
2. To determine unknown inductance, resistance, capacitance by performing experiments on DC Bridges & AC Bridges.
3. To determine the ratio and phase angle errors of Instrument transformers.

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

1. Choose and test any measuring instruments.
2. Find the accuracy of any instrument by performing experiments.
3. Calculate the various parameters using different types of measuring instruments.

LIST OF EXPERIMENTS

The following experiments are required to be conducted as compulsory experiments:

1. Calibration and testing of single-phase energy Meter.
2. Calibration of dynamometer power factor meter.
3. Crompton DC Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric testing of oil using HT Testing Kit.
6. Schering Bridge & Anderson Bridge.
7. Measurement of 3 - Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

1. Calibration LPF wattmeter – by Phantom testing.
2. Measurement of 3-phase power with single watt meter and two CTs.
3. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given CT by Null method.
4. PT testing by comparison – V. G. as Null detector – Measurement of % ratio error and phase angle of the given PT
5. Resistance strain gauge – strain measurements and Calibration.
6. Transformer turns ratio measurement using AC bridges.
7. Measurement of % ratio error and phase angle of given CT by comparison.

TEXT BOOKS:

1. A. K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications,2005.
2. Dr. Rajendra Prasad, "Electrical Measurements & Measuring Instruments", Khanna Publishers 1989.

REFERENCE BOOKS:

1. G. K. Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016.
2. R. K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd.,2007.
3. S. C. Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2012.
4. Buckingham and Price, "Electrical Measurements", Prentice – Hall, 1988.
5. Reissland, M. U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.

6.E.W. Golding and F. C. Widdis, "Electrical Measurements and measuring Instruments", fifth Edition,Wheeler Publishing, 2011.

ELECTRICAL MEASUREMENTS AND SENSORS LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To calibrate Watt, Energy and PF Meter and determination of three phase active & reactive powers.	3	3	2	2	2	-	-	-	1	-	-	1
To determine unknown inductance, resistance, capacitance by performing experiments on DC Bridges & AC Bridges.	3	3	2	2	2	-	-	-	1	-	-	1
To determine the ratio and phase angle errors of Instrument transformers	3	3	2	2	2	-	-	-	1	-	-	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Choose and test any measuring instruments	3	3	2	2	2	-	-	-	1	-	-	1
Find the accuracy of any instrument by performing experiments	3	3	2	2	2	-	-	-	1	-	-	1
Calculate the various parameters usingdifferent types of measuring instruments	3	3	2	2	2	-	-	-	1	-	-	1

types of measuring instruments												

ELECTRONIC DEVICES AND CIRCUITS LAB

II B. Tech I Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EC11	ESC	0	0	2	1	40	60	100

Course Overview:

This laboratory course aims to provide hands-on experience and simulation-based learning of semiconductor devices and basic electronic circuits. Students will analyze the characteristics and applications of diodes, BJTs, and FETs, design rectifiers and amplifiers, and simulate modern electronic circuits using software tools. The course bridges theoretical concepts with practical implementation, developing foundational skills essential for analog electronics and circuit analysis.

Course Outcomes (COs): By the end of this course, students will be able to:

CO1: Analyze the I-V characteristics of semiconductor devices such as diodes, BJTs, and FETs.
CO2: Design and evaluate basic rectifier, clipper, clamper, and voltage regulation circuits.
CO3: Demonstrate biasing techniques for BJTs and determine their operating point using DC load line analysis.
CO4: Design and analyze transistor amplifier circuits in various configurations using h-parameter models.
CO5: Simulate and interpret electronic circuits using appropriate simulation tools.

LIST OF EXPERIMENTS

A. Hardware-Based Experiments (7):

1.Study the I-V characteristics of a PN junction diode in forward and reverse bias to determine cut-in voltage and dynamic resistance.

2.Examine the reverse bias characteristics of a Zener diode and demonstrate its application as a voltage regulator under varying conditions.

3.Design and analyze half-wave and full-wave rectifiers (center-tap and bridge) with and without capacitor filters to evaluate ripple factor and output voltage.

4.Implement clipper and clamper circuits to observe waveform shaping through positive, negative, and biased configurations.

5.Plot the input and output characteristics of a BJT in common emitter configuration to determine input/output resistance and current gain.

6.Design and test fixed bias and voltage divider bias circuits to establish a stable operating point for a BJT amplifier and study DC load line behavior.

7.Construct and analyze a Common Base (CB) configuration of a BJT to study input-output characteristics and determine current gain (α) and input/output resistance.

B. Software-Based Simulation Experiments (7):

1.Simulate a full-wave bridge rectifier with capacitor filter to analyze waveform smoothing and ripple reduction in DC power supply design.

2.Simulate a Zener diode-based voltage regulator to study voltage stabilization against varying supply voltages and load resistances.

3.Simulate a common emitter amplifier with and without emitter bypass capacitor to analyze the effect on voltage gain and signal amplification.

4.Simulate BJT operation as a switch and small-signal amplifier to understand its dual functionality in digital and analog applications.

5.Simulate the output and transfer characteristics of a JFET to determine parameters such as pinch-off voltage, drain resistance, and transconductance.
6.Simulate the characteristics of a MOSFET and design a CMOS inverter to study digital switching behavior and low-power logic design.
7.Simulate the transfer and output characteristics of an enhancement-mode NMOS transistor to analyze threshold voltage, drain current, and switching behavior.

Hardware Requirements:

1. Regulated DC Power Supply (0–30V)
2. Function Generator
3. Digital Multimeter
4. Cathode Ray Oscilloscope (CRO) or DSO
5. Breadboards and Connecting Wires
6. Resistors, Capacitors, Diodes (1N4007, Zener Diodes)
7. BJTs (e.g., BC107, 2N2222), JFETs (e.g., J201), MOSFETs (e.g., IRF540N)
8. Trainer Kits (optional but preferred for ease)

Software Requirements (Any one of the listed tools or equivalent):

1. LTSpice (Free from Analog Devices)
2. NI Multisim (Academic License or Student Version)
3. Proteus Design Suite (Simulation and PCB Design)
4. TINA-TI (Free from Texas Instruments)
5. PSPICE for TI or OrCAD Lite
6. Windows PC or Laptop with minimum 4GB RAM and i3 processor or better

Course Articulation Matrix

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

DESIGN OF ELECTRICAL SYSTEMS USING AUTOCAD

II B. Tech I Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE17	ESC	0	0	2	1	40	60	100

Prerequisites: Basic Electrical and Electronics Engineering

Prerequisite:

Course Objectives:

1. To introduce the concepts of electrical circuits and its components.
2. To understand magnetic circuits, DC circuits and AC single phase and three phase circuits.
3. To study and understand the different types of DC, AC machines and Transformers.
4. To import the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.
6. To introduce the concepts of diodes and transistors.
7. To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

1. To analyze and solve electrical circuits using network laws and theorems.
2. To understand and analyze basic Electric and Magnetic circuits.
3. To study the working principles of Electrical Machines.
4. To introduce components of Low Voltage Electrical Installations.

1. To identify and characterize diodes and various types of transistors.

2. To provide hands-on training in using AutoCAD for electrical design and drafting.
3. To understand the principles of preparing electrical wiring diagrams and panel layouts.
4. To enable students to design residential, commercial, and industrial electrical systems.
5. To introduce students to symbols, standards, and practices in electrical CAD.

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

1. Apply AutoCAD tools to create electrical schematics and layouts.
2. Design residential and commercial wiring systems as per standards.
3. Develop and document substation and panel wiring drawings.
4. Interpret electrical diagrams and create professional CAD documentation.
5. Work on real-time electrical design problems using CAD tools.

LIST OF EXPERIMENTS

Module I: Introduction to AutoCAD for Electrical Design Overview of AutoCAD interface and tools

- Layers, blocks, and annotation in AutoCAD
- Electrical symbols: IEC/ANSI/IS standards
- Drawing and modifying basic electrical elements

Lab Experiments:

- Creating simple electrical circuit diagrams using AutoCAD
- PART-A: ELECTRICAL
- Use of layers and blocks for electrical layouts

Module II: House Wiring and Lighting System Design

- Design of single-line diagrams (SLDs)
- Layout of internal wiring for residential buildings
- Load calculation and cable selection
- Earthing and protection system basics

Lab Experiments:

- Preparation of residential wiring layout
- 1.Verification of KVL and KCL

- Switchboard and lighting plan for 1BHK/2BHK house

Module III: Commercial and Industrial Electrical Layouts

- Design of power circuits and lighting for commercial buildings
- Distribution board design and component placement
- Panel board and busbar layout

Lab Experiments:

- Design and drafting of distribution system for a small commercial building
- 2.Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-phase Transformer
- Electrical room layout with control panels

Module IV: Substation and Control Circuit Design

- Single-line diagram of substations
- Control circuit schematics
- Relay control and contactor wiring diagrams
- Cable routing and tray layout

Lab Experiments:

- Drawing of 11kV/440V substation SLD
- Panel wiring diagram for DOL/Star-Delta motor starter

Module V: Mini Project and Professional Practice

- Project planning, drawing standards, title block, and BOM
- Design and documentation of a small-scale electrical system
- Printing, plotting, and exporting drawings

Lab Activity:

- Mini-project: Design and documentation of electrical system for a small apartment, lab, or factory setup

3.Series and parallel resonance of RLC Circuits.

Software Requirements:

- AutoCAD Electrical (Student or Institutional License)
- Optional: E-Plan, DraftSight, or similar tools for advanced users

4.Magnetization characteristics of DC Shunt Generator

5.Performance Characteristics of a Self-excited DC Shunt Motor

6.Performance Characteristics of a Three phase Induction Motor

PART-B: ELECTRONICS

1.Study and operation of (i) Multimeters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.

2.P-N Junction diode characteristics

3.Zener diode characteristics

4.Input and Output characteristics of Transistor in CB configuration

5.Input and Output characteristics of Transistor in CE configuration

6.Full Wave Rectifier with and without filters

TEXT BOOKS:

1.Basic Electrical and electronics Engineering, M.S. Sukija and T.K. Nagasarkar, Oxford University press, 1stEdition, 2012.

1.K.B. Raina and S.K. Bhattacharya "Electrical Design Estimating and Costing" New Age International.

2.Prof. Sham Tickoo "AutoCAD Electrical 2023 for Electrical Control Designers" CADCIM Technologies.

2.Basic Electrical and electronics Engineering, D.P. Kothari and I.J. Nagarath, McGraw Hill Education, 2nd Edition,2020.

3.Surjit Singh "Basic Electrical Engineering Drawing" Dhanpat Rai & Co.

REFERENCE BOOKS:

1.Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, PEI and PHI, 9th Edition, 2006.

1.Frederic P. Hartwell and Herbert P. Richter “Practical Electrical Wiring” Park Publishing.

2.James A. Leach and Shawna Lockhart “AutoCAD 2023 Instructor” SDC Publications.

3.Ray C. Mullin and Phil Simmons “Electrical Wiring Residential” Cengage Learning.

4.IS 732: Code of Practice for Electrical Wiring Installations.

2.Millman’s Electronic Devices and Circuits, J. Millman,C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.

5.National Electrical Code (NEC) – India.

Online Resources:

1. **Autodesk Knowledge Network**: https://knowledge.autodesk.com.
2. **NPTEL**: Basic Electrical Drawing and CAD-related modules (search under "Electrical Engineering").

ENVIRONMENTAL SCIENCE

II B. Tech I Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7BS12	ESC	1	0	0	1	40	60	100

Course Objectives:

1. Understand the components, structure, and functions of ecosystems and their relevance to human society.
2. Comprehend classification, sustainable management, and challenges of natural resources including water, minerals, land, forests, and energy.
3. Grasp the significance, value, and conservation approaches for biodiversity, including threats and legislative frameworks.
4. Analyze types, sources, and impacts of environmental pollution, and learn technological and policy measures for pollution prevention and control.
5. Develop awareness about global environmental challenges, international agreements, and the role of policy, law, and Environmental Impact Assessment (EIA) in sustainable development.

Course Outcomes:

1. Understand the structure, function, and significance of ecosystems, including energy flow, biogeochemical cycles, and biodiversity conservation through field experiences.
2. Analyze the classification, utilization, and sustainable management of natural resources, along with alternative energy options.
3. Evaluate biodiversity at genetic, species, and ecosystem levels, its values, threats, and conservation methods under national and international frameworks.
4. Identify types, sources, and impacts of environmental pollution, and apply suitable control technologies while assessing global environmental challenges and protocols.
5. Interpret environmental policies, legislation, and the EIA process to propose management plans addressing contemporary environmental and sustainability issues.

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, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, services and carrying capacity, Field visits.

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. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

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. India as a mega diversity nation, Hot spots of biodiversity. Field visit. 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: Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. Global Environmental Issues and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. 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, biomedical 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- economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan(EMP). Contemporary Environmental Issues Climate change; Sustainable development goals (SDGs); Global environmental challenges; Environmental policies and international agreements.
TEXT BOOKS:
1.Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.
2.Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
3.Environmental Studies by R. Rajagopalan, Oxford University Press.
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 Anubha Kaushik, 4th Edition, New age international publishers.
5.Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

II B. TECH II SEMESTER

NUMERICAL METHODS AND COMPLEX VARIABLES

II B. Tech II Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7BS06	ESC	3	0	0	2	40	60	100

Pre-requisites: Mathematics courses of first year of study.

Course Objectives: To learn

1. Expressing periodic function by Fourier series and a non-periodic function by Fourier transforms
2. Various numerical methods to find roots of polynomial and transcendental equations.
3. Concept of finite differences and to estimate the value for the given data using interpolation.
4. Evaluation of integrals using numerical techniques
5. Solving ordinary differential equations of first order using numerical techniques.
6. Differentiation and integration of complex valued functions.
7. Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
8. Expansion of complex functions using Taylor's and Laurent's series.

Course outcomes: After learning the contents of this paper, the student must be able to

1. Express any periodic function in terms of sine and cosine.
2. Find the root of a given polynomial and transcendental equations.
3. Estimate the value for the given data using interpolation
4. Find the numerical solutions for a given first order ODE's
5. Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.
6. Taylor's and Laurent's series expansions in complex function.

UNIT-I: Fourier Series & Fourier Transforms

Fourier series – Dirichlet's Conditions – Half-range Fourier series – Fourier Transforms: Fourier Integral Theorem (Only statements), Fourier Sine and Cosine transforms (Elementary illustrations)

UNIT-II: Numerical Methods-I

Solution of polynomial and transcendental equations: Bisection method – Iteration Method – Newton-Raphson method and Regula-Falsi method. Finite differences: forward differences – backward differences – central differences – symbolic relations – Interpolation using Newton's forward and backward difference formulae – Lagrange's method of interpolation.

UNIT-III: Numerical Methods-II

Numerical integration: Trapezoidal rule - Simpson's 1/3rd and 3/8th rules.
Ordinary differential equations: Taylor's series – Euler's method – Runge-Kutta method of fourth order for first order ODE.

UNIT-IV: Complex Differentiation

Differentiation of Complex functions – Analyticity – Cauchy-Riemann equations (without proof) – Harmonic Functions – Finding harmonic conjugate – Milne-Thomson method – Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

UNIT-V: Complex Integration

Line integral – Cauchy's theorem – Cauchy's Integral formula – Zeros of analytic functions – Singularities – Taylor's series – Laurent's series. Residues – Cauchy Residue theorem (All theorems without Proof).

TEXT BOOKS:

1.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2.S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

REFERENCE BOOKS:

1.Murray R. Spiegel, Ph.D., Seymour Lipschutz, Ph.D., John J. Schiller, Ph.D., Dennis Spellman, Ph.D., Complex Variables (Schaum's outline).
2.M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers.
3.Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley &Sons, 2006.
4.J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, Mc-Graw Hill, 2004.

ELECTRICAL MACHINES - II

II B. Tech II Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE18	ESC	3	0	0	3	40	60	100

Prerequisites: Electrical Circuits-I &II and Electrical Machines -I

Course Objectives:

1. To deal with the detailed analysis of three phase induction motors & Alternators.
2. To understand operation, construction and types of single-phase motors and their applications.
3. To introduce the concept of parallel operation of alternators.

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

1. Understand the concepts of rotating magnetic fields.
2. Examine the operation of AC machines.
3. Analyze performance characteristics of AC machines.

UNIT - I: Three Phase Induction Machines:

Constructional details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation. Torque equation-expressions for maximum torque and starting torque – torque-slip characteristics.

UNIT - II: Characteristics of Induction Machines:

Equivalent circuit - phasor diagram - crawling and cogging, No-load Test and Blocked rotor test – Predetermination of performance-Methods of starting and starting current and Torque calculations, Applications. Speed Control Methods: Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator-principle of operation.

UNIT - III: Synchronous Generator (Alternator):

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – EMF Equation. Harmonics in generated EMF – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – phasor diagram – load characteristics.

UNIT - IV: Regulation of Synchronous Generator:

Synchronous impedance method, MMF method, ZPF method and ASA methods – two reaction theory-Determination of Xd and Xq (Slip test) Phasor diagrams – Regulation of salient pole alternators. Parallel Operation of Synchronous Generator: Synchronizing Alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input.

UNIT - V: Synchronous Motors:

Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed. Hunting and its suppression – Methods of starting. Single Phase Machines: Single phase induction motor – Constructional Features-Double revolving field theory –split-phase motors – AC series motor- Universal Motor- Shaded pole motor and Applications.

TEXT BOOKS:

1.P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.

2.I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

REFERENCE BOOKS:

1.Prithwiraj Purkait, Indrayudh Bandyopadhyay, “Electrical Machines”, Oxford, 2017.

2.M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.

3.A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

4.A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.

Online Recourses:

1. https://nptel.ac.in/courses/108/105/108105131/
2. https://nptel.ac.in/courses/108/106/108106072/

ELECTRICAL MACHINES-II

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To deal with the detailed analysis of three phase induction motors & Alternators	3	3	3	2	-	2	1	-	2	-	1	1
To understand operation, construction and types of single-phase motors and their applications.	3	3	3	2	-	2	1	-	2	-	1	1
To introduce the concept of parallel operation of alternators	3	3	3	2	-	2	1	-	2	-	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand the concepts of rotating magnetic fields	3	3	3	2	-	2	1	-	2	-	1	1
Examine the operation of AC machines	3	3	3	2	-	2	1	-	2	-	1	1
Analyse performance characteristics of AC machines	3	3	3	2	-	2	1	-	2	-	1	1

POWER SYSTEM - II

II B. Tech II Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE19	ESC	3	0	0	3	40	60	100

Prerequisite: Electrical Circuits - I & II and Power Systems – I

Course Objectives:

1. To study the performance of transmission lines and travelling waves.
2. To understand the concept of voltage control, compensation methods and per unit representation of power systems.
3. To know the, Symmetrical components and fault calculation analysis

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

1. Analyze transmission line performance and apply load compensation techniques to control reactive power.
2. Understand the application of per unit quantities in power systems.
3. Determine the fault currents for symmetrical and unbalanced faults.

UNIT-I UNDERGROUND CABLES:

Construction, types of cables, insulation in cables, calculation of insulation resistance and stress in insulation. Capacitance of single and 3 core belted cables. Grading of cables, capacitance grading, and description of inters heath grading, numeric problems.

UNIT - II: AC Distribution:

Introduction, AC distribution, Single phase, 3-phase 3 wire, 3-phase 4 wire system, bus bar arrangement, Selection of site for substation. Voltage Drop Calculations (Numerical Problems) in AC Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

UNIT - III: Voltage Control & Power Factor Improvement:

Introduction – methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers, power factor improvement methods.
Compensation in Power Systems: Introduction - Concepts of Load compensation – Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line.

UNIT - IV Per Unit Representation of Power Systems:

The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system.
Symmetrical components: Positive, Negative and Zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and network equations

UNIT - V: Fault calculations:

single line to ground (LG), line to line (LL), double line to ground (LLG) faults with and without fault impedance. Numerical Problems.

TEXT BOOKS:

1.C. L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", 3rd Edition, New Age International, 2009.

2.D.P. Kothari and I.J. Nagrath, "Modern Power System Analysis", Tata Mc Graw Hill Pub. Co., New Delhi, Fourth edition, 2011.

REFERENCE BOOKS:

1.A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, "A Text book on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.

2.W. D. Stevenson, "Elements of Power System Analysis", 4th Edition, McGraw Hill, 1984.

3.John J. Grainger & W.D. Stevenson, "Power System Analysis", Mc Graw Hill International,1994.

4.Hadi Sadat, "Power System Analysis", Tata Mc Graw Hill Pub. Co. 2002.

Online Recourses:

1. https://nptel.ac.in/courses/108/102/108102047/
2. https://nptel.ac.in/courses/108/107/108107112/

POWER SYSTEM - II

B.Tech. II Year II Sem.

L T P C
3 0 0 3

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To study the performance of transmission lines and travelling waves.	3	3	3	2	-	2	1	-	2	-	1	1
To understand the concept of voltage control, compensation methods and per unit representation of power systems.	3	3	3	2	-	2	1	-	2	-	1	1
To know the, Symmetrical components and fault calculation analysis	3	3	3	2	-	2	1	-	2	-	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Analyze transmission line performance and apply load compensation techniques to control reactive power.	3	3	3	2	-	2	1	-	2	-	1	1
Understand the application of per unit quantities in power systems.	3	3	3	2	-	2	1	-	2	-	1	1
Determine the fault currents for symmetrical and unbalanced faults.	3	3	3	2	-	2	1	-	2	-	1	1

DIGITAL ELECTRONICS

II B. Tech II Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EC22	ESC	3	0	0	3	40	60	100

Prerequisites: Electronic Devices and Circuits

Course Objectives:

1. To learn fundamental concepts of digital system design and common forms of number representations and their conversions.
2. To implement and design logical operations using combinational logic circuits and sequential logic circuits.
3. To understand the semiconductor memories and programmable logic devices.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Understand the working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Implement the given logical problems using programmable logic devices.

UNIT - I: Fundamentals of Digital Systems and Logic Families:

Digital signals, Digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, Examples of IC gates, Number systems-binary, Signed binary, Octal hexadecimal number, Binary arithmetic, One'sand Two's complements arithmetic.

UNIT - II: Combinational Circuits-I:

Standard representation for logic functions, K-map representation and simplification of logic functions using K- map, Minimization of logical functions, Don't care conditions, Multiplexer, De-Multiplexer

UNIT - III: Combinational Circuits-II:

Adders, Subtractors, Carry look ahead adder, Digital comparator, Parity checker/generator, Code converters, Priority encoders, Decoders/Drivers for display devices, Q-M method of function realization.

UNIT - IV: Sequential Circuits:

Introduction to flip-flops, SR, JK, T and D type's flip-flops, Shift registers, Conversion of flip-flops, Ring counter, Ripple (Asynchronous) counters, Synchronous counters.

UNIT - V: Semiconductor Memories and Programmable Logic Devices:

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read-only memory (ROM), ROM types, Read and write memory (RAM) types, Programmable logic array, Programmable array logic, Field Programmable Gate Array (FPGA).

TEXT BOOKS:

1.A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

2.M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCE BOOKS:

1.R.S. Sedha, "A Textbook of Digital Electronics", S. Chand, 2005

2.R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

DIGITAL ELECTRONICS

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To learn fundamental concepts of digital system design and common forms of number representations and their conversions	2	1	3	2	1	1	1	1	3	2	1	3
To implement and design logical operations using combinational logic circuits and sequential logic circuits	2	1	3	2	1	1	1	1	3	2	1	3
To understand the semiconductor memories and programmable logic devices	2	2	3	3	2	2	2	1	1	1	3	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand the working of logic families and logic gates	2	2	3	3	1	2	3	3	1	1	1	1
Design and implement Combinational and Sequential logic circuits	2	2	1	2	3	1	2	2	2	1	1	1
Implement the given logical problems using programmable logic devices	3	2	2	2	2	2	2	1	1	1	1	1

CONTROL SYSTEMS

II B. Tech II Sem (R25)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE20	ESC	3	0	0	3	40	60	100

Prerequisite: Electrical Circuits-I & II and Electrical Machines-I

Course objectives:

1. Understand the mathematical modelling of physical systems.
2. Comprehend the representation of dynamical systems through input-output models, including transfer functions and state-space models.
3. Understand the design of controllers and compensators to enhance the performance and stability of dynamical systems

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

1. Find the transfer function and state-space representation of linear time-invariant dynamical systems.
2. Analyze the performance and stability of linear time-invariant systems in both time and frequency domains.
3. Study classical controllers/compensators to improve the performance and stability of linear time- invariant systems.

UNIT - I: Mathematical modelling of physical systems:

Open - loop and Closed loop Systems, Concept of Feedback Control, Benefits of Feedback and Effects of feedback, Linear, Non-Linear, Time Variant and Time Invariant systems, Mechanical and Electrical Systems. Transfer function, Block-Diagram Techniques, Signal flow graph, Controller Components: DC Servo motors, AC Servomotors, Synchro's.

UNIT - II: Time-Domain Analysis with Input-Output Models:

Time response of first and second order systems for standard test inputs. Analysis of standard Second order systems with step input, Types of System, Error Analysis for Linear time Invariant Systems, Design specifications for second-order systems based on the time- response. Concept of Stability: Routh-Hurwitz Criteria. Relative Stability analysis, Root-Locus technique: Construction of Root-loci.

UNIT - III: Frequency Domain Analysis:

Introduction to frequency response, Relationship between time and frequency response, Concept of Bode plots and construction. Polar plots, Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin

UNT - IV: Classical Controllers and Compensators:

Proportional, Integral and Derivative Controllers- PI, PD and PID controllers, Lead, Lag and Lead-Lag compensators (elementary treatment only).

UNT - V: State Variable Analysis:

Concept of State, State variables and State model. State Representation, Transformation of State variables, Solution of state equations and Complete response of the Systems. Concept of controllability and observability.

TEXT BOOKS:

1.I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

2.B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

3.Norman S Nise, "Control Systems Engineering", Wiley, 2019 8th Edition.

REFERENCE BOOKS:

1.K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.

2.K. R. Varmah, "Control Systems", McGraw Hill Education, 2010.

Online Recourses:

1. https://www.controleng.com
2. https://www.mathworks.com
3. https://nptel.ac.in/courses/108/102/108102043

CONTROL SYSTEMS

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand the mathematical modelling of physical systems.	3	3	3	3	3	-	-	1	-	-	2	2
Comprehend the representation of dynamical systems through input-output models, including transfer functions and state-space models.	3	3	3	3	3	-	-	1	-	-	2	2
Understand the design of controllers and compensators to enhance the performance and stability of dynamical systems	3	3	3	3	3	-	-	1	-	-	2	2

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Find the transfer function and state-space representation of linear time-invariant dynamical systems	3	3	3	3	3	-	-	1	-	-	2	2
Analyze the performance and stability of linear time-invariant systems in	3	3	3	3	3	-	-	1	-	-	2	2
both time and frequency domains												
Study the classical controllers/compensators to improve the performance and stability of linear time-invariant systems.	3	3	3	3	3	-	-	1	-	-	2	2

Computational Mathematics Lab

II Year II Semester:

Course Code:	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A7BS07	BSC	0	0	2	1	40	60	100
Contact Classes: 0	Tutorial Classes: 0	Practical Classes: 32				Total Classes: 32		

Course Objectives : To learn

1. Solve problems of Eigen values and Eigen Vectors
2. Solution of Algebraic and Transcendental Equations.
3. Solve problems of Linear system of equations
4. Solve problems of **First-Order ODEs Higher order linear differential equations with** constant coefficients

Visualize all solutions Graphically through programmes.

Course Outcomes : After learning the contents of this paper, the student must be able to

1. Develop the code to find the Eigen values and Eigen Vectors using Python.
2. Develop the code find solution of Algebraic and Transcendental Equations and Linear system of equations using Python.
3. Write the code to solve problems of **First-Order ODEs Higher order linear differential equations with** constant coefficients

UNIT-I	EIGEN VALUES AND EIGENVECTORS	Programs: 6

Programs:

- Finding real and complex Eigen values.
- Finding Eigen vectors.

UNIT-II	SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS	Programs: 6

Bisection method and Newton Raphson Method

Programs:

- Root of a given equation using Bisection method.
- Root of a given equation Newton Raphson Method.

UNIT-III	LINEAR SYSTEM OF EQUATIONS	Programs: 6

Jacobi's iteration method and Gauss-Seidal iteration method

Programs:

- Solution of given system of linear equations using Jacobi's method.
- Solution of given system of linear equations using Gauss-Seidal method.

UNIT-IV	FIRST-ORDER ODEs	Programs: 8

Exact and non-exact equations, Applications: exponential growth/decay, Newton's law of cooling.

Programs:

- Solving exact and non-exact equations.
- Solving exponential growth/decay and Newton's law of cooling problems.

UNIT-V	HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS	Programs: 6

Programs:

- Solving homogeneous ODEs.
- Solving non homogeneous ODEs.

Text Books:

1. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
2. Think Python First Edition, by Allen B. Downey, Orielly publishing.
3. Introduction to Python Programming, William Mitchell, PovelSolin, Martin Novak etal.,NCLab Public Computing, 2012.
4. Introduction to Python Programming, ©Jacob Fredslund, 2007.

Reference Books:

References

1. An Introduction to Python, John C. Lusth, The University of Alabama, 2011.
2. Introduction to Python, ©Dave Kuhlman, 2008.

Web references:

1. https://www.efunda.com/math/math_home/math.cfm
2. https://www.sosmath.com/
3. https://www.wolframalpha.com/

E -Text Books:

1. https://www.e-booksdirectory.com/details.php?ebook=10166
2. An Introduction to Python by Guido van Rossum - Download link (e-booksdirectory.com)
3. Introduction to Numerical; Methods - Download link (e-booksdirectory.com)
4. Ordinary Differential Equations (ODE) - Download link (e-booksdirectory.com)

MOOCS Course:

1. https://swayam.gov.in/
2. https://onlinecourses.nptel.ac.in/

ELECTRICAL MACHINES - II LAB

II B. Tech II Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE21	ESC	0	0	2	1	40	60	100

Prerequisites: Electrical Machines – I

Course Objectives:

1. To understand the operation of Induction, Synchronous Machines and Transformers.
2. To study the performance analysis of Induction and Synchronous Machines through various Testing methods.
3. To analyze the performance of single and three-phase transformers.

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

1. Assess the performance of different types of AC machines using different testing methods.
2. Analyze the suitability of AC machines and Transformers for real word applications
3. Determine the performance of single and three-phase transformers.

LIST OF EXPERIMENTS

The following experiments are required to be conducted as compulsory experiments:

1.Sumpner's test on a pair of single-phase transformers

2.No-load & Blocked rotor tests on three phase Induction motor

3.Regulation of a three -phase alternator by synchronous impedance & MMF methods

4.'V' and 'Inverted V' curves of a three–phase synchronous motor.

5.Equivalent Circuit of a single-phase induction motor

6.Determination of Xd and Xq of a salient pole synchronous machine

7.Brake Test on three phase Induction Motor

8.Regulation of three-phase alternator by ZPF and ASA methods

In addition to the above experiments, at least any two of the following experiments are required to be conducted from the following list:

1.Separation of core losses of a single-phase transformer

2.Efficiency of a three-phase alternator

3.Parallel operation of Single-phase Transformers

4.Measurement of sequence impedance of a three-phase alternator.

5.Scott Connection of transformer

TEXT BOOKS:

1.P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

2.I.J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCE BOOKS:

1.Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.

2.M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

3.A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.

4.A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

ELECTRICAL MACHINES - II LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To understand the operation of Induction, Synchronous machines and Transformers	3	3	3	3	3	-	-	1	-	-	2	2
To study the performance analysis of Induction and Synchronous Machines through various testing methods	3	3	3	3	3	-	-	1	-	-	2	2
To analyse the performance of single and three-phase phase transformer	3	3	3	3	3	-	-	1	-	-	2	2

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Assess the performance of different types of AC machines using different testing methods	3	3	3	3	3	-	-	1	-	-	2	2
Analyse the suitability of AC machines and Transformers for real word applications	3	3	3	3	3	-	-	1	-	-	2	2
Determine the performance of single and three-phase transformers	3	3	3	3	3	-	-	1	-	-	2	2

CONTROL SYSTEMS LAB

II B. Tech II Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE22	ESC	0	0	2	1	40	60	100

Course Objectives:

1. Understand system representations like transfer function and state space, and assess system dynamic response.
2. Evaluate system performance using both time and frequency domain analyses, identifying methods to enhance performance.
3. Study controllers and compensators to improve system performance based on the assessments from time and frequency domain analyses.

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

1. Improve system performance by skilfully selecting appropriate controllers and compensators tailored to specific applications.
2. Apply diverse time domain and frequency domain techniques to effectively assess and enhance system performance.
3. Demonstrate the application of various control strategies to different systems such as power systems and electrical drives, showcasing adaptability and versatility in control applications.

LIST OF EXPERIMENTS

The following experiments are required to be conducted compulsory experiments:

1.Time response of Second order system

2.Characteristics of Synchro's

3.Effect of feedback on DC servo motor

4.Transfer function of DC motor

5.Transfer function of DC generator

6.Lag and lead compensation – Magnitude and phase plot

7.Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using simulation tools.

8.State space model for classical transfer function using simulation tools.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

1.Characteristics of AC servo motor

2.Temperature controller using PID

3.Effect of P, PD, PI, PID Controller on a second order systems

4(a) Simulation of P, PI, PID Controller.
(b) Linear system analysis (Time domain analysis, Error analysis) using suitable software

5.Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions, and application of speed control of motor.

6.Design of Lead-Lag compensator for the given system and with specification using suitable software

TEXT BOOKS:

1.M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.

2.B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

REFERENCE BOOKS:

1.K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.

2.I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

CONTROL SYSTEMS LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand system representations like transfer function and state space, and assess system dynamic response.	3	3	3	3	3	-	-	1	-	-	2	2
Evaluate system performance using both time and frequency domain analyses, identifying methods to enhance performance.	3	3	3	3	3	-	-	1	-	-	2	2
Study controllers and compensators to improve system performance based on the assessments from time and frequency domain analyses	3	3	3	3	3	-	-	1	-	-	2	2

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Improve system performance by skillfully selecting appropriate controllers and compensators tailored to specific applications.	3	3	3	3	3	-	-	1	-	-	2	2
Apply diverse time domain and frequency domain techniques to effectively assess and enhance system performance.	3	3	3	3	3	-	-	1	-	-	2	2

Demonstrate the application of various control strategies to different systems such as power systems and electrical drives, showcasing adaptability and versatility in control applications.	3	3	3	3	3	-	-	1	-	-	2	2

DIGITAL ELECTRONICS LAB

II B. Tech II Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EC23	ESC	0	0	2	1	40	60	100

Prerequisites: Analog Electronics & Digital Electronics

Course Objectives:

- To learn basic techniques for the design of digital circuits and number conversion systems.
- To implement simple logical operations using combinational logic circuits.
- To design combinational logic circuits, sequential logic circuits.

Course Outcomes: After learning the contents of this paper the student must be able to

- Understand the working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Analyze different types of semiconductor memories.

LIST OF EXPERIMENTS

1.Realization of Boolean Expressions using Gates
2.Design and realization logic gates using universal gates
3.Generation of clock using NAND/NOR gates
4.Design a 4 - bit Adder / Subtractor
5.Design and realization a 4 - bit gray to Binary and Binary to Gray Converter
6.Design and realization of a 4-bit pseudo random sequence generator using logic gates.
7.Design and realization of an 8-bit parallel load and serial out shift register using flip-flops.
8.Design and realization Asynchronous and Synchronous counters using flip-flops
9.Design and realization 8x1 using 2x1 mux
10.Design and realization 2-bit comparator
11.Verification of truth tables and excitation tables
12.Realization of logic gates using DTL, TTL, ECL, etc.,

TEXT BOOKS:

1.A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2.M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCE BOOKS:

1.R.S. Sedha, “A Textbook of Digital Electronics”, S.Chand, 2005
2.R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009

DIGITAL ELECTRONICS LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To learn basic techniques for the design of digital circuits and number conversion systems	3	2	3	1	1	1	3	1	2	1	2	3
To implement simple logical operations using combinational logic circuits	3	3	3	2	2	1	3	1	2	2	2	3
To design combinational logic circuits, sequential logic circuits	2	2	1	2	2	1	3	1	2	2	2	3

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand the working of logic families and logic gates	2	2	2	3	3	2	1	1	3	3	3	3
Design and implement Combinational and Sequential logic circuits.	2	1	3	1	2	3	3	1	3	2	2	3
Analyse different types of semiconductor memories	1	1	2	1	1	3	3	1	3	3	3	3

PCB DESIGN

II B. Tech II Sem

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	TOTAL
A7EE23	ESC	0	0	2	1	40	60	100

Course Objectives:

1. To understand the basics of PCB types, materials, and design standards.
2. To gain hands-on experience with PCB layout software tools.
3. To develop skills in schematic capture, component placement, routing, and Gerber generation.
4. To fabricate and test a simple single-layer PCB.

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

1. Understand the design and fabrication process of PCBs.
2. Design schematic diagrams and convert them to PCB layouts.
3. Apply routing and layout techniques using EDA tools.
4. Generate Gerber files and perform DRC/ERC effectively.
5. Fabricate, assemble, and test basic single-layer PCBs.

LIST OF EXPERIMENTS

Module I: Fundamentals of PCB Design

1. Types of PCBs: Single-layer, Double-layer, Multilayer
2. PCB materials and manufacturing process
3. PCB design rules and standards (IPC standards)
4. Introduction to EDA tools (e.g., KiCad, Eagle, Altium, EasyEDA)

Lab Activity:

5. Exploring the user interface of PCB design software
6. Setting up design rules

Module II: Schematic Design

1. Creating circuit schematics using PCB CAD tools
2. Component library management
3. Electrical rule checking (ERC)
4. Netlist generation

Lab Activity:

5. Designing a basic power supply or LED flasher circuit
6. Performing ERC and generating netlist

Module III: PCB Layout and Routing

1. Importing netlist to layout editor
2. Footprint assignment and component placement
3. Manual vs auto-routing
4. Design Rule Check (DRC)

Lab Activity:

5. Placing components and routing for the schematic designed earlier
6. Performing DRC and correcting errors

Module IV: PCB Output Files and Fabrication

1. Generating Gerber files, drill files, and BOM
2. Understanding layers (Top, Bottom, Soldermask, Silkscreen)

3. PCB printing, photoresist method, and etching
4. Introduction to SMD and through-hole assembly

Lab Activity:

5. Generate Gerber files and preview using Gerber viewer
6. Fabricate a basic single-layer PCB (simulation or actual lab process)

Module V: Mini Project and Testing

1. Assembling components on fabricated PCB
2. Soldering and desoldering techniques
3. Continuity testing and troubleshooting
4. Mini-project: Design a simple power supply, logic gate trainer, or timer circuit

Lab Activity:

5. Complete mini project: From schematic to testing of PCB

TEXT BOOKS:

1.Walter C. Bosshart "Printed Circuit Board Design and Technology" Tata McGraw Hill

2.Clyde F. Coombs "Printed Circuit Boards: Design and Technology": McGraw-Hill

3.Peter Dalmaris "PCB Design Using KiCad 6"

REFERENCE BOOKS:

1.Kraig Mitzner **"Complete PCB Design Using OrCAD Capture and PCB Editor"**

2.James Angus **"Electronic Product Design"**

IPC Standards:

1. IPC-2221: Generic Standard on Printed Board Design
2. IPC-7351: Generic Requirements for Surface Mount Design

Software Tools (Free/Open Source Recommended):

1. **KiCad** (Open-source)
2. **EasyEDA** (Online tool)
3. **Eagle CAD** (Free for education)
4. **LTSpice / Tinkercad** for circuit simulation (optional)