NARSIMHA REDDY ENGINEERING COLLEGE
An Autonomous Institution| Affiliated to JNTUH | Approved by AICTE
Accredited by NBA & NAAC with 'A' Grade

ACADEMIC REGULATIONS (NR-25)

FOR

B.Tech Regular Four Year Degree Courses

(For the Batches Admitted From 2025-2026)

&

B. Tech (Lateral Entry Scheme)

(For the Batches Admitted From 2026-2027)

ELECTRICAL & ELECTRONICS ENGINEERING

INSTITUTE VISION

To produce competent professionals who can contribute to the industry, research and societal benefits with environment consciousness and ethical values.

INSTITUTE MISION

M1: Adapt continuous improvements in innovative teaching-learning practices and state-of-the-art infrastructure to transform students as competent professionals and entrepreneurs in multi- disciplinary fields.

M2: Develop an innovative ecosystem with strong involvement and participation of students and faculty members.

M3: Impart National development spirit among the students to utilize their knowledge and skills for societal benefits with ethical values.

DEPARTMENT VISION

To be recognized as a centre of excellence by nurturing competent and ethical electrical engineers, fostering innovation, advanced research and setting global benchmarks in developing sustainable solutions for societal progress.

DEPARTMENT MISSION

M1: To impart high-quality technical education integrated with rigorous academic learning, while fostering innovation and creative problem-solving skills in the field of Electrical and Electronics Engineering.

M2: To promote a strong research culture among students and faculty to develop technologically advanced and cost-effective sustainable solutions for societal upliftment.

M3: To actively engage, collaborate, and build partnerships with leading industries, research and academic institutions to strengthen technological advancements.

ACADEMIC REGULATIONS (NR25) FOR B.TECH REGULAR STUDENTS WITH EFFECT FROM THE ACADEMIC YEAR 2025-26:

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

Narsimha Reddy Engineering College (NRCM) offers new regulations termed as NR-25 regulations in line with National Educational Policy for four-year (eight semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS), with effect from the academic year **2025-26.**

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 as per the guidelines of Telangana Council of Higher Education, 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: SL: C (lecture periods: tutorial periods: practical periods: Self Learning: credits) pattern has been defined.

All courses offered in each semester are to be registered by the student. Against each course in the course structure, the L: T: P: SL: C (lecture periods: tutorial periods: practical periods: Self Learning: 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.

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- One credit is allocated for three hours per week in a semester for Project/Mini-Project (SL) 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
8	Other Core Courses (OCC)	Industry Training/ Internship/ Industry Oriented Mini- project	Industry Training/ Internship/ Industry Oriented Mini- Project
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 institution 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 Two faculty members may be allocated for the tutorial session of problematic course for better interaction/practice and to minimise the failures in the subject.

5.8 **Professional Electives:** The students have 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 department or opt to register for the equivalent Massive Open Online Courses (MOOCs) as listed from time to time by the Institute.

5.9 **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 or opt to register for the equivalent Massive Open Online Courses (MOOCs) as listed

from time to time by the Institute. 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.

5.10 **Provision for Early Registration of MOOCs:**

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

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.

5.11 **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.

5.12 MOOCs are allowed for professional and open elective courses and for a few Minors & Honors courses.

5.13 **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 Institute 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** : Objective/quiz paper for 10 marks.
ii) **Part – B** Descriptive paper for 20 marks. totaling to 30 marks.

Total duration of mid-term examination is two hours.

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 (with a weightage of 4M from Unit-1, 4M from Unit-2, 2M from Unit-3 for Mid-I Examination and 2M from Unit-3, 4M from Unit-4, 4M from Unit-5 for Mid-II Examination).

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:

1. 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.
2. Five marks for the Viva-Voce/PPT/Poster Presentation/Working Model/Case Study on a topic in the concerned subject. This assessment shall be completed before II Mid- Term Examination.

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**.** The first mid-term exam will be conducted in the conventional mode using a drawing board**,** while the second mid-term exam will be conducted using a CAD package.

9.2.3 **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.

9.3 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. CBT exams shall be conducted by the Institute.

9.4 Semester End Examination for theory courses

9.4.1 **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.

9.4.2 **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.

9.4.3 **Duration of SEE:**

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

9.5 **Semester End Examination for Practical Courses:**

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.

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.

9.6 **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.

9.7 **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.

9.7.1 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.

9.8 **UG Project Work:**

9.8.1 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.

9.8.2 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.

9.8.3 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**

9.8.4 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.

9.8.5 For conducting viva-voce exam of project work, Principal selects an external examiner from the list of experts in the relevant branch submitted by the Head of the Department.

9.8.6 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.

9.9 Skill Development Courses:

Four Skill Development Courses are included in the Curriculum in II-I, II-II, III-I and III-II 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.

9.10 **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 Institute 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

$$\mathbf{SGPA = \{ \Sigma N\ Ci\ Gi \} / \{ \Sigma N\ i=1\ Ci \}}$$

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.

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

$$\mathbf{CGPA = \{\sum^{M} C_j G_j\} / \{\sum^{M} C_j\}}$$

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

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 Institute 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 NR-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 Institute-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 Institute 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 that particular college, then student should consult the Institute 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 Institute 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 NR-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 NR-25 regulations are in force.

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

22.3 A student detained due to shortage of credits and re-admitted in NR-25 regulations: Such students shall be promoted to the next semester in NR-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 NR-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 NR-23 regulations by the Institute. All these details are summarized in a set of look- up Table; one set for each B. Tech. branch.

22.6 **Look Up Table of equivalence courses**

22.6.1 A lookup table will be provided for the benefit of students. This lookup table will include all the courses to be registered by students who have been re-admitted under the NR-25 Academic Regulations from the NR-23 Academic Regulations. Separate lookup tables will be provided for the following categories of students:

1. Students re-admitted into the I Year II Semester of the NR-25 Regulations
2. Students re-admitted into the II Year I Semester of the NR-25 Regulations
3. Students re-admitted into the II Year II Semester of the NR-25 Regulations
4. Students re-admitted into the III Year I Semester of the NR-25 Regulations
5. Students re-admitted into the III Year II Semester of the NR-25 Regulations
6. Students re-admitted into the IV Year I Semester of the NR-25 Regulations
7. Students re-admitted into the IV Year II Semester of the NR-25 Regulations For every B.Tech. branch there shall be separate set of seven lookup tables.

22.6.2 Applicability of Look-up Table: The above look-up table shall be applicable for i) students who seek readmission from NR-23 regulations to NR-25 regulation for the equivalence courses.

22.6.3 These look-Up Tables are not applicable for the students who seek transfer from other Institution to NRCM. Such students should consult the University regarding equivalent courses.

22.7 The NR-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 NRCM from various other Universities/Institutions is having back-logs at the previous University/institute, have to pass the courses offered at NRCM which are equivalent to the failed courses at the previous University/institute.

23.3 The transferred students from other Universities/Institutions to NRCM, shall be given a chance to write CBTs for getting CIE component in the **equivalent course(s)** as per the clearance letter issued by the University.

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 Principal is final.

26.3 The Institute 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 Institute authorities.

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

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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 123/124 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 student can avail exemption of courses ***totaling up to 3/4 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
4. 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
5. The attendance requirements of B.Tech. (Regular) shall be applicable to B.Tech. (LES).
6. **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.

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

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MALPRACTICE RULES DISCIPLINARY ACTION FOR/ IMPROPER CONDUCT IN EXAMINATION

	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 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 any other 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 and sent to the University. Academic planner tools
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 University 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 University 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/assistant – superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use	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.

	of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears 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 University 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 University for further action to award a suitable punishment. Academic planner tools	

PROGRAM OUTCOMES (POs):

PO1: Engineering knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/development of solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct investigations:: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering tool usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The engineer and the world: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and

society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project management and finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-long learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUT COMES (PSOs):

PSO1: Engineering Knowledge and Analysis: Apply principles of engineering, science, and mathematics through differential and integral calculus, complex variables to solve electrical engineering problems

PSO2: System Design: Ability to utilize logical and technical skills to model, analyze, design, realize physical systems, simulate, measuring, control and experimenting the components or processes by using software/hardware tools related to Electrical and Electronics Engineering problems and other allied themes.

PSO3: Application of the knowledge on society/environment : Apply the knowledge of Electrical and Electronics Engineering with self-learning to address societal and environmental challenges, while fostering leadership, economic understanding, and professional ethics in multidisciplinary environment

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS):

PEO-I: Preparation: Graduates excel in higher education and become successful professionals in Electrical Engineering and its allied domains.

PEO-II: Core Competence: Graduates will have a strong foundation in engineering principles, scientific knowledge, and technical fundamentals, enabling them to address complex challenges in research, industry, higher education and entrepreneurship through rigorous learning.

PEO-III: Professionalism & Lifelong Learning: Graduates shall have effective communication, teamwork, leadership, social responsibility, and ethical values while fostering adaptability and a commitment to lifelong learning.

KNOWLEDGE AND ATTITUDE PROFILE (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

SUSTAINABLE DEVELOPMENT GOALS (SDGs):

SDG-1: No Poverty

- NRCM provides scholarships through state and central government schemes to over 950+ students annually.
- Institutional financial aid covers tuition and transportation for economically weaker sections.
- The Career Development Center runs skill-based training programs to uplift socio-economically disadvantaged students.

SDG-2: Zero Hunger

- Mid-day meals and subsidized food are made available for hostel and day-scholar students from poor backgrounds.
- The college practices food waste minimization through monitored mess operations and awareness programs.
- Student-led initiatives coordinate food donation drives in collaboration with NGOs.

SDG-3: Good Health and Well-being

- NRCM organizes regular medical check-up camps in collaboration with local hospitals.
- On-campus health center provides basic care and first-aid with visiting doctors on call.
- Physical education programs and wellness workshops are embedded into the campus lifestyle.

SDG-4: Quality Education

- NRCM ensures inclusive learning through bridge courses and remedial classes.
- Digital classrooms and LMS platforms are utilized to support blended learning.
- The institution partners with industries to provide internships and certification programs.

SDG-5: Gender Equality

- NRCM maintains a balanced gender ratio and has a strong anti-harassment cell.
- Women empowerment cell conducts regular workshops on leadership and self-defense.
- Female faculty and student representation is promoted in all committees.

SDG-6: Clean Water and Sanitation

- NRCM has implemented rainwater harvesting and efficient water usage systems.
- The campus ensures clean drinking water and hygienic sanitation facilities for

all.
- Awareness programs on water conservation are conducted for students and staff.

SDG-7:
- **Affordable and Clean Energy**
- Solar panels have been installed on campus buildings for sustainable power.
- Energy audits are conducted periodically to monitor consumption patterns. NRCM promotes the use of LED lights and energy-efficient appliances.

SDG-8: Decent Work and Economic Growth
- The Career Development Center facilitates placements and skill development programs.
- Entrepreneurship cells and incubation support are provided for startups.
- MoUs with companies offer real-time projects and industrial exposure.

SDG-9: Industry, Innovation, and Infrastructure
- NRCM has established research labs, IoT, and AI centers of excellence.
- Technical fests and hackathons are organized to boost innovation.
- Students participate in national-level innovation competitions.

SDG-10: Reduced Inequalities
- Scholarships are offered irrespective of caste, creed, or gender.
- Student mentoring and counseling ensure inclusive academic support.
- Programs are conducted to sensitize students on equity and inclusion.

SDG-11: Sustainable Cities and Communities
- Campus greenery is maintained with over 2,000 trees and plants.
- NRCM collaborates with local bodies on urban development projects.
- Students are encouraged to design sustainable housing and smart city models.

SDG-12: Responsible Consumption and Production
- Waste segregation and recycling units are active on campus.
- Workshops on sustainable practices are included in the curriculum.
- Procurement policies emphasize eco-friendly and reusable materials.

SDG-13: Climate Action
- NRCM conducts climate change awareness campaigns and tree plantation drives.
- Environmental Science is mandatory for all students.
- Participation in the International Day for Climate Action is encouraged.

SDG-14: Life Below Water
- Students engage in coastal clean-up drives and plastic awareness campaigns.
- Environmental clubs study marine pollution and water ecosystem conservation.

- Projects on microplastic impact and aquatic health are taken up.

SDG-15: Life on Land

- NRCM maintains a botanical garden and biodiversity registers on campus.
- Tree-planting initiatives are undertaken regularly by NSS and Eco Club.
- Wildlife protection and biodiversity conservation seminars are organized.

SDG-16: Peace, Justice and Strong Institutions

- NRCM has transparent grievance redressal mechanisms and student councils.
- Sessions on ethics, human values, and constitutional duties are mandatory.
- Legal awareness and democratic participation programs are held annually.

SDG-17: Partnerships for the Goals

- NRCM actively collaborates with NGOs, industries, and academic institutions.
- Participates in global SDG networks and knowledge exchanges.
- Engages in MoUs with sustainability-focused organizations.

COURSE STRUCTURE & SYLLABUS (NR25 Regulations)
Applicable from AY 2025-2026 Batch

I Year I Semester

S.No.	Course Code	Course Title	C	L	T	P	Credits
1.	25MA101	Matrices and Calculus	BS	3	1	0	4
2.	25PH102	Advanced Engineering Physics	BS	3	0	0	3
3.	25EN103	English for Skill Enhancement	HS	3	0	0	3
4.	25ME104	Engineering Drawing and Computer Aided Drafting	ES	2	0	2	3
5.	25CS105	Programming for Problem Solving	ES	3	0	0	3
6.	25EE106	Electrical Circuits - I	ES	2	0	0	2
7.	25CS107	Programming for Problem Solving Lab	ES	0	0	2	1
8.	25PH108	Advanced Engineering Physics Lab	BS	0	0	2	1
9.	25EN108	English Language and Communication skills Lab	HS	0	0	2	1
		Induction Program					
		Total Credits		**16**	**1**	**8**	**21**

I Year II Semester

S.No.	Course Code	Course Title	C	L	T	P	Credits
1.	25MA201	Ordinary Differential Equations and Vector Calculus	BS	3	0	0	3
2.	25CH202	Engineering Chemistry	BS	3	0	0	3
3.	25EE203	Electrical Circuits - II	ES	3	0	0	3
4.	25CS204	Python Programming	ES	2	0	0	2
5.	25CS205	Data Structures	ES	3	0	0	3
6.	25CH207	Engineering Chemistry Lab	BS	0	0	2	1
7.	25CS208	Data Structures Lab	ES	0	0	2	1
8.	25CS209	Python Programming Lab	ES	0	0	4	2
9.	25EE210	Electrical Circuits Lab	ES	0	0	2	1
10.	25ME211	Engineering Workshop	ES	0	0	2	1
		Total Credits		**14**	**0**	**12**	**20**

II YEAR I SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1	25EE301	Electromagnetic fields	PC	3	0	0	3
2	25EE302	Electrical Machines - I	PC	3	0	0	3
3	25EC303	Electronic Devices and Circuits	PC	3	0	0	3
4	25EE304	Power Systems - I	PC	3	0	0	3
5	25EE305	Electrical Measurements and Sensors	PC	2	0	0	2
6	25MB306	Innovation and Entrepreneurship	HS	2	0	0	2
7	25EE307	Electrical Machines - I Laboratory	PC	0	0	2	1
8	25EC308	Electronic Devices and Circuits Laboratory	PC	0	0	2	1
9	25EE309	Electrical Measurements and Sensors Laboratory	PC	0	0	2	1
10	25SD313	Design of Electrical Systems using AutoCAD	SD	0	0	2	1
		Total Credits		**16**	**0**	**08**	**20**

II YEAR II SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1	25EE401	Electrical Machines – II	PC	3	0	0	3
2	25MA402	Numerical Methods and Complex Variables	BS	3	0	0	3
3	25EE403	Power Systems – II	PC	3	0	0	3
4	25EE404	Control Systems	PC	3	1	0	4
5	25EE405	Digital Electronics	PC	3	0	0	3
6	25EE406	Electrical Machines-II Laboratory	PC	0	0	2	1
7	25EE407	Control Systems Laboratory	PC	0	0	2	1
8	25SD408	PCB Design	SD	0	0	2	1
9	25EE411	Digital Electronics Laboratory	PC	0	0	2	1
10	25VA400	Environmental Science	VA	1	0	0	1
		Total Credits		**16**	**1**	**8**	**21**

III YEAR I SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1	25EE501	Power Electronics	PC	3	0	0	3
2	25EE502	Power System Protection	PC	3	0	0	3
3	25EE504	Microprocessors and Microcontrollers	PC	3	0	0	3
4		Professional Elective-I	PE	3	0	0	3
5		Open Elective-I	OE	2	0	0	2
6	25EE508	Power Electronics Laboratory	PC	0	0	2	1
7	25EE509	Power System Laboratory	PC	0	0	2	1
8	25EE512	Microprocessors and Microcontrollers Laboratory	PC	0	0	2	1
9	25EE510	Field Based Project / Internship	PC	0	0	4	2
10	25SD511	Robotics and Automation	SD	0	0	2	1
11	25VA500	Gender Sensitization Lab and Human Values and Professional Ethics	VA	1	0	0	1
		Total Credits		**15**	**0**	**12**	**21**

III YEAR II SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1	25EE601	Power System Operation and Control	PC	3	0	0	3
2	25EE602	Signals and Systems	PC	3	0	0	3
3	25MB603	Business Economics and Financial Analysis	HS	3	0	0	3
4		Professional Elective-II	PE	3	0	0	3
5		Open Elective – II	OE	2	0	0	2
6	25EE607	Signals and Systems Laboratory	PC	0	0	2	1
7	25EE608	Power System Simulation Laboratory	PC	0	0	2	1
8	25EE609	Electrical and Electronics Design Laboratory	PC	0	0	2	1
9	25SD610	Design of Solar Power System	SD	0	0	2	1
10	25EN611	English for Employability Skills Laboratory	HS	0	0	2	1
11	25VA600	Indian Knowledge System	VA	1	0	0	1
		Total Credits		**15**	**0**	**10**	**20**

IV YEAR I SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1	25EE701	Power Electronics for Renewable Energy Systems	PC	3	0	0	3
2	25EE702	Hybrid Electric Vehicles	PC	3	0	0	3
3	25MB703	Fundamentals of Management for Engineers	HS	3	0	0	3
4		Professional Elective - III	PE	3	0	0	3
5		Professional Elective – IV	PE	3	0	0	3
6		Open Elective – III	OE	2	0	0	2
7	25EE710	Power Electronics for Renewable Energy Systems Laboratory	PC	0	0	2	1
8	25EE711	Electric Vehicles Laboratory	PC	0	0	2	1
9	25EE712	Industry Oriented Mini Project/ Summer Internship	PC	0	0	4	2
		Total Credits		**17**	**0**	**08**	**21**

IV YEAR II SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1		Professional Elective – V	PE	3	0	0	3
2		Professional Elective – VI	PE	3	0	0	3
3	25EE807	Project Work	PC	0	0	28	14
		Total Credits		06	0	28	20

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE – I

25EE505	Utilization of Electrical Energy
25EE506	Renewable Energy Systems
25EE507	VLSI Design

PROFESSIONAL ELECTIVE – II

25EE604	Power Semiconductor Drives
25EE605	High Voltage Engineering
25EE606	Programmable Logic Controllers

PROFESSIONAL ELECTIVE – III

25EE704	Energy Storage Systems
25EE705	Power Quality
25EE706	Digital Signal Processing

PROFESSIONAL ELECTIVE – IV

25EE707	Battery Management Systems
25EE708	Smart Grid Technologies
25EE709	AI and ML for Electrical Engineering Applications

PROFESSIONAL ELECTIVE – V

25EE801	EV Charging Infrastructure
25EE802	HVDC Transmission
25EE803	Embedded Systems

PROFESSIONAL ELECTIVE – VI

25EE804	Electrical Distribution and Automation
25EE805	Smart Metering and Communication Protocols
25EE806	Energy Conservation and Audit

OPEN ELECTIVES

OPEN ELECTIVE-I		
Department	**Course Code**	**Course**
Civil	25CE513	Disaster Management
	25CE514	Low Cost Materials and Green Buildings
EEE	25EE512	Fundamentals of Electric Vehicles
	25EE513	Industrial Automation and Control
Mechanical	25ME513	Optimization Techniques
	25ME514	Industrial Robotics
ECE	25EC515	Principles of Communication
	25EC516	Fundamentals of Cyber Physical Systems
CSE	25CS515	Operating Systems
	25CS516	Database Management Systems
CSE-CS	25CY513	Cyber Security
	25CY514	Mathematics for Machine Learning
CSE-AIML	25AM514	Fundamentals of AI
	25AM515	Machine Learning Basics
IT	25IT513	Java Programming
	25IT514	Web Programming

OPEN ELECTIVE-II		
Department	**Course Code**	**Course**
Civil	25CE613	Building Science and Technology
	25CE614	Environmental Impact Assessment
EEE	25EE612	Digital Energy
	25EE613	Energy Audit
Mechanical	25ME611	Artificial Intelligence in Mechanical Engineering
	25ME612	Non-Conventional Sources of Energy
ECE	25EC612	Fundamentals of Image Processing
	25EC613	Automotive Electronics
CSE	25CS613	Introduction to Computer Networks
	25CS614	Software Engineering
CSE-CS	25CY614	Information System Audit & Assurance
	25CY615	Social Media Security
CSE-AIML	25AM615	Introduction to Natural Language Processing
	25AM616	Chatbots
IT	25IT613	Introduction to Artificial Intelligence
	25IT614	Scripting Languages

OPEN ELECTIVE-III		
Department	**Course Code**	**Course**
Civil	25CE717	Road Safety Engineering
	25CE718	Building Services Engineering
EEE	25EE713	Sustainable Energy
	25EE714	Smart Grid Systems
Mechanical	25ME715	Engineering Materials
	25ME716	Digital Manufacturing
ECE	25EC715	Introduction to Wireless Communications
	25EC716	Electronics for Health Care
CSE	25CS719	Algorithms Design and Analysis
	25CS720	Fundamentals of Cyber Security
CSE-CS	25CY717	Data Privacy
	25CY718	Security Incident & Response Management (SOC)
CSE-AIML	25AM719	AI applications
	25AM720	Computer Vision with Open CV
IT	25IT717	Cloud Computing
	25IT718	Prompt Engineering

MATRICES AND CALCULUS

B Tech I Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25MA101	**Basic Sciences**	**3**	**1**	**0**	**4**	**40**	**60**	**100**

COURSE OBJECTIVES:

To learn

1. How to Solve systems of linear equations using matrix methods
2. Analyzing eigenvalues and eigenvectors in diagonalization of matrices and apply them to reduce quadratic forms to canonical form
3. Geometrical approach to the mean value theorems and their application to the mathematical problems
4. Finding maxima and minima of functions of two and three variables
5. Evaluation of multiple integrals and their applications

COURSE OUTCOME:

Student will be able to

1. Apply matrix operations to solve systems of linear equations using rank and inverse, Gauss Seidel methods
2. The student will reduce quadratic forms to canonical form using eigenvalues and eigenvectors and interpret their nature for engineering applications
3. To apply mean value theorems in analyzing functions, study and trace curves for better visualization
4. To apply partial derivatives in solving problems related to maxima, minima, and engineering applications
5. Evaluate double and triple integrals in various coordinate systems and apply them to compute areas and 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) – Finding inverse and power of a matrix by Cayley-Hamilton Theorem. Quadratic forms and

Nature of the Quadratic Forms – Reduction of Quadratic form to canonical form 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

TEXTBOOKS:

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

ADVANCED ENGINEERING PHYSICS

B Tech I Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25PH102	**Basic Sciences**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: 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
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 OUTCOME:

1. Analyze crystal structures, identify defects, and apply different technique for material characterization
2. Apply quantum mechanical principles to explain particle behaviour in infinite potential well
3. Analyze the behavior of Qubits using Bloch's sphere representation, explore quantum gates and measurements, and evaluate quantum algorithms such as Deutsch-Jozsa, Shor, and Grover
4. Classify magnetic and dielectric materials and evaluate their applications in emerging technologies
5. Analyze the construction and working of various types of LASERs and optical fibres, and evaluate their applications in modern technologies

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. X -Ray Diffraction: Bragg's Law, Powder Method, Calculation of Average Crystallite Size Using Debye Scherrer's Formula.

Concept of Nanomaterials: surface to volume ratio, scanning electron microscopy (SEM): block diagram, working principle

UNIT-II:

Quantum Mechanics

Quantum Mechanics: Introduction, de-Broglie Hypothesis, Heisenberg Uncertainty Principle, postulates of quantum mechanics: operators in quantum mechanics, eigen values and eigen

functions, expectation value;

Schrödinger's Time Independent Wave Equation, Physical Significance Of Wave Function, Particle in a 1-d 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

Magnetic Materials: Classification of Magnetic Materials, Weiss Domain Theory of Ferromagnetism, Hysteresis, 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.

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

LASER: Introduction to Laser, Characteristics of Laser, Einstein Coefficients and Their Relations, Meta-Stable State, Population Inversion, Pumping, Lasing Action, Ruby Laser, He-Ne Laser, Semiconductor Diode Laser.

Applications: Bar Code Scanner, Lidar for Autonomous Vehicle.

Fibre Optics: 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

TEXTBOOKS:

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
4. Modern Engineering Physics by Dr. K. Vijay Kumar, Dr. Chandralingam, S.Chand Publications

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

ENGLISH FOR SKILL ENHANCEMENT

B Tech I Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EN103	**Humanities & Social Sciences**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

COURSE OBJECTIVES:

This course will enable the students to:

1. Improve their vocabulary
2. Use appropriate sentence structures in their oral and written communication
3. Develop their reading and study skills
4. Equip students to write paragraphs, essays, précis and draft letters
5. Acquire skills for technical report writing

COURSE OUTCOME:

Students will be able to:

1. Comprehend texts and produce precise formal writing using effective reading strategies and structured language
2. Apply language skills to produce coherent texts on digital transformation using effective structure and organization
3. Comprehend poetic themes of gratitude and attitude, and apply language skills for effective personal and professional communication
4. Comprehend entrepreneurial ideas and apply language skills to produce concise, context- driven communication
5. Apply language and reading skills to understand professional ethics and produce structured technical reports

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 'The Road Not Taken' by Robert Frost from the prescribed textbook titled English for the Young in the Digital World published by Orient Black Swan 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 Black Swan 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

TEXTBOOKS:

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 Delhi.
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

ENGINEERING DRAWING AND COMPUTER AIDED DRAFTING

B Tech I Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25ME104	**Engineering sciences**	**2**	**0**	**2**	**3**	**40**	**60**	**100**

COURSE OBJECTIVES:

1. To introduce the fundamentals of engineering drawing and projection systems
2. To develop skills in constructing orthographic, isometric, and sectional views
3. To train students in interpreting and creating technical drawings using CAD tools
4. To familiarize students with dimensioning standards and drafting conventions
5. To bridge manual drafting techniques with computer-aided drafting practices

COURSE OUTCOME:

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

1. Explain the fundamentals of engineering graphics and construct basic geometrical figures, scales, and curves using conventional drafting methods
2. Apply the principles of orthographic projection to draw projections of points, lines, and planes using
3. Construct projections and sectional views of regular solids and analyze their spatial orientations with auxiliary planes using CAD techniques
4. Develop lateral surfaces of prisms, cylinders, pyramids, and cones using standard engineering drawing using both manual and CAD tools
5. Generate isometric projections and convert between isometric and orthographic views of simple and compound solids using conventional and computer-aided methods

UNIT-I:

Introduction to Engineering Graphics (Conventional)

Principles of Engineering Graphics and their Significance, Geometrical Constructions, Scales, Plain and Diagonal, Conic Sections including the Rectangular Hyperbola, General method only. Cycloid, Epicycloid and Hypocycloid

UNIT-II:

Orthographic Projections (Conventional)

Principles of Orthographic Projections, Conventions, Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer aided orthographic projections, points, lines and planes. Introduction to Computer aided drafting, views, commands and conics

UNIT-III:

Projections of Regular Solids (Conventional and Computer Aided)

Auxiliary Views, Sections, Prism, Cylinder, Pyramid, Cone, Computer aided projections of solids, sectional views

UNIT-IV:

Development of Surfaces (Conventional and Computer Aided)

Prism, Cylinder, Pyramid and Cone

UNIT-V:

Isometric Projections (Conventional and Computer Aided)

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 Views to Orthographic Views and Vice- versa, Conventions. Conversion of orthographic projection into isometric view

Note:

1. The End Semester Examination will be in conventional mode.
2. CIE – I will be in conventional mode.
3. CIE – II will be using Computer

TEXTBOOKS:

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., 3rd Edition, 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, 3rd Edition, 2020
3. Engineering Drawing, M. B. Shah and B.C. Rane, Pearson, 2nd Edition, 2009
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford, 1st Edition, 2015
5. Computer Aided Engineering Drawing, K. Balaveera Reddy, CBS Publishers, 2nd Edition, 2015

PROGRAMMING FOR PROBLEM SOLVING

B Tech I Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CS105	**Engineering Sciences**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: Fundamentals of Computers								

COURSE OBJECTIVES:

1. To develop problem-solving skills using algorithms and flowcharts.
2. To introduce the fundamentals of C programming constructs such as variables, operators, data types, control structures and I/O.
3. To strengthen programming skills through modular programming using functions, recursion and arrays and strings.
4. To provide knowledge of advanced C concepts including pointers, structures, unions and Dynamic memory allocation.
5. To understand file concepts and enable students to apply operations on files.

COURSE OUTCOME:

The student will learn

1. To analyze problem-solving techniques to design algorithms and translate them into C Programs.
2. To demonstrate proficiency in using control structures, arrays, functions and recursion to solve computational problems.
3. To implement pointers, structure, and dynamic memory allocation for efficient program development.
4. To perform file operations and manipulations using C programming.
5. To analyze, debug, and optimize C programs to provide correct and efficient solution.

UNIT-I:

Problem solving Concepts and Overview of C

Problem solving Concepts: Representation of an Algorithm and Flowchart with an example problems.

Overview of C: C Language Elements, Variable Declarations and Data Types, Executable statements, General Form of a C Program, Operators: Types, Precedence and Associativity, Arithmetic expressions, Formatting Numbers in Program Output.

Conditional, Looping and Control Statements: Conditional statements (if, if-else, else-if ladder, nested, switch), Looping (for, while, do-while) and nested loops.

UNIT-II:

Arrays and Strings

Arrays: Introduction, types of arrays, creating, accessing and manipulating elements of an array, searching and sorting of an array.

String: String Basics, String Library Functions: Assignment and Substrings, Longer Strings: Concatenation and Whole-Line Input, String Comparison.

UNIT-III:

Functions, Recursion and Pointers

Functions: Built-in, User defined functions, categories of function, passing parameter techniques, scope of names and array of functions.

Recursion: The Nature of Recursion, Tracing a Recursive Function, Recursive Mathematical Functions, Recursive Functions with Array and String Parameters.

Pointers: Introduction, pointer arithmetic, pointer with arrays and strings.

UNIT-IV:

Structure, Union and Dynamic memory Allocation

Structure and Union Types: User-Defined Structure Types, Structure Type Data as Input and Output Parameters, Functions with Structured Result Values, Union Types.

Dynamic Memory Allocation: Introduction, malloc, calloc, realloc, free.

UNIT-V:

Files, Searching and Sorting

Files: Introduction, text and binary files, operations and accessing methods.

Searching and Sorting: Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms).No need of implementation for Searching and sorting techniques.

TEXTBOOKS:

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, McGraw-Hill.
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, Mc Graw Hill, 4th Edition.
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw

ELECTRICAL CIRCUITS-I

B Tech I Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE106	**Engineering Sciences**	**2**	**0**	**0**	**2**	**40**	**60**	**100**
Prerequisite: 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 OUTCOME:

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
4. Evaluate the performance of single-phase and three-phase AC circuits using phasor representation, impedance, and power concepts
5. Design equivalent networks using source transformation, star-delta transformation, and network reduction techniques

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, Star-Delta transformation, Node voltage method, and Mesh current method

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 circuits. Impedance, Admittance, Active and Reactive Powers, Complex Power.

Resonance: Series and parallel circuits, Bandwidth and Q-factor.

UNIT-III:

Three-phase Circuits: Analysis of balanced and unbalanced three-phase circuits, Star and delta connections, Measurement of three-phase power for balanced and unbalanced loads

UNIT-IV:

Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorems, Maximum power transfer theorem, Tellegen's theorem, Compensation theorem, Millman's theorem and Reciprocity theorem. (AC & DC)

UNIT-V:

Magnetic Coupled circuits: Concept of self and mutual inductance, Dot convention, Coefficient of coupling, Analysis of circuits with mutual inductance

TEXTBOOKS:

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", 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", McGraw Hill, 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", McGraw Hill, 6 th Edition, 2002
6. Chakravarthy A., "Circuit Theory", Dhanpat Rai & Co., First Edition, 1999

PROGRAMMING FOR PROBLEM SOLVING LAB

B Tech I Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CS107	**Engineering Sciences**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Prerequisite: Fundamentals of Computers								

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

COURSE OBJECTIVES:

The students will learn the following:

1. To work with an IDE to create, edit, compile, run and debug programs
2. To analyze the various steps in program development.
3. To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
4. To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
5. To write programs using the Dynamic Memory Allocation concept.

COURSE OUTCOME: ;

The candidate is expected to be able to:

1. Formulate the algorithms for simple problems, translate given algorithms to a working and correct program.
2. Correct syntax errors as reported by the compilers, identify and correct logical errors encountered during execution and implement simple numeric problems of a real word using conditional and control structures.
3. Represent and manipulate data with arrays, strings.
4. Design programs in modular fashion through functions and display data using structures.
5. Create, read and write to and from simple text and binary files

Practice Sessions:

a) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement).

b) Write a program that finds if a given number is a prime number

c) Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.

d) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and

1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

Arrays and Strings :

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

b) Write a C program that uses functions to perform the following:
   i. Addition of Two Matrices
   ii. Multiplication of Two Matrices

c) Write a C program that uses functions to perform the following operations:
   i. To insert a sub-string into a given main string from a given position.
   ii. To delete n Characters from a given position in a given string

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

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

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

Functions and Pointers:

a) Write C programs that use both recursive and non-recursive functions
   i. To find the factorial of a given integer.
   ii. To find the GCD (greatest common divisor) of two given integers.
   iii. To find x^n

b) Write a program to show how the address stored in a pointer changes when we do P++ and P--

c) Write a program for reading elements using a pointer into an array and display the values using the array.

d) Write a program through a pointer variable to sum of n elements from an array.

e) Write a program for display each character of a string using a pointer.

Structure, Union and Dynamic memory allocation:

a) Write a C program to store and display student details using following data using structures and unions.
   rollno(int),
   name(char array) and
   marks(float).

b) Write a C program to store and display three employee details as follows using array of structures
   empID(int),
   name(char array) and
   salary(float).

c) Write a C program to demonstrate dynamic memory allocation techniques.

Files :

a) Write a C program to read the contents of a file.

b) Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.

c) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

d) Write a C program to read name and marks of n number of students and store them in a file.

TEXTBOOKS:

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, McGraw-Hill
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, Mc Graw Hill, 4th Edition
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

ADVANCED ENGINEERING PHYSICS LAB

B Tech I Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25PH108	**Basic Sciences**	**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 OUTCOME:

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

List of Experiments:

1. Synthesis of magnetite (Fe3O4) 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 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

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

B Tech I Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EN108	**Humanities & Social Sciences**	**0**	**0**	**2**	**1**	**40**	**60**	**100**

COURSE OBJECTIVES:

This course will enable the students to:

LISTENING SKILLS:

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 practice speaking in social and professional contexts

COURSE OUTCOME:

Students will be able to:

1. Identify speech sounds and demonstrate basic spoken interaction using formal and informal English in introductory contexts
2. Interpret the speech and infer the intention of the speaker
3. Recognize pronunciation errors, neutralize MTI, and describe objects, people, and events using visual prompts
4. Apply effective listening techniques to extract specific details and develop storytelling skills using creative sequencing
5. Interpret literal and implied meanings in spoken texts and demonstrate non-verbal communication through expressive activities

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

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'

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 Black Swan 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

ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25MA201	**Basic Sciences**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: Mathematical Knowledge at pre-university level								

COURSE OBJECTIVES:

To learn

1. To skills in solving first-order ODEs using methods such as separation of variables, integrating factor, exact equations, and linear equations
2. The formulation and solution techniques of higher-order linear differential equations with constant coefficients
3. Solving ordinary differential equations using Laplace transforms techniques
4. The skills in applying gradient, divergence, curl, and directional derivatives in engineering problems
5. The important theorems like Green's, Gauss's, and Stokes' theorems and their applications

COURSE OUTCOME:

Student will be able to

1. Solve first-order differential equations including exact, linear, and Bernoulli types, and apply them to model physical phenomena such as cooling and growth processes
2. Solve higher-order linear differential equations with constant coefficients and apply the method of variation of parameters to handle non-homogeneous terms
3. Apply Laplace transform techniques to solve initial value problems and evaluate integrals using standard methods
4. Differentiate vector functions and compute gradient, divergence, curl, and directional derivatives
5. Evaluate line, surface, and volume integrals and apply Green's, Gauss's, and Stokes' theorems to solve problems in vector calculus

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 , sin , cos polynomials in 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

TEXTBOOKS:

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. Rajnis

ENGINEERING CHEMISTRY

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CH202	**Basic Sciences**	**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
4. Applications in engineering
5. To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields

COURSE OUTCOME:

1. Analyze the hardness of water and apply suitable treatment methods for potable and boiler water systems
2. Explain electrochemical cell concepts and evaluate corrosion types and prevention techniques
3. Classify energy sources and illustrate the working of modern batteries, fuel cells, and synthetic fuel technologies
4. Differentiate types of polymers and explain their synthesis, properties, and applications
5. Apply knowledge of smart materials, biosensors, cement chemistry, phase rule, and lubricants to analyze their properties, mechanisms, and industrial 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. Defluorination - 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- Dulong's 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 thermoplastics 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 Materials:

Smart materials: Introduction, Classification with examples - Shape Memory Alloys – Nitinol.

Biosensor - Definition, Amperometric Glucose monitor sensor.

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

Phase rule: Definition – Phase, component, degrees of freedom. Phase rule equation. Phase diagrams - One component system - water. Two component system - Lead silver system.

Lubricants: Definition and characteristics of a good lubricant – thin film mechanism of lubrication, properties of lubricants - viscosity, cloud and pour point, flash and fire point

TEXTBOOKS:

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. E-Content- https://doi.org/10.1142/13094 | October 2023

ELECTRICAL CIRCUITS-II

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE203	**Engineering Sciences**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: 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 OUTCOME:

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.
4. Analyze electrical networks using graph theory concepts such as trees, tie-sets, and cut-sets
5. Evaluate the frequency response and performance of different types of filters for practical applications

UNIT-I:

Transient analysis:

Significance of Initial conditions of R, L and C elements

Transient response of series RL, RC and RLC circuits using integro-differential approach for DC and Sinusoidal excitations.

Transient response of parallel RL, RC and RLC circuits using integro-differential approach for DC and Sinusoidal excitations.

UNIT-II:

Electrical circuit Analysis using Laplace Transforms:

Laplace Transforms of step, ramp, exponential, impulse functions (inputs)

Transient response of series RL, RC and RLC circuits using Laplace Transforms approach for DC and Sinusoidal excitations.

Transient response of parallel RL, RC and RLC circuits using Laplace Transforms approach for DC and Sinusoidal excitations

UNIT-III:

Network Topology:

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

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

UNIT-V:

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

TEXTBOOKS:

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", 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", McGraw Hill, 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", McGraw Hill, 6 th Edition, 2002
5. Chakravarthy A., "Circuit Theory", Dhanpat Rai & Co., First Edition, 1999

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/108/106/108106172/
3. https://www.digimat.in/nptel/courses/video/108105159/L01.html
4. https://www.digimat.in/nptel/courses/video/108102042/L01.html

PYTHON PROGRAMMING

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CS204	**Engineering Sciences**	**2**	**0**	**0**	**2**	**40**	**60**	**100**
Prerequisite: 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 OUTCOME:

1. Apply Python syntax, operators, and control structures to develop efficient solutions for arithmetic, conditional, and iterative tasks.
2. Analyze and manipulate strings, lists, tuples, sets, and dictionaries to perform effective data handling and processing.
3. Implement modular programming by defining functions, using recursion, and integrating standard/user-defined modules to build reusable solutions.
4. Evaluate and construct programs that perform file operations and manage exceptions to ensure robust and error-free execution.
5. Design classes, objects, and GUI-based applications using OOP principles such as inheritance, encapsulation, and polymorphism.

UNIT-I:

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-II:

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-III:

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-IV:

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-V:

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

TEXTBOOKS:

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

DATA STRUCTURES

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CS205	**Engineering Sciences**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: A course on "Programming for Problem Solving"								

COURSE OBJECTIVES:

1. Exploring basic data structures such as stacks and queues
2. Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs
3. Introduces sorting and pattern matching algorithms

COURSE OUTCOME:

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

1. Analyze and implement the operations on linear data structures such as Stack and Queue using arrays
2. Design and implement various operations on linked lists (singly, doubly, and circular)
3. Interpret and apply operations on non-linear data structures such as Binary Trees, BST, AVL Trees, and Red-Black Trees
4. Explain the principles of Multi-way Search Trees (B-Trees, B+ Trees) and implement efficient sorting algorithms (Quick Sort, Merge Sort, Heap Sort)
5. Summarize and apply graph operations, implement graph traversal techniques (BFS, DFS), and interpret different hashing techniques for efficient searching and storage

UNIT-I:

Introduction to Data Structures: Basic Terminology, Classification of Data Structures, Operations on Data Structures, Abstract Data Types

Stacks: Stack – Operations: Push, Pop, Peek, Display. Representation and implementation of Stack operations using arrays, Applications of Stacks - Recursion, Infix to Postfix transformation, Evaluating postfix expressions.

Queues: Queue –Operations: enqueue, dequeue, display, representation and implementation of Queue operations using arrays, Applications of Queues, Circular Queues - Representation and implementation of Circular Queues

UNIT-II:

Linked Lists: Singly Linked Lists: Operations -insertion, deletion, search, display. Doubly Linked Lists: Operations insertion, deletion, search, display. Circular Linked Lists: Operations-insertion, deletion, search, display

UNIT-III:

Trees: Basic Tree concepts, Binary Trees: Properties, Types, Representation of Binary Trees using arrays, Traversals of Binary Tree.

Binary Search Trees –BST Operations- Searching, Insertion and Deletion, BST ADT, BST Applications

Balanced Trees- AVL Trees and its operations, Red –Black Trees and its operations, Splay Trees and its operations

UNIT-IV:

Multi way Search Trees: Introduction to B Trees, B+ Trees and their operations. Sorting: Quick Sort, Merge Sort, Radix Sort, Heap sort, Tree Sort, Shell Sort

UNIT-V:

Graphs: Introduction to graphs, Representation of graphs, Graph traversal techniques – Breadth First Search Traversal, Depth First Search Traversal.

Hashing - Hashing and Collision: Introduction, Hash Tables, Hash Functions: Division Method, Multiplication Method, Mid-square Method, Folding Method. Collisions: Collision Resolution by Open Addressing, Collision Resolution by Chaining

TEXTBOOKS:

1. Data Structures: A Pseudocode Approach with C, 2 Nd Edition, R. F. Gilberg and B.A. Forouzan, Cengage Learning
2. Data Structure using C– Reema Thareja, 3rd Edition, Oxford University Press

REFERENCE BOOKS:

1. Data Structures with C, Seymour Lipschutz, TMH
2. Classic Data Structures, 2/e, Debasis, Samanta, PHI, 2009
3. Fundamentals of Data Structures in C, 2/e, Horowitz, Sahni, Anderson Freed, University Press
4. Data Structures using C – A. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education

ENGINEERING CHEMISTRY LAB

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CH207	**Basic Sciences**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Pre requisite: 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:

Students will

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

COURSE OUTCOME:

1. Perform volumetric, potentiometric, conductometric, and pH-metric titrations to estimate concentrations of ions and acids in various solutions
2. Demonstrate polymer synthesis techniques like preparation of Bakelite and Nylon-6,6 and explain their properties
3. Measure physical properties such as viscosity and surface tension of liquids using viscometer and stalagmometer and analyze molecular interactions
4. Investigate the corrosion rate of mild steel in different conditions and evaluate the effectiveness of corrosion inhibitors
5. Analyze the construction, working, and applications of advanced energy devices and smart materials through virtual labs and simulations

List of Experiments:

1. **Volumetric Analysis:** Estimation of Hardness of water by EDTA Complexometry method
2. **Conductometry:**
   a) Estimation of the concentration of strong acid by Conductometry.
   b) Estimation of the concentration of strong and weak acid in an acid mixture by Conductometry
3. **Potentiometry:**
   a) Estimation of concentration of Fe+2ion by Potentiometry using KMnO4
   b) Estimation of concentration of strong acid with strong base by Potentiometry using quinhydrone
4. **pH Metry:** Determination of an acid concentration using pH meter

5. **Lubricants:**
    a) Determination of viscosity of a given liquid using Ostwald's viscometer.
    b) Estimation of acid value of given liquid
6. **Preparations:**
    a) Preparation of Bakelite.
    b) Preparation Nylon – 6, 6
7. **Corrosion:** Determination of rate of corrosion of mild steel in the presence and absence of inhibitor
8. Virtual lab experiments:
    a) Construction of Fuel cell and it's working.
    b) Smart materials for Biomedical applications
    c) Batteries for electrical vehicles.
    d) 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)

DATA STRUCTURES LAB

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CS208	**Engineering Sciences**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Prerequisite: 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 OUTCOME:

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

1. Implement stack and queue data structures
2. Interpret various linked list operations to produce executable codes
3. Develop working procedures for operations on BST, AVL Tree, Redblack Tree
4. Develop executable code for sorting techniques
5. Demonstrate graph operations and hashing techniques

List of Experiments:

Week 1

1. Write a C program to implement Stack operations using arrays.
2. Write a C program to implement Queue operations using arrays.
3. Write a C program to implement Circular Queue operations using arrays

Week 2

1. Implement the following operations on Single Linked List using a C program.
   i. Create ii. Insert iii. Delete iv. Search v. Display

Week 3

1. Write a C program to implement Double Linked List operations –
   i. Create ii. Insert iii. Delete iv. Search v. Display.

Week 4

1. Write a C program to implement Circular Linked List operations –
   i. Create ii. Insert iii. Delete iv. Search v. Display.

Week 5

1. Develop a C code for preorder, in-order and post-order traversals using recursion and non- recursion.

Week 6:

1. Implement the following operations on Binary Search Tree
   i. Create ii. Insert iii. Search iv. Delete v. Display

Week 7:

1. Implement the following operations on AVL Tree
   i. Create ii. Insert iii. Search iv. Delete v. Display

Week 8:

1. Implement the following operations on Red Black Tree
   i. Create ii. Insert iii. Search iv. Delete v. Display

Week 9:

a) Develop a C program for Quick Sort.
b) Demonstrate Merge Sort using a C program
c) Design a C program for Radix Sort.

Week 10:

a) Develop a C program for Tree Sort.
b) Demonstrate Heap sort using a C program

Week 11:

a) Implement a C program for DFS traversal on graph.
b) Implement a C program for BFS traversal on graph

Week 12:

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

TEXTBOOKS:

1. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson
2. Freed, Universities Press
3. Data Structures using C – A. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, PHI/Pearson Education

REFERENCE BOOKS:

1. Fundamentals of Data Structures in C, 2/e, Horowitz, Sahni, Anderson Freed, University Press
2. Data Structures, 2/e, Richard F, Gilberg, Forouzan, Cengage
3. Data Structures and Algorithms, 2008, G.A.V.Pai , TMH

PYTHON PROGRAMMING LAB

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CS209	**Engineering Sciences**	**0**	**0**	**4**	**2**	**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 OUTCOME:

After completion of the course, the student should be able to

1. Develop an efficient code for basic arithmetic, conditionals, and iterative tasks.
2. Gain proficiency in manipulating core data structures for effective data handling and processing.
3. Implement programs into reusable modules, perform file operations, and leverage built-in libraries for efficient coding.
4. Simulate digital logic gates and systems, bridging programming with computational logic concepts.
5. Design classes, objects, and graphical user interfaces to build interactive and visually rich applications.

List of Experiments:

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

   5

   4 4

   3 3 3

   2 2 2 2

   1 1 1 1 1
6. 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)
7. Python program to print all prime numbers in a given interval (use break)
8. Write a program to convert a list and tuple into arrays.

9. Write a program to find common values between two arrays
10. Write a function called palindrome that takes a string argument and returns True 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
11. 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
12. 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.
13. 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
14. The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string
15. 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
16. Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
17. Remove the given word in all the places in a string?
18. 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?
19. Writes a recursive function that generates all binary strings of n-bit length
20. Write a python program that defines a matrix and prints
21. Write a python program to perform multiplication of two square matrices
22. 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
23. Use the structure of exception handling all general-purpose exceptions
24. 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
25. Add an attribute named color to your Rectangle objects and modify draw rectangle so that it uses the color attribute as the fill color.
26. 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
27. 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
28. Write a python code to read a phone number and email-id from the user and validate it for correctness
29. Write a Python code to merge two given file contents into a third file
30. 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
31. Write a Python code to Read text from a text file, find the word with most number of occurrences
32. Write a function that reads a file file1and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters
33. Import numpy, Plotpy and Scipy and explore their functionalities

34. Install NumPypackage with pip and explore it
35. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
36. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset

TEXTBOOKS:

1. Supercharged Python: Take your code to the next level, Overland
2. 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
7. Introduction to Python, Gowrishankar S, Veena A., CRC Press

ELECTRICAL CIRCUITS LAB

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE210	**Engineering Sciences**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Prerequisite: 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 OUTCOME:

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
4. Demonstrate the characteristics of resonance, time response, and filter circuits using circuit simulation software
5. Determine electrical parameters of two-port networks, three-phase systems, and magnetic coupled circuits through experimental methods

The following experiments are required to be conducted compulsorily:

1. Verification of Series and Parallel Resonance using any circuit simulation software (LT Spice etc...)
2. 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...)
3. Determination of Two port network parameters – Z, Y, Transmission and Hybrid parameters
4. Measurement of 3-phase power in Balanced Star connected load using Two-Wattmeter method
5. Determination of Co-efficient of coupling, self and mutual inductance in magnetic Coupled Circuits
6. Frequency domain analysis of Low-pass filter and High-pass filters using circuit simulation software (LT Spice etc...).
7. Verification of Superposition and Maximum Power Transfer theorems using any circuit simulation software (LT Spice etc...)
8. Verification of Thevenin's and Norton's theorems using any circuit simulation software (LT Spice etc...).

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

1. Measurement of Active Power for Delta connected balanced loads
2. Measurement of Reactive Power for Star and Delta connected balanced loads
3. Frequency domain analysis of Band-pass filters

4. Frequency domain analysis of Band-stop filters
5. Determination of Time response of first order RL, RC circuit for periodic non – sinusoidal inputs – Time Constant and Steady state error
6. Verification of Compensation theorem

TEXTBOOKS:

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", 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", McGraw Hill, 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", McGraw Hill, 6 th Edition, 2002
6. Chakravarthy A., "Circuit Theory", Dhanpat Rai & Co., First Edition, 1999

ONLINE RESOURTCES:

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

ENGINEERING WORKSHOP

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25ME211	**Engineering Sciences**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Prerequisite: Practical Skill								

COURSE OBJECTIVES:

1. To introduce students to basic manufacturing processes and workshop practices
2. To provide hands-on training in carpentry, fitting, welding, sheet metal, and machining
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 OUTCOME:

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, welding, sheet metal work, and machining
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:

1. Carpentry: T- Lap Joint, Dovetail Joint, Mortise and Tenon Joint
2. Fitting: V- Fit, Dovetail Fit, Semi- circular fit and L-fit
3. Tin Smithy: Square Tin, Rectangular Tray and Conical Funnel
4. Foundry: Preparation of Green Sand Mould using Single Piece and Split Pattern
5. Welding Practice: Arc Welding and Gas Welding
6. House wiring: Parallel and Series, Two-way Switch and Tube Light

2. TRADES FOR DEMONSTRATION AND EXPOSURE

Plumbing, Machine Shop, Metal Cutting, Power tools in construction and Wood Working

TEXTBOOKS:

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, 2012 edition, 2012

ELECTROMAGNETIC FIELDS

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE301	**Professional Core**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: Mathematics & Physics								

COURSE OBJECTIVES:

1. To introduce the fundamental concepts of electric field and magnetic field
2. To explain the behavior of electric charges and currents in producing electric and magnetic fields.
3. To study the applications of electric and magnetic fields in power transmission lines.
4. To understand the role of electric and magnetic fields in the operation of electrical machines.
5. To study the nature, properties, and applications of electromagnetic waves.

COURSE OUTCOME:

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

1. To understand the basic laws of electromagnetism and their practical applications.
2. To study the relationship between electric fields, magnetic fields, and electric currents.
3. To analyze time-varying electric and magnetic fields and their interactions.
4. To understand the propagation characteristics of electromagnetic (EM) waves.
5. To explore the applications of electromagnetic wave propagation in engineering and communication systems

UNIT-I:

Static Electric Field: Review of conversion of a vector from one coordinate system to another coordinate system, Coulomb's law, Electricfield intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and itsapplications. 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.

TEXTBOOKS:

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, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971
7 A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009

ELECTRICAL MACHINES - I

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE302	**Professional Core**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

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 OUTCOME:

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
4. Evaluate transformer equivalent circuits, efficiency, voltage regulation
5. Compare the performance of two-winding and auto-transformers, and illustrate the operation of poly-phase connections for industrial applications

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.

TEXTBOOKS:

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

ELECTRONIC DEVICES AND CIRCUITS

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EC303	**Professional Core**	**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 OUTCOME:

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

1. Analyze the electrical characteristics and models of semiconductor diodes and apply them in rectifier and clipping circuits
2. Evaluate the operation and configurations of Bipolar Junction Transistors (BJTs) and analyze their input and output characteristics
3. Design appropriate biasing networks for BJTs and determine the operating point for amplifier applications
4. Analyze transistor amplifier circuits using h-parameter models and assess performance for various configurations.
5. 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, Fullwave (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: 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

TEXTBOOKS:

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.

POWER SYSTEM – I

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE304	**Professional Core**	**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 OUTCOME:

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
4. Apply the concepts of voltage drop calculations in AC distribution systems for different loading and power factor conditions
5. Compare the constructional features, advantages, and applications of Air Insulated and Gas Insulated Substations

UNIT-I:

Generation of Electric Power: Operation of Hydel, Thermal, Nuclear and Gas 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).

UNIT-II:

Economics of Power Generation: Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load curve, Load duration curve, number and size of generator units.

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. 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.

UNIT-IV:

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-V:

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

TEXTBOOKS:

1. C. L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", 2nd Edition, New Age International, 2009
2. 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
3. J. B. Gupta, A Course in Power Systems" Katson Books, 11th Edition, 2016.

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.

ELECTRICAL MEASUREMENTS AND SENSORS

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE305	**Professional Core**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: 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 OUTCOME:

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
4. Analyze the operation and applications of DC & AC bridges for measurement of resistance, inductance, and capacitance
5. Evaluate the performance and suitability of various sensors and smart instruments for industrial and commercial 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 rangeusing 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

TEXTBOOKS:

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.

INNOVATION AND ENTREPRENEURSHIP

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25MB306	**Humanities and Social Sciences**	**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 OUTCOME:

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:

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

TEXTBOOKS:

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 LABARATORY

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE307	**Professional Core**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Prerequisite: 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 OUTCOME:

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
4. **Demonstrate** the operation of DC machines and transformers through hands-on laboratory experiments and simulation tools.
5. **Interpret** experimental results and **validate** machine and transformer characteristics

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

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

1. Brake Test on DC shunt motor (Determination of performance curves)
2. Load Test on DC compound generator (Determination of characteristics).
3. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
4. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
5. Speed control of DC shunt motor
6. Modeling of DC Machine using simulation tools.
7. Equivalent circuit of Transformer using simulation tools.

TEXTBOOKS:

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. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013
4. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

ELECTRONIC DEVICES AND CIRCUITS LABARATORY

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EC308	**Professional Core**	**0**	**0**	**2**	**1**	**40**	**60**	**100**

Course Overview:

1. 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 OUTCOME:

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

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.

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

ELECTRICAL MEASUREMENTS AND SENSORS LABARATORY

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE309	**Professional Core**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Prerequisite: Electrical Circuits –I & II								

Course Overview:

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 OUTCOME:

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.
4. Demonstrate calibration and testing procedures for conventional and modern measuring instruments.
5. Interpret experimental results to validate instrument performance and suitability for specific applications

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.
8. Demonstration of different sensors using trainer kit

TEXTBOOKS:

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.

DESIGN OF ELECTRICAL SYSTEMS USING AUTOCAD

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25SD313	**Skill Development**	**0**	**0**	**2**	**1**	**40**	**60**	**100**

COURSE OBJECTIVES:

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

COURSE OUTCOME:

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

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
- 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
- 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
- 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

Software Requirements:

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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.
   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").

ELECTRICAL MACHINES - II

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE401	**Professional Core**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: 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 OUTCOME:

1. Understand the concepts of rotating magnetic fields.
2. Examine the operation of AC machines.
3. Analyze performance characteristics of AC machines.
4. **Evaluate** the voltage regulation and synchronization methods of synchronous generators under different operating conditions
5. **Apply** the principles of synchronous motors and single-phase machines to determine their practical applications in industry

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 intorotor 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

TEXTBOOKS:

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

Online Recourses:

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

NUMERICAL METHODS AND COMPLEX VARIABLES

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25MA402	**Basic Sciences**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: 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 OUTCOME:

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

1. Apply Fourier series and transforms to represent periodic functions and analyze signals using sine and cosine components.
2. Compute forward, backward, and central differences, and use symbolic relations to simplify calculations.
3. Apply numerical integration techniques and solve first-order ordinary differential equations using Taylor, Euler, and Runge-Kutta methods.
4. Analyze complex functions for differentiability and analyticity, and apply methods to find harmonic conjugates and study elementary analytic functions.
5. Evaluate complex integrals using Cauchy's theorems and apply residue calculus to analyze singularities and series expansions.

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).

TEXTBOOKS:

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

POWER SYSTEM – II

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE403	**Professional Core**	**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 OUTCOME:

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.
4. **Design** and **evaluate** control strategies using classical controllers and compensators for desired system performance.
5. **Apply** state-variable methods to model, solve, and assess controllability and observability of dynamic 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

UNIT-IV:

Classical Controllers and Compensators: Proportional, Integral and Derivative Controllers- PI, PD and PID controllers, Lead, Lag and Lead-Lag compensators (elementary treatment only).

UNIT-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

TEXTBOOKS:

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 SYSTEM

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE404	**Professional Core**	**3**	**1**	**0**	**4**	**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 OUTCOME:

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.
4. **Design** and **evaluate** control strategies using classical controllers and compensators for desired system performance.
5. **Apply** state-variable methods to model, solve, and assess controllability and observability of dynamic 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

UNIT-IV:

Classical Controllers and Compensators: Proportional, Integral and Derivative Controllers- PI, PD and PID controllers, Lead, Lag and Lead-Lag compensators (elementary treatment only).

UNIT-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.

TEXTBOOKS:

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.

DIGITAL ELECTRONICS

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE405	**Professional Core**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: Electronic Devices and Circuits								

COURSE OBJECTIVES:

1. To learn fundamental concepts of digital system design and common
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 OUTCOME:

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.
4. **Analyze** and **optimize** combinational and sequential circuits using techniques like K-map simplification and flip-flop conversions
5. **Evaluate** memory organization, characteristics, and programmable logic devices for practical digital system applications

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).

TEXTBOOKS:

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

ELECTRICAL MACHINES - II LAB

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE406	**Professional Core**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Prerequisite: 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 OUTCOME:

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.
4. Demonstrate the operation, testing, and performance evaluation of AC machines and transformers through hands-on experiments.
5. Interpret experimental results to validate theoretical concepts and support decision-making for machine selection and application

The following experiments are required to be conducted as compulsory experiments

1. Load Test on Single phase Induction Motor
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

TEXTBOOKS:

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

CONTROL SYSTEMS LAB

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE407	**Professional Core**	**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 OUTCOME:

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.
4. **Design** and implement classical controllers and compensators (P, PI, PD, PID, Lead-Lag) using simulation tools and experimental setups
5. **Interpret** experimental and simulation results to validate system stability, performance, and controller effectiveness for practical engineering applications.

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

TEXTBOOKS:

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

DIGITAL ELECTRONICS LAB

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE411	**Professional Core**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Prerequisite: Analog Electronics & Digital Electronics								

COURSE OBJECTIVES:

1. To learn basic techniques for the design of digital circuits and number conversion systems.
2. To implement simple logical operations using combinational logic circuits.
3. To design combinational logic circuits, sequential logic circuits.

COURSE OUTCOME:

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. Analyze different types of semiconductor memories.
4. Demonstrate the realization of Boolean expressions and logic functions using various logic families and universal gates.
5. Interpret and verify the operation of combinational and sequential circuits through experimental setups.

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.,

TEXTBOOKS:

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.

PCB DESIGN

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25SD408	**Skill Development**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Prerequisite:								

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 OUTCOME:

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.

Module I: Fundamentals of PCB Design

- Types of PCBs: Single-layer, Double-layer, Multilayer
- PCB materials and manufacturing process
- PCB design rules and standards (IPC standards)
- Introduction to EDA tools (e.g., KiCad, Eagle, Altium, EasyEDA)

Lab Activity:

- Exploring the user interface of PCB design software
- Setting up design rules

Module II: Schematic Design

- Creating circuit schematics using PCB CAD tools
- Component library management
- Electrical rule checking (ERC)
- Netlist generation

Lab Activity:

- Designing a basic power supply or LED flasher circuit
- Performing ERC and generating netlist

Module III: PCB Layout and Routing

- Importing netlist to layout editor
- Footprint assignment and component placement

- Manual vs auto-routing
- Design Rule Check (DRC)

Lab Activity:

- Placing components and routing for the schematic designed earlier
- Performing DRC and correcting errors

Module IV: PCB Output Files and Fabrication

- Generating Gerber files, drill files, and BOM
- Understanding layers (Top, Bottom, Soldermask, Silkscreen)
- PCB printing, photoresist method, and etching
- Introduction to SMD and through-hole assembly

Lab Activity:

- Generate Gerber files and preview using Gerber viewer
- Fabricate a basic single-layer PCB (simulation or actual lab process)

Module V: Mini Project and Testing

- Assembling components on fabricated PCB
- Soldering and desoldering techniques
- Continuity testing and troubleshooting
- Mini-project: Design a simple power supply, logic gate trainer, or timer circuit

Lab Activity:

- Complete mini project: From schematic to testing of PCB

TEXTBOOKS:

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

1. **KiCad** (Open-source)
2. **EasyEDA** (Online tool)
3. **Eagle CAD** (Free for education)
4. **LTSpice / Tinkercad** for circuit simulation (optional)

ENVIRONMENTAL SCIENCE

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25VA400	**Value Added**	**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 OUTCOME:

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**

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.

TEXTBOOKS:

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