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)

COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

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 emerge as a Centre of Excellence in Cyber Security by developing competent professionals through innovative education and research, addressing industry and societal digital security needs with a strong focus on ethics, sustainability, and societal responsibility

DEPARTMENT MISSION

M1: To deliver industry-aligned Cyber Security education through innovative teaching methods and good infrastructure, fostering technical expertise, entrepreneurship, and responsible professional practices.

M2: To build a strong research and innovation ecosystem in Cyber Security through collaboration with academia and industry.

M3: To nurture ethical values and professional responsibility, enabling graduates to apply Cyber Security knowledge for societal welfare, digital trust, and national development.

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

$$\mathbf{SGPA = \{ \Sigma_{N} C_i G_i \} / \{ \Sigma_{N} C_i \}}$$

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), Ci is the no. of credits allotted to the i^{th} course, and Gi 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

$$\mathbf{CGPA = \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \}}$$

where '**M'** is the tota**l** 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), Cj is the no. of credits allotted to the j^{th} course, and Gj 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 of unfair means or misconduct or has the tendency to disrupt the	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.

	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: To provide effective and efficient real time solutions using acquired knowledge in various domains to crack problem using suitable mathematical analysis, data structure and suitable algorithm

PSO2: To develop environmental and sustainable engineering solution having global and societal context using modern IT tools.

PSO3: To exhibit professional and leadership skills with ethical values dealing diversified projects with excellent communication and documentation qualities.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS):

PEO-I: To provide students with a solid foundation in mathematics, engineering, basic science fundamentals required to solve computing problems and also to pursue higher studies and research.

PEO-II: To train students with good Computer Science and Engineering breadth so as to comprehend, analyze, design and create innovative computing products and solutions for real life problems.

PEO-III: To inculcate in students professional and ethical attitude, communication skills, teamwork skills, multi-disciplinary approach and an ability to relate computer engineering issues with social awareness.

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.	25EE103	Basic Electrical Engineering	ES	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.	25CS107	Programming for Problem Solving Lab	ES	0	0	2	1
7.	25PH108	Advanced Engineering Physics Lab	BS	0	0	2	1
8.	25EE111	Basic Electrical Engineering Lab	ES	0	0	2	1
		Induction Program	-	-	-	-	-
		Total Credits		**14**	**1**	**8**	**19**

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.	25EN203	English for Skill Enhancement	HS	3	0	0	3
4.	25EC204	Electronic Devices and Circuits	ES	3	0	0	3
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.	25EN210	English Language and Communication Skills Lab	HS	0	0	2	1
10.	25ES211	Engineering IT Workshop	ES	0	0	2	1
		Total Credits		**15**	**0**	**12**	**21**

II YEAR I SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1.	25MA301	Mathematical and Statistical Foundations	BS	3	0	0	3
2.	25CY302	Computer Organization	PC	3	0	0	3
3.	25CS303	Object Oriented Programming through java	PC	3	0	0	3
4.	25AM304	Software Engineering	PC	3	0	0	3
5.	25CS305	Database Management System	PC	3	0	0	3
6.	25AM306	Software Engineering Lab	PC	0	0	2	1
7.	25CS307	Object Oriented Programming through java Lab	PC	0	0	3	1.5
8.	25CS308	Database Management System Lab	PC	0	0	3	1.5
9.	25SD309	Data Visualization - Power BI	SD	0	0	2	1
		Total Credits		**15**	**0**	**10**	**20**

II YEAR II SEMESTER

S.No.	Course Code	Course Title	C	L	T	P	Credits
1.	25CY401	Discrete Mathematics	PC	3	0	0	3
2.	25CY402	Operating Systems	PC	3	0	0	3
3.	25CY403	Formal Languages and Automata Theory	PC	3	0	0	3
4.	25CS404	Computer Networks	PC	3	0	0	3
5.	25CY405	Mathematical Foundations of Cryptography	PC	3	0	0	3
6.	25MB406	Innovation and Entrepreneurship	HS	2	0	0	2
7.	25CY407	Operating Systems & Computer Networks Lab	PC	0	0	3	1.5
8.	25CY408	Mathematical Foundations of Cryptography Lab	PC	0	0	3	1.5
9.	25SD409	Node JS	SD	0	0	2	1
10.	25VA400	Environmental Science	VA	1	0	0	1
		Total Credits		**18**	**0**	**08**	**22**

III YEAR I SEMESTER

S. No.	Course Code	Course Title	C	L	T	P	Credits
1.	25CY501	Information Security	PC	3	0	0	3
2.	25CY502	Network Management Systems and Operations	PC	3	0	0	3
3.	25MB503	Business Economics and Financial Analysis	HS	3	0	0	3
4.		Professional Elective-I	PE	3	0	0	3
5.		Open Elective-I	OE	2	0	0	2
6.	25CY509	Information Security Laboratory	PC	0	0	3	1.5
7.	25CY510	Network Management Systems and Operations Lab	PC	0	0	3	1.5
8.	25CY511	Field Based Research Project	PC	0	0	4	2
9.	25SD512	Full Stack Development	SD	0	0	2	1
10.	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.	25CY601	Cyber Security Essentials	PC	3	0	0	3
2.	25CY602	Secure Coding Practices	PC	3	0	0	3
3.	25CY603	Algorithm Design and Analysis	PC	3	0	0	3
4.		Professional Elective-II	PE	3	0	0	3
5.		Open Elective-II	OE	2	0	0	2
6.	25CY609	Cyber Security Essentials Lab	PC	0	0	2	1
7.	25CY610	Secure Coding Practices Lab	PC	0	0	2	1
8.	25EN611	English for Employability Skills Lab	HS	0	0	2	1
9.	25CY612	DevOps Lab	PC	0	0	2	1
10.	25SD613	Cyber Defense Techniques	SD	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.	25CY701	Vulnerability Assessment & Penetration Testing	PC	3	0	0	3
2.	25CY702	Cyber Crime Investigation & Digital Forensics	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.	25CY714	Vulnerability Assessment & Penetration Testing Lab	PC	0	0	2	1
8.	25CY715	Cyber Crime Investigation & Digital Forensics Lab	PC	0	0	2	1
9.	25CY716	Industry Oriented Mini Project/ 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.	25CY811	Project Work	PC	0	0	28	14
		Total Credits		**6**	**0**	**28**	**20**

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE – I

25CY504	Artificial Intelligence
25CY505	Web Programming
25CY506	Data Warehousing and Business Intelligence
25CY507	Cloud Computing
25CY508	Mobile Application Development

PROFESSIONAL ELECTIVE – II

25CY604	Machine Learning
25CY605	Data Science
25CY606	Information Retrieval Systems
25CY607	Ad-hoc & Sensor Networks
25CY608	Mobile Application Security

PROFESSIONAL ELECTIVE – III

25CY704	Artificial Intelligence in Cyber Security
25CY705	Cyber Laws
25CY706	Privacy Preserving Data Mining
25CY707	Security Computing
25CY708	Malware Analysis

PROFESSIONAL ELECTIVE – IV

25CY709	Security Incident Response Management (SOC)
25CY710	Authentication Techniques
25CY711	Quantum Computing
25CY712	Information System Audit & Assurance
25CY713	Web Database Security

PROFESSIONAL ELECTIVE – V

25CY801	Deep Learning
25CY802	Block chain Technology
25CY803	Information Storage Management
25CY804	Cloud Security
25CY805	Data Analytics for Fraud Detection

PROFESSIONAL ELECTIVE – VI

25CY806	Digital Watermarking and Steganography
25CY807	Social Media Security
25CY808	Quantum Cryptography
25CY809	Green Computing
25CY810	Data Privacy

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 Sem								
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

BASIC ELECTRICAL ENGINEERING

B Tech I Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE103	**Engineering Sciences**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

COURSE OBJECTIVES:

1. To understand DC circuits and network theorems
2. To study AC circuits and three phase circuits
3. To study and understand Transformers and three phase transformer connection
4. To study about three phase induction motor and alternator
5. To import the knowledge of various electrical installations and the concept of power factor and its improvement

COURSE OUTCOME:

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

1. Understand and analyze Basic Electrical AC circuits
2. Understand and analyze Basic Electrical DC circuits.
3. Study and analyze the equivalent circuit of Transformers and three phase transformer connections
4. Understand construction and working principle of three phase induction motor and alternator
5. Design and develop the Low Voltage component of Electrical Installations

UNIT-I:

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

UNIT-II:

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

UNIT-III:

Transformers: Construction & working principle of transformer, types of transformers Ideal and practical transformer, Model problems related to EMF equation of transformer, Auto transformer, equivalent circuit, losses in transformers, regulation and efficiency. Three phase transformer connections

UNIT-IV:

Electrical Machines: Construction and Working principle of DC machines, performance characteristics of dc shunt machine. Generation of RMF , Construction and Working of 3-

phase Induction motor, Significance of Torque Slip Characteristics, Single phase Induction Motor Construction and Working, Construction and Working Synchronous Generator

UNIT-V:

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

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

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

BASIC ELECTRICAL ENGINEERING LAB

B Tech I Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EE111	**Engineering Sciences**	**0**	**0**	**2**	**1**	**40**	**60**	**100**

COURSE OBJECTIVES:

1. To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach
2. To study the transient response of various R, L and C circuits using different excitations
3. To determine the performance of different types of DC, AC machines and Transformers

COURSE OUTCOME:

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

1. Verify the basic Electrical circuits through different experiments
2. Analyze the transient responses of R, L and C circuits for different input conditions
3. Evaluate the performance calculations of Electrical Rotating Machines through various testing methods
4. Evaluate the performance calculations of Electrical Transformer through various testing methods
5. Examine the electrical circuits performance parameters

List of experiments/demonstrations:

PART- A (compulsory)

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

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

1. Verification of Superposition theorem
2. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star)
3. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
4. Measurement of Active and Reactive Power in a balanced Three-phase circuit
5. No-Load Characteristics of a Three-phase Alternator

TEXTBOOKS:

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

REFERENCE BOOKS:

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

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

ENGLISH FOR SKILL ENHANCEMENT

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EN203	**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

ELECTRONIC DEVICES AND CIRCUITS

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EC204	**Engineering Sciences**	**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 electronic 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, Full- wave (Center-tap and bridge), Capacitor filter for rectifiers, Clippers and clampers, Zener diode – I-V characteristics and voltage regulation

UNIT-II:

Bipolar Junction Transistor (BJT):

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

UNIT-III:

BJT Biasing:

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

UNIT-IV:

Transistor Amplifiers:

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

UNIT-V:

Special Purpose Diodes:

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

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

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25EN210	**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

ENGINEERING IT WORKSHOP

B Tech I Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25ES211	**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

Trades for Exercises of Engineering Workshop:

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. Welding Practice: Arc Welding and Gas Welding
5. House wiring: Parallel and Series, Two-way Switch and Tube Light

EXERCISES OF IT WORKSHOP:

PC Hardware

Task1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

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

Task3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva

Task 4: Every student should install Linux on the computer. This computer should have

windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Word and Excel

Task1–Orientation and Usage of word: The mentor needs to give an overview Microsoft (MS) office or equivalent (FOSS)tool word: Importance of Word as word Processors, Details of the four tasks and features that would be covered in each, Using word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word, to create a project certificate. Features to be covered:- Formatting Fonts in Word, Drop Cap in Word, Applying Text Effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.

Task 2: Creating project and Creating a Newsletter: abstract Features to be covered:- Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes. Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing tool bar and Word Art, Formatting Images, Text boxes, Paragraphs and Mail Merge in word

Excel

Task 3: Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 4: Creating a Scheduler-Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text, Calculating GPA:- Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP

PowerPoint

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

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

Task3: Master Layouts (slide, template, and notes),Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides

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
3. Comdex Information Technology course tool kit Vikas Gupta, *WILEY Dreamtech*
4. The Complete Computer up grade and repair book,3rd edition Chery lA Schmidt, *WILEY Dreamtech*

REFERENCE BOOKS:

1. Workshop Manual, K. Venugopal, Anuradha Publications, 2012 edition, 2012
2. Introduction to Information Technology, ITL Education Solutions Limited, Pearson Education
3. PC Hardware - A Handbook – Kate J. Chase, PHI (Microsoft)
4. LaTeX Companion – Leslie Lamport, PHI / Pearson
5. IT Essentials PC Hardware and Software Companion Guide, Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education
6. IT Essentials PC Hardware and Software Labs and Study Guide, Third Edition by Patrick Regan – CISCO Press, Pearson Education

MATHEMATICAL AND STATISTICAL FOUNDATIONS

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25MA301	**Basic Sciences**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: Mathematics courses of first year of study.								

COURSE OBJECTIVES:

1. The basic concepts of number theory useful for cryptography and related applications.
2. The theory of Random Variable, and the applications of common probability distributions (Binomial, Poisson).
3. The basics of sampling, sampling distributions and the role of the central limit theorem in statistical analysis.
4. Methods for testing hypotheses concerning single and two sample means, proportions, and variances, including F-tests.
5. Techniques of curve fitting and the concepts of correlation and regression for analyzing data in engineering and scientific problems.

COURSE OUTCOME:

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

1. Apply the number theory concepts to cryptography domain.
2. Understand and apply discrete and continuous random variables and their probability distributions.
3. Analyze continuous distributions like uniform and normal, apply sampling techniques, and use the Central Limit Theorem for statistical inference.
4. Apply appropriate statistical tests for single and two sample means, proportions, and variances (F-test included).
5. To perform curve fitting, correlation and regression for given data.

UNIT-I:

Basics of Number Theory 10 L

Greatest Common Divisors and Prime Factorization: Greatest common divisors – The Euclidean algorithm – The fundamental theorem of arithmetic – Factorization of integers and the Fermat numbers. Congruence's: Introduction to congruence's – Linear congruence's.

UNIT-II:

Random Variables and Probability Distributions 8 L

Concept of a Random Variable – Discrete Probability Distributions – Continuous Probability Distributions – Mean of a Random Variable – Variance of a Random Variable

Discrete Probability Distributions: Binomial Distribution – Poisson distribution

UNIT-III:

Continuous Distributions and Sampling 10 L

Uniform Distribution – Normal Distribution – Areas under the Normal Curve – Applications of the Normal Distribution – Normal Approximation to the Binomial Distributions. **Fundamental Sampling Distributions:** Random Sampling – Some Important Statistics – Sampling Distributions – Sampling Distribution of Means – Central Limit Theorem.

UNIT-IV:

Tests of Hypotheses (Large and Small Samples) 10 L

Statistical Hypotheses: General Concepts – Testing a Statistical Hypothesis. Single sample: Tests concerning a single mean. Two samples: Tests on two mean (Unknown for equal variance). One sample: Test on a single proportion. Two samples: Tests on two proportions. Two- sample tests concerning variances: F-distribution

UNIT-V:

Applied Statistics 10 L

Curve fitting by the method of least squares – Fitting of straight lines – Second degree parabolas and more general curves – Correlation and Regression – Rank correlation.

TEXT BOOKS:

1. Kenneth H. Rosen, Elementary Number Theory & its Applications, sixth edition, Addison Wesley, ISBN 978-0-321-50031-1.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
3. S C Gupta and V K Kapoor, Fundamentals of Mathematical Statistics, Khanna publications.

REFERENCE BOOKS:

1. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons, Ltd, 2004.
2. Sheldon M Ross, Probability and statistics for Engineers and scientists, academic press.
3. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.

COMPUTER ORGANIZATION

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CY302	Professional Core	3	0	0	3	40	60	100
Prerequisite: A Course on "Digital Electronics".								

COURSE OBJECTIVES:

1. Understand and apply binary number systems and digital logic fundamentals.
2. Simplify and design combinational circuits using Boolean algebra and Karnaugh maps.
3. Analyze computer architecture concepts including data representation and micro-operations.
4. Explain the organization and control of basic computer systems and instruction cycles.
5. Describe CPU organization, instruction formats, addressing modes, and micro programmed control.

COURSE OUTCOME:

1. Demonstrate the ability to represent and manipulate data using binary number systems and apply Boolean algebra to analyze and design digital logic circuits.
2. Simplify Boolean functions using Karnaugh Maps and design minimal logic circuits using universal logic gates.
3. Classify data representation formats and implement arithmetic, logic, and shift micro operations using register transfer language.
4. Illustrate the basic organization of a computer and differentiate between hardwired and micro programmed control unit designs.
5. Analyze CPU structure, addressing modes, and execute arithmetic operations including fixed point, floating-point, and BCD formats.

UNIT-I:

Binary Systems: Digital Systems, Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Binary Codes, Binary Storage and Registers, Binary Logic.

Boolean Algebra And Logic Gates: Basic Definitions, Axiomatic definition of Boolean Algebra, Basic theorems and properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates, Integrated Circuits.

UNIT-II:

Gate-Level Minimization: The Map method, Four-variable map, Five-variable map, Product of Sum's simplifications, Don't care conditions, NAND and NOR implementation, other two level implementations, Exclusive-OR Function.

UNIT-III:

Basic Structure of Computers: Computer Types, Functional unit, Data Representation, Fixed Point Representation, Floating Point Representation, Error Detection codes.

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, Logic micro-operations, Shift micro operations, Arithmetic logic shift unit

UNIT-IV:

Basic Computer Organization and Design: Instruction codes, Computer Registers, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt, Complete Computer Description.

Micro Programmed Control: Control memory, Address sequencing, micro program example, design of control unit, Micro program Sequencer, Hard wired control Vs Micro programmed control

UNIT-V:

Central Processing Unit Organization: General Register Organization, STACK organization. Instruction formats, Addressing modes. DATA Transfer and manipulation, Program control. Reduced Instruction set computer.

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Floating – point Arithmetic, BCD Adder.

TEXT BOOKS:

1. Digital Design: With an Introduction to the Verilog HDL – Fifth Edition, M. Morris Mano, Pearson Education.
2. Fundamentals of Logic Design – Roth, 7th Edition, Thomson.
3. Computer Systems Architecture – M. Moris Mano, 3rd Edition, Pearson/PHI 4. Computer Organization – Carl Hamacher, Zvonks Vranesic, SafeaZaky, 5th Edition, McGraw Hill.

REFERENCE BOOKS:

1. Digital Principles and Design – Donald D. Givone, Tata Mc Graw Hill.
2. Fundamentals of Digital Logic and Micro Computer Design, 5th Edition, M. Rafiquzzaman, Wiley-Inter science.
3. Computer Organization and Architecture – William Stallings 7th Edition, Pearson/ PHI.
4. Structured Computer Organization – Andrew S. Tanenbaum, 6th Edition PHI/Pearson.

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
25CS303	Professional Core	**L**	**T**	**P**	4	**CIE**	**SEE**	**TOTAL**
		4	0	0		40	60	100

COURSE OBJECTIVES:

1. Understand the basic object-oriented programming concepts and apply them in problem solving.
2. Illustrate classes, objects, inheritance and polymorphism.
3. Demonstrate packages, interfaces and exception handling.
4. Provide knowledge on application development using collection framework.
5. Understand the basics of java console and GUI based programming.

COURSE OUTCOME:

1. Analyze the behavior of basic programming constructs to solve real world problems.
2. Implement the concepts of classes, objects, reusability using inheritance and polymorphism
3. Demonstrate the use of packages and able to handle exceptions raised in programs.
4. Apply Multi-threading concepts to develop inter process communication and develop applications using concepts of collection frameworks.
5. Design interactive programs using Applets, AWT and Swings.

UNIT-I:

OBJECTORIENTEDTHINKING

Introduction, Need of object-oriented programming, Applications of OOP, history of Java, Java Virtual Machine, Java Features/Buzzwords.

Identifiers, Keywords, Data types, Variables, Literals, Operators- Unary, Binary, and Ternary, Expressions, Primitive type conversion and casting, flow of control- branching, conditional, loops.

UNIT-II:

CLASSES, INHERITANCE, POLYMORPHISM

Classes and Objects: Classes, Objects, Methods, Constructors- Types of Constructors, Cleaning up unused objects- Garbage collector, static keyword, this keyword, arrays, Command line arguments, Nested Classes.

Strings: String, String Buffer, String Tokenizer.

Inheritance and Polymorphism: Types of Inheritance, deriving classes using extends keyword, super keyword, Polymorphism – Method overloading, Constructor overloading ,Method overriding, final keyword, abstract classes.

UNIT-III:

INTERFACES, PACKAGES, EXCEPTIONS

Interfaces: Introduction, Extending interfaces, interfaces vs abstract classes. **Packages:**

Creating packages, importing packages, Access protection, Exploring java.io and java.util packages.

Exceptions: Introduction, Exception handling techniques-try…catch, throw, throws, finally block, User defined Exceptions.

UNIT-IV:

MULTITHREADING, COLLECTIONS

Multithreading: java.lang. Thread, main thread, creation of new threads, thread priority, multithreading- using isalive() and join(), Synchronization, Suspending and resuming threads, Communication between threads.

Collections: Overview of Collection Framework – Array List, Vector, Tree Set, Hash Map, Hashable, Iterator, Comparator.

UNIT-V:

APPLETS, AWT AND SWINGS

Applets: Applet class, Applet life cycle. Event Handling-Introduction, Event Delegation Model, Java.awt.event Description, Adapter classes.

Abstract Window Toolkit: Introduction to AWT, components and containers, Button, Label, Check box, Radio Button, Choice, List, Text Field and Text Area, Layout Managers.

Swings: JFrame, JComponent, JPanel, Components in Swings: JScrollPane, JTabbedPane, JDialog Box, JTree, JTable.

TEXT BOOKS:

1. Java: The Complete Reference,10th edition,Herbert Schildt,Mcgraw Hill.
2. Java Fundamentals: A Comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
3. Java for Programming, P.J.Dietel Pearson Education.

REFERENCE BOOKS:

1. Object Oriented Programming through Java, P.RadhaKrishna, Universities Press.
2. Thinking in Java, BruceEckel, Pearson Education.
3. Programming in Java, S.Malhotra and S.Choudhary, Oxford University Press.

SOFTWARE ENGINEERING

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25AM304	**Professional Core**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite:								

COURSE OBJECTIVES:

1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

COURSE OUTCOME:

1. Describe the principles of software engineering, various process models, and their applications in software development.
2. Elicit, analyze, and document software requirements, distinguishing between functional and non-functional requirements.
3. Design software architectures and models using UML diagrams and architectural patterns to meet system requirements.
4. Apply testing strategies including black-box and white-box testing, and evaluate software quality using relevant metrics.
5. Identify, assess, and manage software risks, and implement quality assurance processes adhering to industry standards.

UNIT-I:

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI). Process models: The waterfall model, Spiral model, Incremental Process Models, Concurrent Models, Component based development and Agile Development.

UNIT-II:

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document. Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

UNIT-III:

Design Engineering: Design process and design quality, design concepts, the design model.

Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, use case diagrams, class diagrams, sequence diagrams, collaboration diagrams, activity diagrams and component diagrams.

UNIT-IV:

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.

Metrics for Process and Products: Software measurement, metrics for software quality.

UNIT-V:

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM.

Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

TEXT BOOKS:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, McGraw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.
3. The unified modeling language user guide, Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

REFERENCE BOOKS:

1. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.
3. Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.
4. Fundamentals of Software Engineering-Rajib Mall, PHI.

DATABASE MANAGEMENT SYSTEM

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CS305	Professional Core	3	0	0	3	40	60	100
Prerequisite: A course on "Data Structures".								

COURSE OBJECTIVES:

To learn

1. To understand the basic concepts and the applications of database systems.
2. To master the basics of PL/SQL and construct queries using SQL.
3. Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

COURSE OUTCOME:

1. Interpret the concepts of Database systems and design issues in modeling applications.
2. Develop the database using constraints and queries in SQL and PL/SQL.
3. Outline the concepts of relational model and indexing techniques.
4. Apply the Schema Refinement techniques for database design.
5. Summarize the components of transaction management in database systems.

UNIT-I:

Introduction to Database and System Architecture:

Database Systems and their Applications, Database Vs File System, View of Data, Data Models, Database users and Administrator, Database SystemStructure.

Introduction to Database Design: ER Diagrams, Attributes, Entities and Entity sets, Relationships and Relationship sets, Extended ER Features, Conceptual Design with the ER Model, Logical database Design.

UNIT-II:

SQL Queries and Constraints: Types of SQL Commands, Form of Basic SQL Query, SQL Operators, Aggregate Operators, Set Operators, Nested Queries, NULL values, Keys, Integrity Constraints Over Relations, Joins, Introduction to Views, Introduction to PL/SQL, Cursors, Triggers and Active Databases.

UNIT-III:

Relational Model:

Introduction to Relational Model, Basic Structure, Database Schema, Relational Algebra, Relational Calculus.

File Organization and Indexing:

Introduction, Types of File Organizations, Overview of Indexes, Types of Indexes, Index DataStructures, Tree structured Indexing, Hash based Indexing.

UNIT-IV:

Schema Refinement:

Introduction to Schema Refinement, Properties of Decomposition, Functional Dependencies, Reasoning about FD,

Normalization: Normal Forms – 1NF, 2NF, 3NF, BCNF, 4NF and 5NF.

UNIT-V:

Transaction Management:

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability.

Concurrency Control: Lock based Protocols, Time stamp based protocols, validation based protocols.

Recovery System: Recovery and Atomicity, Log based recovery, Shadow Paging, Recovery with concurrent Transactions, Buffer Management.

TEXTBOOKS:

1. "Database Management Systems", Raghurama Krishnan, Johannes Gehrke, TATA Mc GrawHill 3rd Edition.
2. "Database System Concepts", Silberschatz, Korth, Mc Grawhill, V edition.
3. "Introduction to Database Systems", C.J. Date Pearson Education.

REFERENCEBOOKS:

1. "Database Systems design, Implementation and Management", Rob & Coronel 5th Edition.
2. "Database Management Systems", P.Radha Krishna HI-TECH Publications 2005.
3. "Database Management System", Elmasri Navate, Pearson Education.

SOFTWARE ENGINEERING LAB

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25AM306	**Professional Core**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Prerequisite : Prerequisites: A course on "Programming for Problem Solving". **Co-requisite: A Course on "Software Engineering".**								

COURSE OBJECTIVES:

1. To have hands-on experience in developing a software project by using various software
2. engineering principles and methods in each of the phases of software development.

COURSE OUTCOME:

1. Ability to translate end-user requirements into system and software requirements
2. Ability to generate a high-level design of the system from the software requirements
3. Will have experience and/or awareness of testing problems
4. Will be able to develop a simple CASE tools
5. Will be able to develop a simple testing report

List of Experiments

Do the following seven exercises for any two projects given in the list of sample projects or any other Projects:

1. Development of problem statements.
2. Preparation of Software Requirement Specification Document, Design Documents and Testing
   Phase related documents.
3. Preparation of Software Configuration Management and Risk Management related documents.
4. Study and usage of any Design phase CASE tool
5. Performing the Design by using any Design phase CASE tools.
6. Develop test cases for unit testing and integration testing
7. Develop test cases for various white box and black box testing techniques.

Sample Projects:

1. Passport automation System
2. Book Bank
3. Online Exam Registration
4. Stock Maintenance System
5. Online course reservation system
6. E-ticketing
7. Software Personnel Management System
8. Credit Card Processing
9. E-book management System.
10. Recruitment system

TEXT BOOKS:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, McGraw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.
3. The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.

REFERENCE BOOKS:

1. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill

OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
25CS307	Professional Core	**L**	**T**	**P**	1.5	**CIE**	**SEE**	**TOTAL**
		0	0	3		40	60	100

COURSE OUTCOME:

1. Analyze a problem, identify and define the computing requirements appropriate to its solution
2. Using object-oriented programming concepts.
3. Design the applications using Inheritance, Polymorphism and Synchronization concepts.
4. Handle exceptions at Compile time and Run time.
5. Solve the real-world problems using Java Collection framework & Develop GUI applications using Applets, AWT and Swings.

LIST OF EXPERIMENTS

TASK 1

Write java programs that implement the following a. Class and object b. Constructor c. Parameterized constructor d. Method overloading e. Constructor overloading.

TASK 2

a) Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome.

b) Write a Java program for sorting a given list of names in ascending order.

c) Write a Java Program that reads a line of integers, and then displays each integer and the sum of all the integers (Use StringTokenizer class of java.util)

TASK 3

Write java programs that uses the following keywords

a) this b) super c) static d) final

TASK 4

a) Write a java program to implement method overriding

b) Write a java program to implement dynamic method dispatch.

c) Write a Java program to implement multiple inheritance.

d) Write a java program that uses access specifiers.

TASK 5

a) Write a Java program that reads a file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.

b) Write a Java program that reads a file and displays the file on the screen, with a line number before each line.

c) Write a Java program that displays the number of characters, lines and words in a text file

TASK 6

a) Write a Java program for handling Checked Exceptions.

b) Write a Java program for handling Unchecked Exceptions.

TASK 7

a) Write a Java program that creates three threads. First thread displays "Good Morning" every one second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds. b) Write a Java program that correctly implements producer consumer problem using the concept of interthread communication.

TASK 8

Write a program illustrating following collections framework

a) ArrayList b) Vector c) Hash Table d) Stack

TASK 9

a) Develop an applet that displays a simple message.

b) Develop an applet that receives an integer in one text field and compute its factorial value a return it in another text field, when the button named "Compute" is clicked. c) Write a J program that works as a simple calculator. Use a grid layout to arrange button for the digitsand the +, -,*, % operations. Add a text field to display the result.

TASK 10

a) Write a Java program for handling mouse events.

b) Write a Java program for handling key events.

TASK 11

a) Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields Num1 and Num 2.

b) The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1or Num2 were not an integer, the program would throw Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception and display the exception in a message dialog box.

TASK 12

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

b) Write a Java program that allows the user to draw lines, rectangles and ovals.

c) Create a table in Table.txt file such that the first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using JTable component.

TEXT BOOKS:

1. Java: The Complete Reference, 10th edition, Herbert Schildt, Mcgraw Hill.

2. Java Fundamentals - A Comprehensive introduction, Herbert Schildt and Dale skrien, TMH.
3. Java for programming, P.J. Dietel Pearson education (OR) Java: How to Program P.J. Dietel and H.M. Dietel, PHI

REFERENCE BOOKS:

1. Object Oriented Programming through java, P. Radha Krishna, Universities Press.
2. Thinking in Java, Bruce Eckel, Pearson Education
3. Programming in Java, S. Malhotra and S. Choudhary, Oxford University Press.

DATABASE MANAGEMENT SYSTEM LAB

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
25CS308	Professional Core	**L**	**T**	**P**	1.5	**CIE**	**SEE**	**TOTAL**
		0	0	3		40	60	100
Co-requisites: Co-requisite of course "Database Management Systems"								

COURSE OBJECTIVES:

1. Introduce ER data model, database design and Normalization
2. Learn SQL basics for data definition and data manipulation

COURSE OUTCOME:

1. Demonstrate the use of DDL and DML commands in SQL.
2. Apply the basic SELECT operations for data retrieval.
3. Illustrate the SQL concepts to retrieve data from multiple tables.
4. Construct PL/SQL code to work with database objects.
5. Experiment with procedural constructs and exception handling to develop applications in the database systems.

LIST OF EXPERIMENTS:

TASK 1 : Concept design with E-R Model

1. Requirement Analysis & Collection
2. Identify Entities and Attributes
3. Identify Relationships
4. Draw the E-R Diagram
5. Validate and Refine the E-R Model

TASK 2 : DDL commands (Create, Alter, Drop, Truncate)

1. Create a table EMP with the following structure:

Name	Data Type
EMPNO	NUMBER(6)
ENAME	VARCHAR2(20)
JOB	VARCHAR2(10)
MGRID	NUMBER(6)
DEPTNO	NUMBER(3)
SAL	NUMBER(7,2)

2. Add a column **commission** to the emp table. Commission should be numeric with null valuesallowed.
3. Alter the **job** field of EMP table by modifying its size.
4. Create a table DEPT with the following structure:

Name	Data Type
DEPTNO	NUMBER(3)

DNAME VARCHAR2(10)
LOC VARCHAR2(10)

DEPTNO as the primary key

5. Add constraints to the EMP table with **empno** as the primary key and **deptno** as the foreign key referencing the DEPT table.
6. Add check constraint to the EMP table to check the **empno** value with **empno**>100.
7. Add NOT NULL constraint on **sal** field with default value 5000, otherwise it should accept the values from the user.
8. Add columns **dob, doj** with date data type to the EMP table. Drop the column **doj** from the EMP table.
9. Create EMP1, EMP2 tables as copy of EMP table. Drop EMP1 table and truncate EMP2 table.

TASK 3: DML COMMANDS (Insert, Update, Delete)

1. Insert 5 records into DEPT table.
2. Insert 11 records into EMP table.
3. Update the EMP table to set the value of **commission** of all employees to Rs1000/- who are working as "clerk".
4. Delete the records from EMP table whose **job** is "Admin".
5. Delete the rows from DEPT table whose **deptno** is 10.

TASK 4: DQL COMMAND (SELECT) - SQL Operators and Order by Clause

Note: Use EMPLOYEES and DEPARTMENTS tables of HR Schema

1. List the records in the EMPLOYEES table by sorting the salary in descending order.
2. Display only those employees whose department number is 30.
3. Display the unique department numbers from EMPLOYEES table.
4. List the employee name, salary and 15% rise in salary. Label the column as "pay_hike".
5. Display the rows whose salary ranges from 5000 to 7500.
6. Display all the employees in department 10 or 20 in alphabetical order of employee names.
7. List the employee names who do not earn commission.
8. Display all the details of the employees with 5-character names with 'S' as starting character.
9. Display joining date of all employees in the year of 1998.
10. List out the employee names whose salary is greater than 5000 and less than 6000.

TASK 5: SQL Aggregate Functions, Group By clause, Having clause

1. Count the total records in the EMPLOYEES table.
2. Calculate the total and average salary of the employees.
3. Determine the max and min salary and rename the column as "max_salary" and "min_salary".
4. Find number of unique departments from the EMPLOYEES table.
5. Display job wise sum, average, maximum, and minimum salary from EMPLOYEES table.
6. Display maximum salaries of all the departments having maximum salary >2000.
7. Display job wise sum, average, maximum, minimum salaries in department 10 having

average salary greater than1000. Sort the result with the sum of salary in descending order.

TASK 6: SQL Functions

1. Display the employee name concatenated with employee number.
2. Display the employee name with half of employee name in upper case and half in lowercase.
3. Display the month name of "14-OCT-09" in full.
4. Display the date of joining of all employees in the format "dd-mm-yy".
5. Display the date after two months of hire date of employees.
6. Display the last date of the month in "05-OCT-09".
7. Display the hire date by rounding the date with respect to month and year.
8. Display the commission earned by employees. If they do not earn commission, display it as "NoCommission".

TASK 7: Nested Queries

1. Display the salary of the third highest paid employee in EMPLOYEES table.
2. Display the employee name and salary of employees whose salary is greater than the minimum salary of the company and job title starts with 'I'.
3. Write a query to display information about employees who earn more than any employee in department number 30.
4. Display the employees who have the same job as "Jones" and whose salary is greater than or equal to the salary of "Ford".
5. List out the employee names who get the salary greater than the maximum salary of departments with department number 20, 30.
6. Display the maximum salary of the departments where maximum salary is greater than 9000.
7. Create a table employee with the same structure as EMPLOYEES table and insert rows into the table using select clause.
8. Create MANAGER table from the EMPLOYEES table which should hold details only about the managers.

TASK 8: Joins, Set Operators.

1. Display all the EMPLOYEES and the DEPARTMENTS information implementing a left outer join.
2. Display the employee name and department name in which they are working implementing a fullouter join.
3. Write a query to display the employee name, salary and their manager's name for everyemployee.
4. Write a query to display the employee name, job, employee number, department name and location for each department, even if there are no employees.
5. Display the details of employees those who draw the same salary.
6. Display the names of employees who did not change their job at least once. (Use Set Operators)
7. Display the names of employees whose current job_id is same as their previous one. (Use Set Operators)
8. Display the names of employees with their current and previous job details. (Use Set

Operators)

TASK 9: Views

1. Create a view that displays the employee id, name and salary of employees who belong to10th department using with check option.
2. Create a view with read only option that displays the employee name and their department name.
3. Display all the views generated.
4. Execute the DML commands on the views created.

TASK 10: TCL COMMANDS (Save Point, Rollback, Commit)

TASK 11: Triggers, Procedures, and Functions

1.Write a trigger on employee table that shows the old and new values of employee name after updatingon employee name.

2.Write a PL/SQL procedure to insert, delete, and update the records in the EMPLOYEES table.

3.Write a PL/SQL function that accepts the department number and returns the total salary of thatdepartment.

TASK 12: NORMALIZATION

1. Identify Functional Dependencies
2. Check for 1NF (First Normal Form)
3. Decompose into 2NF (Second Normal Form)
4. Decompose into 3NF (Third Normal Form)
5. Apply Boyce-Codd Normal Form (BCNF)
6. Normalization to 4NF and 5NF

TEXT BOOKS:

1. The Complete Reference, 3rd edition by James R.Groff, Paul N.Weinberg, Andrew J. Oppel
2. SQL & PL/SQL for Oracle10g, Black Book, Dr. P.S.Deshpande.

REFERENCE BOOKS:

1. Database Systems design, Implementation and Management", Rob &Coronel 5th Edition.
2. "Database Management Systems", P.Radha Krishna HI-TECH Publications 2005.
3. "Database Management System", Elmasri Navate, Pearson Education.

DATA VISUALIZATION - POWER BI

B Tech II Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25SD309	**Skill Development**	**0**	**0**	**2**	**1**	**40**	**60**	**100**

COURSE OBJECTIVES:

1. Effective use of Business Intelligence (BI) technology (Tableau) to apply data visualization
2. To discern patterns and relationships in the data.
3. To build Dashboard applications.
4. To communicate the results clearly and concisely.
5. To be able to work with different formats of data sets.

COURSE OUTCOME:

1. Understand how to import data into Tableau.
2. Understand concepts of Dimensions and Measures.
3. Develop Programs and understand how to map Visual Layouts and Graphical Properties
4. Create Dashboard, custom charts
5. publish to tableau online for any real time dataset

LIST OF PROGRAMS

1. Understanding Data, what is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization.

2. Getting started with Tableau Software using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Tree maps), Using the Show me panel.

3. Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.

4. Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view.

5. Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data

6. Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data.

7. Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colors.

8. Creating Dashboards & Storytelling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.

9. Tableau file types, publishing to Tableau Online, sharing your visualizations, printing, and exporting.

10. Creating custom charts, cyclical data and circular area charts, Dual Axis charts.

11. Visualize various data patterns taking any dataset from Kaggle.

12. Visualize data patterns using Google Charts by creating interactive Line, Bar, and Pie charts along with Dashboards using HTML and JavaScript.

TEXTBOOKS:

1. Brett Powell, Microsoft Power BI cookbook, 2nd edition.
2. Roger D. Peng, R Programming for Data Science
3. Norman Matloff Cengage Learning India, The Art of R Programming.

WEB REFERENCE:

1. https://developers.google.com/chart/interactive/docs.

DISCRETE MATHEMATICS

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
25CY401	**Professional Core**	**L**	**T**	**P**	**3**	**CIE**	**SEE**	**TOTAL**
		3	**0**	**0**		**40**	**60**	**100**

COURSE OBJECTIVES:

1. Introduces elementary discrete mathematics for computer science and engineering.
2. Topics include formal logic notation, methods of proof, induction, sets, relations, algebraic structures, elementary graph theory, permutations and combinations, counting principles; recurrence relations and generating functions.

COURSE OUTCOME:

1. Understand and construct precise mathematical proofs
2. Apply logic and set theory to formulate precise statements
3. Analyze and solve counting problems on finite and discrete structures
4. Describe and manipulate sequences
5. Apply graph theory in solving computing problems

UNIT-I:

Mathematical logic: Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

UNIT-II:

Set theory: Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

UNIT-III:

Algebraic Structures: Introduction, Algebraic Systems, Semi groups and Monoids, Lattices as Partially Ordered Sets, Boolean Algebra.

UNIT-IV:

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Exclusion.

UNIT-V:

Graph Theory: Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science: J.P. Tremblay, R. Manohar, McGraw-Hill, 1st ed.
2. Discrete Mathematics for Computer Scientists & Mathematicians: Joe l. Mott, Abraham Kandel, Teodore P. Baker, Prentis Hall of India, 2nd ed.

REFERENCE BOOKS:

1. Discrete and Combinatorial Mathematics - an applied introduction: Ralph. P. Grimald, Pearson education, 5^{th} edition.
2. Discrete Mathematical Structures: Thomas Kosy, Tata McGraw Hill Publishing co.

OPERATING SYSTEMS

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CY402	**Professional core**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: **1. A course on "Computer Programming and Data Structures".** **2. A course on "Computer Organization and Architecture".**								

COURSE OBJECTIVES:

1. Introduce operating system concepts (i.e., processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection)
2. Introduce the issues to be considered in the design and development of operating system
3. Introduce basic Unix commands, system call interface for process management, inter process communication and I/O in Unix

COURSE OUTCOME:

1. Will be able to control access to a computer and the files that may be shared
2. Demonstrate the knowledge of the components of computers and their respective roles in computing.
3. Ability to recognize and resolve user problems with standard operating environments.
4. Gain practical knowledge of how programming languages, operating systems
5. Gain practical knowledge of how architectures interact and how to use each effectively.

UNIT-I:

Operating System - Introduction, Structures - Simple Batch, Multiprogrammed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls

Process - Process concepts and scheduling, Operations on processes, Cooperating Processes, Threads

UNIT-II:

CPU Scheduling - Scheduling Criteria, Scheduling Algorithms, Multiple -Processor Scheduling. System call interface for process management-fork, exit, wait, waitpid, exec

Deadlocks - System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock

UNIT-III:

Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors

Inter process Communication Mechanisms: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

UNIT-IV:

Memory Management and Virtual Memory - Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms.

UNIT-V:

File System Interface and Operations -Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management. Usage of open, create, read, write, close,lseek, stat, ioctl system calls.

TEXT BOOKS:

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
2. Advanced programming in the UNIX environment, W.R. Stevens, Pearson education.

REFERENCE BOOKS:

1. Operating Systems- Internals and Design Principles, William Stallings, Fifth Edition–2005,Pearson Education/PHI
2. Operating System A Design Approach- Crowley, TMH.
3. Modern Operating Systems, Andrew S. Tanenbaum 2nd edition, Pearson/PHI
4. UNIX programming environment, Kernighan and Pike, PHI/ Pearson Education
5. Internals -The New Frontiers, U. Vahalia, Pearson Education.

FORMAL LANGUAGES AND AUTOMATA THEORY

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CY403	**Professional core**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: Mathematical Foundations								

COURSE OBJECTIVES:

1. To provide introduction to some of the central ideas of theoretical computer science from the perspective of formal languages.
2. To introduce the fundamental concepts of formal languages, grammars and automata theory.
3. Classify machines by their power to recognize languages.
4. Employ finite state machines to solve problems in computing.
5. To understand deterministic and non-deterministic machines.
6. To understand the differences between decidability and undecidability.

COURSE OUTCOME:

1. Understand the concept of abstract machines and their power to recognize the languages.
2. Employ finite state machines for modeling and
3. Ability to solve computing problems.
4. Design context free grammars for formal languages.
5. Distinguish between decidability and undecidability.

UNIT-I:

Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems.

Nondeterministic Finite Automata: Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions.

Deterministic Finite Automata: Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions. Conversion of NFA to DFA, Moore and Melay machines

UNIT-II:

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions. Pumping Lemma for Regular Languages, Statement of the pumping lemma, Applications of the Pumping Lemma.

Closure Properties of Regular Languages: Closure properties of Regular languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.

UNIT-III:

Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Tress, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages.

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA,

Equivalence of PDA's and CFG's, Acceptance by final state, Acceptance by empty stack, Deterministic Pushdown Automata. From CFG to PDA, From PDA to CFG.

UNIT-IV:

Normal Forms for Context- Free Grammars: Eliminating useless symbols, Eliminating €-Productions. Chomsky Normal form Greibach Normal form.

Pumping Lemma for Context-Free Languages: Statement of pumping lemma, Applications

Closure Properties of Context-Free Languages: Closure properties of CFL's, Decision Properties of CFL's Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine

UNIT-V:

Types of Turing machine: Turing machines and halting

Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem that is RE, Undecidable Problems about Turing Machines, Recursive languages, Properties of recursive languages, Post's Correspondence Problem, Modified Post Correspondence problem, Other Undecidable Problems, Counter machines.

TEXT BOOKS:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Theory of Computer Science – Automata languages and computation, Mishra and Chandrasekaran, 2nd edition, PHI.

REFERENCE BOOKS:

1. Introduction to Languages and The Theory of Computation, John C Martin, TMH.
2. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
3. A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press.
4. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.
5. Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan,Rama R, Pearson.

COMPUTER NETWORKS

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CS404	**Professional core**	**3**	**0**	**0**	**3**	**40**	**60**	**100**
Prerequisite: 1. A course on "Programming for problem solving". **2. A course on "Data Structures".**								

COURSE OBJECTIVES:

1. Equip the students with a general overview of the concepts and fundamentals of computer networks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.
3. Elucidate the students about working and implementation of protocols at various layers in protocols stack.
4. Appreciating the protocol working by observing and analyzing outputs of the packet sniffer

COURSE OUTCOME:

1. Gain the knowledge of the basic computer network technology.
2. Gain the knowledge of the functions of each layer in the ISO-OSI and TCP/IP reference model.
3. Obtain the skills of sub netting and routing mechanisms.
4. Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.
5. Understanding working of the protocols through traces captured by a packet sniffer

UNIT-I:

Introduction: The Internet, Protocol, Network Edge, Access Networks, Network Core, Packet Switching, Circuit Switching, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol reference models: ISO-OSI, TCP/IP, Types of Network attacks, History of Computer Networking and the Internet.

UNIT-II:

Application Layer: Principles of Network Applications, Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols, The Web and HTTP, File Transfer: FTP, Electronic Mail in the
Internet, SMTP, DNS, Peer-to-Peer Applications, Socket Programming: Creating Network Applications.

UNIT-III:

Transport Layer: Transport-Layer Services, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N (GBN), Selective Repeat (SR),Connection-Oriented Transport: TCP, The TCP Connection, Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection

Management, Principles of Congestion Control, TCP Congestion Control, Fairness.

UNIT-IV:

Network Layer: Data and Control plane, Forwarding and Routing 308, Network Service Models, Virtual Circuit and Datagram Networks, Router working, The Internet Protocol (IP): Forwarding and Addressing in the Internet, Datagram Format, IPv4 Addressing, Internet Control Message Protocol(ICMP), IPv6, IP Security, Routing Algorithms- The Link-State (LS) Routing Algorithm, The Distance Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet-Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP, Broadcast and Multicast Routing, Broadcast Routing Algorithms, Multicasting.

UNIT-V:

The Link Layer: The Services Provided by the Link Layer, Error-Detection and -Correction Techniques Parity Checks, Checksum Methods, Cyclic Redundancy Check (CRC), Hamming code, Multiple Access Links and Protocols, Channel Partitioning Protocols, Random Access Protocols, Taking-Turns Protocols, DOCSIS: The Link-Layer Protocol for Cable Internet Access, Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs),Link Virtualization-Multiprotocol Label Switching (MPLS), Data Center Networking, A Day in the Life of a Web Page Request. Wireless network characteristics, Wireless LAN.

TEXT BOOKS:

1. Computer Networking: A Top-Down Approach – James F.Kurose, Keith W. Ross, Pearson
2. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson/PHI

REFERENCE BOOKS:

1. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

MATHEMATICAL FOUNDATIONS OF CRYPTOGRAPHY

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CY405	**Professional core**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

COURSE OBJECTIVES:

1. Build a solid mathematical basis to understand foundations of cryptography
2. Formally understand the notions related to security authentication and privacy.
3. Provide a rigorous treatment of the emerging and key subject subarea of CSE - security.

COURSE OUTCOME:

1. Students will gain an understanding of the basic cryptographic functions, computational models, and complexity classes
2. Students will gain an understanding of universal one-way functions and trapdoor permutations, and **analyze** computational indistinguishability in various scenarios.
3. Apply the principles of Zero-Knowledge Proof Systems to demonstrate security in interactive protocols.
4. Understand about encryption schemes and **assess** their security through notions like semantic security and indistinguishability.
5. **Design and analyze** secure digital signatures and message authentication schemes using pseudorandom functions to ensure authenticity, integrity, and resistance to attacks.

UNIT-I:

Basic functions of cryptography - Encryption Schemes, Digital Signatures, Fault Tolerant Protocols and Zero-Knowledge Proofs.

The Computational Model: P, NP, and NP- Completeness, Probabilistic Polynomial Time, Non-Uniform Polynomial Time

UNIT-II:

Computational Difficulty One-Way Functions Definitions, Strong One- Way Functions, Weak One-Way Functions, Universal One-Way Function, Trapdoor One-Way Permutations Computational Indistinguishability: Definition,

Relation to Statistical Closeness, Indistinguishability by Repeated Experiments, Indistinguishability by Circuits

UNIT-III:

Zero-Knowledge Proof Systems : Zero-Knowledge Proofs, Perfect and Computational Zero-Knowledge, An Example (Graph Isomorphism in PZK) Zero-Knowledge with Respect to Auxiliary Inputs

UNIT-IV:

Encryption Schemes: Private-Key versus Public-Key Schemes, The Syntax of Encryption

Schemes, Semantic Security, Indistinguishability of Encryptions, Stream--Ciphers, Preliminaries: Block—Ciphers

UNIT-V:

Digital Signatures and Message Authentication: Attacks and security, Variants Constructions of Message Authentication Schemes: Applying a pseudorandom function to the document

TEXTBOOKS:

1. Foundations of Cryptography (two volumes), Oded Goldreich, Cambridge university Press,2004. (Indian print available).

REFERENCEBOOKS:

1. Introduction to Modern Cryptography, J. Katz, Y. Lindell, Chapman Hall, USA 2007.
2. Modern cryptography - Theory and practice, Wen Bo Mao, Prentice Hall, USA, 2003 (Indian edition available)

OPERATING SYSTEMS & COMPUTER NETWORKS LAB

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CY407	**Professional core**	**0**	**0**	**3**	**1.5**	**40**	**60**	**100**

Prerequisite:

- **A course on "Programming for Problem Solving".**
- **A course on "Computer Organization and Architecture".**

Co-requisite: A course on "Operating Systems".

COURSE OBJECTIVES:

1. To provide an understanding of the design aspects of operating system concepts through simulation.
2. Introduce basic Unix commands, system call interface for process management, inter process communication and I/O in Unix.
3. To understand the working principle of various communication protocols.
4. To understand the network simulator environment and visualize a network topology and observe its performance
5. To analyze the traffic flow and the contents of protocol frames

COURSE OUTCOME:

1. Simulate and implement operating system concepts such as scheduling, deadlock management, file management and memory management.
2. Able to implement C programs using Unix system calls.
3. Implement data link layer farming methods & Analyze error detection and error correction codes.
4. Implement and analyze routing and congestion issues in network design.
5. Implement Encoding and Decoding techniques used in presentation layer & able to work with different network tools

LIST OF EXPERIMENTS:

1. Write C programs to simulate the following CPU Scheduling algorithms a) FCFS b) SJF c)Round Robin d) priority
2. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
3. Write a C program to implement the Producer – Consumer problem using semaphores using UNIX/LINUX system calls.
4. Write C programs to simulate Page replacement policies a) FCFS b) LRU c) Optimal
5. Implement the data link layer framing methods such as character, character-stuffing and bit stuffing.
6. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
7. Implement Dijsktra's algorithm to compute the shortest path through a network
8. Take an example subnet of hosts and obtain a broadcast tree for the subnet.
9. Implement distance vector routing algorithm for obtaining routing tables at each node.
10. Implement data encryption and data decryption

11. Write a program for congestion control using Leaky bucket algorithm.

TEXT BOOKS:

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.
2. Advanced programming in the Unix environment, W. R. Stevens, Pearson education.

REFERENCE BOOKS:

1. Operating Systems – Internals and Design Principles, William Stallings, Fifth Edition–2005,Pearson Education/PHI.
2. Operating System - A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S Tanenbaum, 2nd edition, Pearson/PHI.
4. UNIX Programming Environment, Kernighan and Pike, PHI/Pearson Education.
5. UNIX Internals: The New Frontiers, U. Vahalia, Pearson Education.

MATHEMATICAL FOUNDATIONS OF CRYPTOGRAPHY LAB

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25CY408	**Engineering Sciences**	**0**	**0**	**3**	**1.5**	**40**	**60**	**100**

COURSE OUTCOME:

1. Apply classical and modern encryption techniques to ensure data confidentiality and integrity.
2. Demonstrate the generation and verification of digital signatures using cryptographic libraries.
3. Simulate secure protocols and fault-tolerant mechanisms in distributed systems.
4. Implement and analyze Zero-Knowledge Proofs to understand privacy-preserving authentication.
5. Evaluate and compare cryptographic primitives such as hash functions, MACs, and encryption schemes.

LIST OF EXPERIMENTS:

1. Implement Basic Encryption/Decryption Schemes
   - Implement Caesar cipher, Vigenère cipher, and XOR cipher.
   - Test encryption and decryption on text input.
2. Demonstrate Digital Signature Generation and Verification
   - Use Python libraries (e.g., cryptography or pycryptodome) to sign a message with a private key and verify it using a public key.
3. Simulate a Fault-Tolerant Protocol
   - Simulate a basic consensus protocol (like 2-phase commit) handling failure scenarios.
4. Implement Zero-Knowledge Proof (ZKP) Concept
   - Simulate a ZKP for Graph Isomorphism using a challenge-response protocol.
5. Implement a Simple One-Way Hash Function
   - Build a toy hash function and demonstrate its one-way property. Compare it to SHA-256.
6. Test for Strong and Weak One-Way Functions
   - Write a program to simulate strong vs weak one-way functions. Use time complexity analysis to show difficulty of inversion.
7. Demonstrate Trapdoor One-Way Permutations
   - Use RSA key generation to demonstrate how trapdoor functions work in public-key encryption.
8. Demonstrate Computational Indistinguishability
   - Create two similar distributions and test whether a computational process can distinguish between them (simulate using coin tosses).
9. Implement a Zero-Knowledge Proof for Discrete Logarithms
   - Given a number , simulate ZKP to prove knowledge of xxx without revealing it.
10. Implement Perfect and Computational ZKP

- Demonstrate perfect ZKP using small problems like Sudoku validation without revealing the solution.

11. Auxiliary Inputs in ZKP
    - Simulate a scenario where an adversary has auxiliary information and test how ZKP maintains secrecy.
12. Compare Private-Key vs Public-Key Encryption
    - Implement AES (symmetric) and RSA (asymmetric) and compare their usage on messages.
13. Demonstrate Block Cipher Modes
    - Implement ECB, CBC, and CFB modes for AES and show their impact on ciphertext for patterned plaintext.
14. Implement a Digital Signature Scheme Using RSA
    - Generate keys, sign a message, and verify using the RSA algorithm.
15. Construct a Message Authentication Code (MAC)
    - Use a pseudorandom function like HMAC-SHA256 to generate and verify MACs for file integrity.

TEXT BOOKS:

1. Foundations of Cryptography (two volumes), Oded Goldreich, Cambridge university Press,2004. (Indian print available).

REFERENCE BOOKS:

1. Introduction to Modern Cryptography, J. Katz, Y. Lindell, Chapman Hall, USA 2007.
2. Modern cryptography - Theory and practice, Wen Bo Mao, Prentice Hall, USA, 2003 (Indian edition available).

NODE JS

B Tech II Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIE**	**SEE**	**TOTAL**
25SD409	**Skill Development**	**0**	**0**	**2**	**1**	**40**	**60**	**100**
Prerequisite: Object Oriented Programming through Java, HTML Basics.								

COURSE OBJECTIVES:

1. To implement responsive web pages using HTML, CSS3, Bootstrap, and JavaScript validation.
2. To develop full-stack applications with Node.js, Express, React.js, and secure them using JWT.
3. To build and integrate RESTful APIs using Node.js and Django with frontend CRUD operations.
4. To create Flutter apps with responsive layouts, state management, and custom widgets.
5. To enhance Flutter apps by integrating REST APIs and adding animations for better user experience.

COURSE OUTCOME:

1. Design responsive web pages using HTML, CSS, Bootstrap, and JavaScript.
2. Develop backend applications using Java and Node.js.
3. Build single-page applications with React.js.
4. Create Flutter apps with custom widgets, layouts, and forms.
5. Integrate APIs, add animations, and perform UI testing in Flutter apps.

LIST OF EXPERIMENTS:

1. Students need to implement the following experiments
2. Build a responsive website with registration, login, catalog, and cart pages using HTML, CSS3,Bootstrap, and JavaScript validation.
3. Create a react application for the student management system having registration, login, contact, about pages and implement routing to navigate through these pages
4. Create a service in react that fetches the weather information from openweathermap.org and the display the current and historical weather information using graphical representation using chart.js
5. Develop an express web application that can interact with REST API to perform CRUD op operations on student data. (Use Postman)
6. Implement JWT authentication in Node.js to create secure endpoints.
7. Create a TODO application in react with necessary components and deploy it into github.
8. Integrate a React frontend with Node.js backend to perform CRUD operations on a shared dataset (e.g.,MongoDB, MySQL.)
9. Build a Django REST API for managing student data, tested using Postman.
10. Install Flutter and Dart SDK; Write Dart programs on data types, control flow, Functions, Class &Objects and collections to understand syntax and features.
11. Create a Flutter app showcasing common widgets (Text, Image, Container, Card, ListView).
12. Design a responsive UI using Row, Column, Stack, media queries, and breakpoints.
13. Implement screen navigation using Navigator and named routes.

14. Use stateful & stateless widgets; manage state using Provider or setState.
15. Design a form in Flutter with input fields, validation, and error handling (e.g., student registration form).
16. Fetch and display data from a REST API (e.g., weather or student info) in Flutter.
17. Add basic animations (fade or slide) to a Flutter app for enhancing UI interactions

TEXT BOOKS:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.

REFERENCE BOOKS:

1. Jon Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Wrox Publications, 2010
2. Bryan Basham, Kathy Sierra and Bert Bates, Head First Servlets and JSP, O'Reilly Media, 2ndEdition, 2008.
3. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, 2nd Edition, A Press.

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 Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives

UNIT-V:

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio- economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan(EMP). Contemporary Environmental Issues Climate change; Sustainable development goals (SDGs); Global environmental challenges; Environmental policies and international agreements

TEXT BOOKS:

1. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.
2. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
3. Environmental Studies by R. Rajagopalan, Oxford University Press

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5 Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS