Academic Regulations

Programme Structure

and

Detailed Syllabus

Bachelor of Technology (B.Tech)

in

Electronics and Communications Engineering

(Four Year Regular Programme)

(Applicable for Batches admitted from 2025-26)

GOKARAJU RANGARAJU

INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Bachupally, Kukatpally, Hyderabad- 500 090

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

HYDERABAD

Academic Regulations for B.Tech (Regular) under GR25

(Applicable for Batches Admitted from 2025-26)

Under Graduate Degree Programme in Engineering and Technology (UG)

Gokaraju Rangaraju Institute of Engineering and Technology (GRIET) offers a 4-year (8 Semesters) Bachelor of Technology (B.Tech) degree programme. The following programmes are offered in GRIET.

S.No	Department	Programme Code	Programme
1	Civil Engineering	01	B.Tech Civil Engineering
2	Electrical and Electronics Engineering	02	B.Tech Electrical and Electronics Engineering
3	Mechanical Engineering	03	B.Tech Mechanical Engineering
4	Electronics and Communication Engineering	04	B.Tech Electronics and Communication Engineering
5	Computer Science and Engineering	05	B.Tech Computer Science and Engineering
6	Computer Science and Business System	32	B.Tech Computer Science & Business System
7	Computer Science and Engineering (AIML)	66	B.Tech Computer Science and Engineering (Artificial Intelligence & Machine Learning)
8	Computer Science and Engineering (Data Science)	67	B.Tech Computer Science and Engineering (Data Science)

GR25 Regulations shall govern the above programmes offered by the Departments with effect from the students admitted to the programmes in 2025-26 academic year is given below.

1. **Medium of Instruction:** The medium of instruction (including examinations and reports) is English.

2. **Admissions:** Admission to the undergraduate (UG) Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the Telangana State Government/JNTUH University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in the common entrance examination conducted by the Government/University or on the basis of any other order of merit approved by the Government/University, subject to reservations as prescribed by the Government/University from time to time.

3. **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).

3.2.2 Credit Courses

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

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

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

3.2.3 Subject Course Classification

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

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	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	PC	Professional Core	Includes core courses related to the parent branch of Engineering
5	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	PC	Project Work	B.Tech Project Work
8	PC	Industry Training/ Internship/ Industry Oriented Mini- project	Industry Training/ Internship/ Industry Oriented Mini-Project
9	PC	Seminar	Seminar based on core contents related to parent branch of Engineering
10	SD	Skill Development Courses	Courses designed to help individuals gain, improve, or refine specific skills
11	VAC	Value Added Courses	Courses to build professional values, traditional knowledge and sensitization of societal issues

4. Mandatory Induction Programme

An induction programme 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 vii) Familiarization to department as well as entire institute and viii) Making students understand Innovative practices at the college premises etc.

5. 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 A student shall register for all the courses offered in a semester as specified in the course structure. Course registrations are exercised through F-235 form.

5.3 Professional Electives: The students have to choose six Professional Electives (PE-I to PE- VI) from the specified list.

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

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

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

5.5 Provision for Early Registration of MOOCs:

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

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

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

5.6 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.

5.7 MOOCs are allowed only for PE-I, PE-II/OE-I, OE-II courses and for few Minors & Honors courses

5.8 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.

6. 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. 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. 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. Distribution of Marks and Evaluation

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

9.2 Continuous Internal Evaluation (CIE)

9.2.1 Theory Courses:

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

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

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

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

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

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

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

3. Five marks for the Quiz/Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned

subject. This assessment shall be completed before II Mid-Term Examination.

9.2.2 Graphics for Engineers 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. Each mid examination is conducted for 90 minutes. Average of the two mid exams shall be considered.

9.3 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.

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 Graphics for Engineers 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 graphics for engineers courses is 3 hours.

9.5 Continuous Internal Evaluation and Semester End Examination for Practical Courses

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

1. 10 marks for a write-up on day-to-day experiments in the laboratory (in terms of aim, components/procedure, expected outcome).
2. 10 marks for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. 10 marks for the internal practical examination conducted by the laboratory teacher concerned.
4. The remaining 10 marks are for G-Lab on Board (G-LOB)/Project and Presentation, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

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

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

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

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

9.6 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.

9.8UG 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, Controller of Examination appoints an external examiner. The external examiner may be selected from the list of experts 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:

Skill Development Courses are included in the Curriculum. 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 psychomotor 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 controller of examination from time to time.

10. 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:

Letter Grade	Grade Point	Percentage of marks
O (Outstanding)	10	Marks >= 90
A+ (Excellent)	9	Marks >= 80 and Marks < 90
A (Very Good)	8	Marks >= 70 and Marks < 80
B+ (Good)	7	Marks >= 60 and Marks < 70
B (Average)	6	Marks >= 50 and Marks < 60
C (Pass)	5	Marks >= 40 and Marks < 50
F (Fail)	0	Marks < 40
Ab (Absent)	0	Absent

Letter grade 'F' in any Course implies failure of the student in that course and no credits of the above table are earned.

10.4 Computation of SGPA and CGPA:

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i) $\mathbf{S_k}$ the SGPA of $\mathbf{k^{th}}$ semester (1 to 8) is the ratio of sum of the product of the number of credits and grade points to the total credits of all courses registered by a student, i.e.,

$$GPA\ (S_k) = \sum_{i=1}^{n} (C_i * G_i) / \sum_{i=1}^{n} C_i$$

Where **Ci** is the number of credits of the **ith** course and **Gi** is the grade point scored by the student in the **ith** course and **n** is the number of courses registered in that semester.

ii) The CGPA is calculated in the same manner taking into account all the courses **m**, registered by student over all the semesters of a programme, i.e., up to and inclusive of **Sk**, where **k ≥ 2**.

$$CGPA = \sum_{i=1}^{m} (C_i * G_i) / \sum_{i=1}^{m} C_i$$

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

iv) The SGPA and CGPA shall be rounded off to 2 decimal points.

11. 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.

12. Re-admission after Detention

- A student detained due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of credits.
- A student detained due to shortage of attendance shall be admitted in the same semester in the successive academic years.
- 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.

13. 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.

14. Award of Degree:

14.1 After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of B.Tech Degree by JNTUH, he/she shall be placed in one of the following four classes based on CGPA secured from the 160 credits.

S. No	Class Awarded	CGPA Secured
1	First Class with Distinction	CGPA >= 7.50 with no F or below grade/ detention anytime during the programme
2	First Class	CGPA >= 7.50 with rest of the clauses of S.No 1 not satisfied
3	First Class	CGPA >= 6.50 and CGPA < 7.50

4	Second Class	CGPA >=5.50 and CGPA < 6.50
5	Pass Class	CGPA >= 5.00 and CGPA < 5.50

Equivalence of grade to marks
Marks % = (CGPA -0.5)*10

14.2 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 GR25 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).

15. Multiple Entry Multiple Exit Scheme (MEME)

15.1 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 15.2 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.

15.2 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 University-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.

15.3 Re-entry into the B.Tech Programme

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 University 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.

15.4 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 permission.
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 programme).

16. Transitory Regulations for the students re-admitted in GR25 Regulations:

16.1 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 GR25 regulations are in force.

16.2 A student detained due to shortage of attendance and re-admitted in GR25 regulations: Such students shall be permitted to join the same semester, but in GR25 Regulations.

16.3 A student detained due to shortage of credits and re-admitted in GR25 regulations: Such students shall be promoted to the next semester in GR25 regulations, only after acquiring the required number of credits as per the corresponding regulations of his/her previous semester.

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

16.5 If a student is readmitted to GR25 Regulations and has any course with 80% of syllabus common with his/her previous regulations, that particular course in GR25 Regulations will be substituted by an equivalent course of previous regulations

16.6 The GR25 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.

17 Student Transfers

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

17.2 There shall be no transfers from one college to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.

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

17.4 The transferred students from other Universities/Institutions to JNTUH affiliated colleges, 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.

18 Honors and Minor Degree Programmes

Honors Degree programme is available for B.Tech CSE and Minor Degree programme is available in Artificial Intelligence & Machine Learning for all branches of B.Tech. degree except for B.Tech CSE(AIML). Minor Degree programmes will commence from II Year II Semester and continue till IV Year I semester and Honors Degree programmes will commence from III Year I Semester and continue till IV Year II Semester.

Academic Regulations for B.Tech (Lateral Entry) under GR25

(Applicable for Batches Admitted from 2025-26)

1. All regulations as applicable for B.Tech 4-year degree programme (Regular) will hold good for B.Tech (Lateral Entry Scheme) except for the following rules:

a) Pursued programme of study for not less than three academic years and not more than six academic years.

b) A student should register 123/124 credits and secure 120 credits. The marks obtained in all 120 credits shall be considered for the calculation of the final CGPA.

c) 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.

d) Lateral Entry students are not permitted to exit the B.Tech. program after completion of second year (B.Tech. II Year II Semester).

e) Students who fail to fulfil all the academic requirements for the award of the degree within six academic years from the year of their admission, shall forfeit their seat in B.Tech programme.

2. Academic Requirements and Promotion Rules:

a) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or laboratories if he/she secures not less than 35% of marks in the Semester-End Examination and a minimum of 40% of the sum total of the Internal Evaluation and Semester-End Examination taken together.

b) A student shall be promoted to the next year only when he/she satisfies the requirements of all the previous semesters.

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.

3. **Award of Class:** After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of B.Tech Degree by JNTUH, he/she shall be placed in one of the following four classes based on CGPA secured from the 120 credits.

S. No	Class Awarded	CGPA Secured
1	First Class with Distinction	CGPA >= 7.50 with no F or below grade/ detention anytime during the Programme
2	First Class	CGPA >= 7.50 with rest of the clauses of S.no 1 not satisfied
3	First Class	CGPA >=6.50 and CGPA < 7.50
4	Second Class	CGPA >= 5.50 and CGPA < 6.50
5	Pass Class	CGPA >= 5.00 and CGPA < 5.50

Academic Regulations for B.Tech with Minors Programme under GR25

(Applicable for Batches Admitted from 2025-26)

1. Objectives

The key objectives of offering B.Tech with Minor programme are:

- To expand the domain knowledge of the students in one of the other programmes of engineering.
- To increase the employability of undergraduate students keeping in view of better opportunity in interdisciplinary areas of engineering & technology.
- To provide an opportunity to students to pursue their higher studies in the inter-disciplinary areas in addition to their own programme of study.
- To offer the knowledge in the areas which are identified as emerging technologies/thrust areas of Engineering.

2. Academic Regulations for B.Tech Degree with Minor programmes

a) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4 -Years B.Tech programme.

b) For B.Tech with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B.Tech degree). Minor Degree programmes will commence from II Year II Semester and continue till IV Year I Semester.

c) After registering for the Minor programme, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), he/she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of B.Tech, he/she will be awarded only B.Tech degree in the concerned programme.

d) There is no transfer of credits from Minor programme courses to regular B.Tech degree course and vice versa.

e) These 18 credits are to be earned from the additional Courses offered by the host department in the college as well as from the MOOCs platform.

f) For the course selected under MOOCs platform following guidelines may be followed:

i) Prior to registration of MOOCs courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.

ii) Minimum credits for MOOCs course must be equal to or more than the credits specified in the Minor course structure provided by the University.

iii) Only Pass-grade/marks or above shall be considered for inclusion of grades in minor grade memo.

iv) Any expenses incurred for the MOOCs courses are to be met by the students only.

g) The option to take a Minor programme is purely the choice of the student.

h) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor programme at any time; and in that case the student will be awarded only B.Tech degree in the concerned programme on earning the required credits of 160.

i) The student can choose only one Minor programme along with his/her basic engineering degree. A student who chooses an Honors programme is not eligible to choose a Minor programme and vice-versa.

j) A student can graduate with a Minor if he/she fulfils the requirements for his/her regular B.Tech programme as well as fulfils the requirements for Minor programme.

k) The institute shall maintain a record of students registered and pursuing their Minor programmes, minor programme-wise and parent programme -wise. The same report needs to be sent to the University once the enrolment process is complete.

l) The institute / department shall prepare the time-tables for each Minor course offered at their respective institutes without any overlap/clash with other courses of study in the respective semesters.

3. Eligibility conditions for the student to register for Minor programme

a) A student can opt for B.Tech programme with Minor programme if she/he has no active backlogs till II Year I Semester (III semester) at the time of entering into II year II semester.

b) Prior approval of mentor and Head of the Department for the enrolment into Minor programme, before commencement of II year II Semester (IV Semester), is mandatory

c) If more than 50% of the students in a programme fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

4. Registration for the courses in Minor Programme

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied/registered for regular B.Tech programme. No course should be identical to that of the regular B.Tech course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum No. of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

5. Minor courses and the offering departments

S. No.	Minor Programme	Eligible programme of students	@Offering Department	Award of Degree
1.	Artificial Intelligence & Machine Learning	All programmes, except B.Tech in CSE (AI&ML) /B.Tech (AI&ML)/ B.Tech (AI)/ B.Tech CSE(AI)	CSE	"B.Tech in programme name with Minor in Artificial Intelligence & Machine Learning"

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Bachupally, Kukatpally, Hyderabad–500090, India.(040)65864440

ELECTRONICS AND COMMUNICATION ENGINEERING

B. Tech (ECE)–GR25 Course Structure

I B. Tech (ECE) - I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	Maths	BS	GR25A1001	Linear Algebra and Function Approximation	3	1	0	4
2	Chemistry	BS	GR25A1004	Engineering Chemistry	3	0	0	3
3	CSE	ES	GR25A1006	Programming for Problem Solving	2	0	0	2
4	EEE	ES	GR25A1007	Fundamentals of Electrical Engineering	3	0	0	3
5	Mgmt	HS	GR25A1027	Innovation and Design Thinking	1	0	0	1
6	ME	ES	GR25A1024	Engineering Workshop	1	0	3	2.5
7	Chemistry	BS	GR25A1018	Engineering Chemistry Lab	0	0	2	1
8	CSE	ES	GR25A1020	Programming for Problem Solving Lab	0	0	3	1.5
9	EEE	ES	GR25A1022	Fundamentals of Electrical Engineering Lab	0	0	2	1
TOTAL					**13**	**1**	**10**	**19**

I B.Tech (ECE) - II Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	Maths	BS	GR25A1002	Differential equations and Vector Calculus	3	1	0	4
2	Physics	BS	GR25A1003	Advanced Engineering Physics	3	0	0	3
3	English	HS	GR25A1005	English for Skill Enhancement	3	0	0	3
4	CSE	ES	GR25A1016	Data structures	2	0	0	2
5	ECE	ES	GR25A1025	Electronic Devices and Circuits	3	0	0	3
6	ME	ES	GR25A1015	Graphics for Engineers	1	0	4	3
7	Physics	BS	GR25A1017	Advanced Engineering Physics Lab	0	0	2	1
8	English	HS	GR25A1019	English Language and Communication Skills Lab	0	0	2	1
9	CSE	ES	GR25A1023	Data Structures Lab	0	0	2	1
10	ECE	ES	GR25A1031	Electronic Devices and Circuits Lab	0	0	2	1
TOTAL					**15**	**1**	**12**	**22**

II B. Tech (ECE) - I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	ECE	PC	GR25A2053	Electronic Circuit Analysis	2	1	0	3
2	ECE	PC	GR25A2054	Digital Electronics	3	0	0	3
3	ECE	PC	GR25A2055	Signals and Systems	2	1	0	3
4	ECE	PC	GR25A2056	Probability Theory and Stochastic Processes	2	1	0	3
5	ECE	PC	GR25A2057	Network Analysis and Synthesis	3	0	0	3
6	Mgmt	VAC	GR25A2002	Value Ethics and Gender Culture	1	0	0	1
7	ECE	PC	GR25A2058	Electronic Circuit Analysis Lab	0	0	2	1
8	ECE	PC	GR25A2059	Digital Electronics Lab	0	0	2	1
9	ECE	PC	GR25A2060	Signals and Systems Lab	0	0	2	1
10	ECE	SD	GR25A2061	Applied Python Programming Lab	0	1	2	2
		TOTAL			**13**	**4**	**8**	**21**

II B. Tech (ECE) - II Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	Maths	BS	GR25A2102	Numerical methods and Complex variables	3	0	0	3
2	ECE	PC	GR25A2062	Electromagnetic Fields and Transmission Lines	3	0	0	3
3	ECE	PC	GR25A2063	Linear Control Systems	2	1	0	3
4	ECE	PC	GR25A2064	Linear and Digital IC Applications	3	0	0	3
5	ECE	PC	GR25A2065	Analog and Digital Communications	3	0	0	3
6	CHEM	VAC	GR25A2001	Environmental Science	1	0	0	1
7	ECE	SD	GR25A2067	Linux and Shell Scripting	0	1	2	2
8	ECE	PC	GR25A2066	Linear and Digital IC Applications Lab	0	0	2	1
9	ECE	PC	GR25A2068	Analog and Digital Communications Lab	0	0	2	1
	TOTAL				**15**	2	6	**20**

III B.Tech (ECE) –I Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	ECE	PC		CMOS VLSI Design	3	0	0	3
2	ECE	PC		RISC and Microcontroller architectures	3	0	0	3
3	ECE	PC		Digital Signal Processing	2	1	0	3
4		PE- I		Professional Elective-I	3	0	0	3
5		OE-1		Open Elective-1	3	0	0	3
6	CHEM	VAC		Indian Knowledge Systems	1	0	0	1
7	ECE	PC		Field-based Research Project	0	0	4	2
8	ECE	PC		CMOS VLSI Design Lab	0	0	2	1
9	ECE	PC		RISC and Microcontroller architectures Lab	0	0	2	1
10	ECE	PC		Digital Signal Processing Lab	0	0	2	1
				TOTAL	**15**	**1**	**10**	**21**

PROFESSIONAL ELECTIVE–I			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Data Communications and Computer Networks
2	ECE		Computer Organization and Operating Systems
3	ECE		Electronic Measurements and Instrumentation
4	ECE		Sustainability for Electronics

OPEN ELECTIVE–I			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Digital Electronics for Engineers

III B.Tech (ECE)-II Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	ECE	PC		Antennas and Wave Propagation	2	1	0	3
2	ECE	PC		IOT Architectures and Protocols	2	0	0	2
3	Mgmt	HS		Economics and Accounting for Engineers	3	0	0	3
4		PE-II		Professional Elective-II	3	0	0	3
5		OE-II		Open Elective-II	3	0	0	3
6	English	BS		Effective Technical Communication	1	0	0	1
7	ECE	SD		FPGA based System Design	0	1	2	2
8	ECE	PC		IOT Architectures and Protocols Lab	0	0	2	1
9	ECE	PC		VLSI Design Verification Lab	0	0	2	1
				TOTAL	**14**	**2**	**6**	**19**

PROFESSIONAL ELECTIVE–II			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Biomedical Instrumentation
2	ECE		CMOS Fabrication Technology
3	ECE		Digital Signal Processors and Architectures
4			Artificial Neural Networks and Deep Learning

OPEN ELECTIVE–II			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
2	ECE		Automotive Electronics

IV B.Tech (ECE)-I Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	ECE	PC		Embedded System Design	3	0	0	3
2	ECE	PC		Microwave and Optical Communications	3	0	0	3
3	Mgmt	HS		Fundamentals of Management and Entrepreneurship	3	0	0	3
4		PE III		Professional Elective-III	3	0	0	3
5		PE IV		Professional Elective-IV	3	0	0	3
6		OE III		Open Elective-III	3	0	0	3
7	ECE	PC		Industry Oriented Mini Project/ Internship	0	0	4	2
8	ECE	PC		Embedded System Design Lab	0	0	2	1
9	ECE	PC		Microwave and Optical Communications Lab	0	0	2	1
				TOTAL	**18**	**0**	**8**	**22**

PROFESSIONAL ELECTIVE–III			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Network Security and Cryptography
2	ECE		Low Power VLSI Design
3			Digital Image Processing
4	ECE		Unmanned Aerial Vehicles and Satellite Imaging

PROFESSIONAL ELECTIVE–IV			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Wireless Communication Networks
2	ECE		Design for Testability
3	ECE		Global Navigation Satellite Systems
4	ECE		Computer Vision and Machine Learning

OPEN ELECTIVE–III			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Hardware for IoT Applications

IV B.Tech (ECE)-II Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	ECE	PE V		Professional Elective-V	3	0	0	3
2	ECE	PE VI		Professional Elective-VI	3	0	0	3
3	ECE	PW		Project Work Phase II	0	0	42	14
		TOTAL			**6**	**0**	**42**	**20**

PROFESSIONAL ELECTIVE–V			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Radar Systems
2	ECE		Analog and Mixed Signal IC Design
3	ECE		AI for Signal and Image Processing
4	ECE		RF Circuit Design

PROFESSIONAL ELECTIVE–VI			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Satellite Communications
2	ECE		Model Based System Engineering
3	ECE		5G and Beyond Communications
4	ECE		Quantum Technologies

PROFESSIONAL ELECTIVES – 4 THREADS

S. No.	Thread 1: Communication, Networks & Security	Thread 2: VLSI, ICs & Embedded Systems	Thread 3: Signal, Image & Biomedical Systems	Thread 4: AI, ML & Emerging Technologies
1	Data Communications and Computer Networks	Computer Organization and Operating Systems	Electronic Measurements and Instrumentation	Sustainability for Electronics
2	Biomedical Instrumentation	CMOS Fabrication Technology	Digital Signal Processors and Architectures	Artificial Neural Networks & Deep Learning
3	Network Security and Cryptography	Low Power VLSI Design	Digital Image Processing	Unmanned Aerial Vehicles & Satellite Imaging
4	Wireless Communication Networks	Design for Testability	Global Navigation Satellite Systems	Computer Vision & Machine Learning
5	Radar Systems	Analog & Mixed Signal IC Design	AI for Signal & Image Processing	RF Circuit Design
6	Satellite Communications	Model Based System Engineering	5G and Beyond Communications	Quantum Technologies

OPEN ELECTIVES FOR GR25 REGULATIONS

S.No.	BOS	COURSE CODE	COURSE
1	ECE		Digital Electronics for Engineers
2	ECE		Automotive Electronics
3	ECE		Hardware for IoT Applications

I-I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
LINEAR ALGEBRA AND FUNCTION APPROXIMATION

Course Code: GR25A1001 **L/T/P/C: 3/1/0/4**
I Year I Semester
Pre-requisites: Mathematical Knowledge at pre-university level

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

1. Write Recognize Rank of the matrix and write the matrix representation of a set of linear equations and to analyze the solution of the linear system of equations.
2. Discovery the Eigen values and Eigen vectors, Reduce the quadratic form to canonical form using orthogonal transformations.
3. Identify the geometrical interpretation of mean value theorems and discovery points in an interval that satisfy the mean value theorem for a given function.
4. Estimate the extreme values of functions of two variables with/ without constraints.
5. Evaluate the multiple integrals and apply the concept to find areas, volumes.

UNIT-I: Matrices
Operations on vectors and matrices - Vector norms- Rank of a matrix by Echelon form – Linear dependence and independence of vectors. System of linear equations: Solution of a linear algebraic system of equations (homogeneous and non-homogeneous) using Gauss elimination.

UNIT-II: Eigen values and Eigen vectors
Eigen values – Eigen vectors and their properties – Diagonalization of a matrix – Orthogonal diagonalization of a symmetric matrix- Definiteness of a symmetric matrix
.Quadratic forms and Nature of the Quadratic Forms – Reduction of Quadratic form to canonical form by Orthogonal Transformation.

UNIT-III: Single Variable Calculus
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). Approximation off a function by Taylor's series

UNIT-IV: Multivariable Calculus (Partial Differentiation and applications)
Partial Differentiation: Total derivative – Jacobian – Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.
Curve Tracing: Curve tracing in cartesian coordinates

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

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Editon, 2016.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING CHEMISTRY

Course Code: GR25A1004 **L/T/P/C: 3/0/0/3**
I Year I Semester
Pre-requisites: Mathematical Knowledge at pre-university level

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

1. Understand the specifications, water quality and treatment methods for domestic & Industrial needs.
2. Apply electrochemical concepts and analyze corrosion processes with suitable control measures.
3. Distinguish various energy sources to prioritize eco-friendly fuels for environmental sustainable development.
4. Analyze the efficacy of polymers in diverse applications
5. Interpret the role of engineering materials and emphasize the scope of spectroscopic techniques in various sectors.

UNIT-I: Water and its treatment: [8]
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 breakpoint chlorination. Defluoridation - Nalgonda technique. **Boiler troubles**: Scales, Sludges and Caustic embrittlement. Internal treatment of boiler feed water - Calgon conditioning, Phosphate conditioning, Colloidal conditioning. **External treatment methods** - Softening of water by ion- exchange processes. Desalination of brackish water – Reverse osmosis.

UNIT-II: Electrochemistry and Corrosion: [8]
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: 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: [8]
Batteries: Definition – 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 Hydrogen –Oxygen Fuel Cell. **Fuels:** Definition and characteristics of a good fuel, Calorific value – Units - HCV, LCV- Dulongs formula - Numerical problems. **Fossil fuels:** Classification, Petroleum - Refining of Crude oil, Cracking - Types of cracking - Moving bed catalytic cracking. LPG and CNG composition and uses. Synthetic Fuels: Fischer Tropschs Process, Introduction and applications of Hythane and Green Hydrogen.

UNIT - IV: Polymers: [8]

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

UNIT-V- Engineering Materials: [8]

Smart materials: Classification with examples - Shape Memory Alloys – Nitinol, Piezoelectric materials – quartz and their engineering applications. **Biosensor** - Definition, Amperometric Glucose monitor sensor. **Cement:** Portland cement, its composition, setting and hardening.

Interpretative spectroscopic applications of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Pollution Under Control- CO sensor (Passive Infrared detection).

TEXT BOOKS:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROGRAMMING FOR PROBLEM SOLVING
(Common to all branches)

Course Code: GR25A1006 **L/T/P/C: 2/0/0/2**
I Year I Semester

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

1. Design algorithms and flowcharts for problem solving and apply the basic elements of C programming to solve simple computational problems.
2. Illustrate decision-making control structures and use functions, including recursion, to develop modular C programs.
3. Discover the need for arrays, searching, sorting, and strings in problem-solving and apply them.
4. Summarize pointer operations and implement structures and unions to solve programming problems.
5. Demonstrate file handling mechanisms, preprocessor directives, and command line arguments in C.

UNIT I: Introduction to Programming:
Introduction to Algorithms: Representation of Algorithm, Flowchart, Pseudo code with examples, compiling and executing programs, syntax, and logical errors.
Introduction to C Programming Language: General Form of a C Program, C Language Elements, operators, precedence and associativity, expression evaluation, implicit and explicit type conversion, Formatting Numbers in Program Output.

UNIT II Decision Making and Functions:
Branching and Loops: Conditional branching with simple if, if-else, nested if-else, else if ladder, switch-case, loops: for, while, do-while, jumping statements: goto, break, continue, exit.
Functions: Top-Down Design and Structure Charts, function declaration, signature of a function, parameters and return type of a function, categories of functions, parameter passing techniques, passing arrays and strings to functions, recursion, merits and demerits of recursive functions, Scope of Names.

UNIT III: Arrays and Strings:
Arrays: One and two-dimensional arrays, creating, accessing, and manipulating elements of arrays.
Searching and sorting: Introduction, Linear search, and Binary search. Bubble Sort, Insertion Sort, Selection Sort.
Strings: Introduction to strings, operations on characters, basic string functions available in C - strlen, strcat, strcpy, strrev, strcmp, String operations without string handling functions, arrays of strings.

UNIT IV: Pointers and Structures:
Pointers: Pointers and the Indirection Operator, declaration and initialization of pointers, pointer to pointer, void pointer, null pointer, pointers to arrays, function pointer.
Structures and Unions: Defining structures, declaring and initializing structures, arrays within structures, arrays of structures, nested structures, pointers to structures, passing structures to functions, unions, and typedef.

UNIT V: File Handling and Preprocessor in C:

Files: Text and binary files, creating, reading, and writing text and binary files, random access to files, and error handling in files.

Preprocessor: Commonly used preprocessor commands like include, define, undef, if, ifdef, ifndef , elif, command line arguments and enumeration data type.

Teaching methodologies:

- PowerPoint Presentations
- Tutorial Sheets
- Assignments

TEXT BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
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. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education
4. Herbert Schildt, C: The Complete Reference, McGraw-Hill, 4th Edition

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FUNDAMENTALS OF ELECTRICAL ENGINEERING
(Common to CSE, CSE(AIML), CSE(DS) and ECE)

Course Code: GR25A1007 **L/T/P/C: 3/0/0/3**
I Year I Semester

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

1. Summarize the fundamental laws of electric circuits.
2. Analyze electric circuits with suitable theorems.
3. Distinguish the single phase and three phase systems.
4. Interpret the working principle of Electrical machines.
5. Outline the protection principles using Switchgear components.

UNIT I: NETWORK ELEMENTS & LAWS

Charge, Current, Voltage, Power, Active elements, Independent and dependent sources. Passive elements - R, L and C, Energy stored in inductance and capacitance, Kirchhoff's laws, Source transformations, Star-delta transformations, Node voltage method, mesh current method.

UNIT II: NETWORK THEOREMS

Superposition theorem, Thevenin's theorem, Norton's theorems, Maximum power transfer theorem and Reciprocity theorem (DC Circuits).

UNIT III: AC CIRCUITS

Representation of sinusoidal waveforms, RMS and average values of periodic sinusoidal and non- sinusoidal waveforms, Phasor representation, Types of power, active power, Reactive power and Apparent power, Power factor. Impedance and Admittance, Analysis of series, parallel and series-parallel circuits, Introduction to three-phase circuits, types of connection. voltage and current relations in star and delta connections. Resonance: Series circuits, Bandwidth and Q-factor.

UNIT IV: BASICS OF ELECTRICAL MACHINES

Transformer: Mutual Induction, construction and working principle, Types of transformers, Ideal transformer, EMF Equation-simple Problems.

Construction and working principles of DC generator, DC motor, Synchronous generator, and Induction Motor – applications.

UNIT V: ELECTRICAL INSTALLATIONS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, MCCB, Earthing – Plate and Pipe Earthing. Types of Batteries – Primary and Secondary, UPS (Uninterrupted power supply)-components, calculation of ratings for UPS-Components to a specific load, power factor improvement methods.

TEXT BOOKS:

1. "Basic Electrical Engineering", D.P. Kothari and I.J. Nagrath, Third edition 2010, Tata McGraw Hill.
2. "Electrical Engineering Fundamentals", Vincent Deltoro, Second Edition, Prentice Hall India, 1989.

REFERENCE BOOKS:

1. "A Textbook of Electrical Technology",- BL Theraja volume-I, S.Chand Publications.
2. "Electrical Machinery", P. S. Bimbhra, Khanna Publishers, 2011.
3. "Electrical and Electronics Technology", E. Hughes, 10th Edition, Pearson, 2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INNOVATION AND DESIGN THINKING
(Common to all branches)

Course Code: GR25A1027 **L/T/P/C: 1/0/0/1**
I Year I Semester

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

1. Explain the concepts and importance of innovation and design thinking.
2. Apply industry analysis tools and ideation techniques to identify problems and opportunities.
3. Develop prototypes and assess market potential for innovative ideas.
4. Demonstrate understanding of sustainable design models and their applications.
5. Describe the basics of IPR and apply them in protecting and managing innovations.

Unit I: Fundamentals of Design Thinking and Innovation

Design Thinking: Meaning and definition of Design Thinking, Nature, features, and importance of Design Thinking. **Principles of Design Thinking** (Empathy, Define, Ideate, Prototype, Test) Design Thinking mind set and skills required. Difference between Design Thinking and traditional problem-solving. Applications of Design Thinking in business. **Innovation:** Introduction, need for innovation, Features, Types of innovations, innovations in manufacturing and service sectors, fostering a culture of innovation, planning for innovation.
Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from).

Unit II: Innovation through Opportunity Mapping and Design Thinking

Competition and Industry trends mapping and assessing initial opportunity, Porter's Five Force Model. Identification of gap, problem, analysing the problem from an industry perspective. Idea generation, **Ideation techniques**: Brainstorming, Brain writing, Round robin, and SCAMPE. Mapping of solution to problem: Problem–Solution Fit, Steps in Mapping, **Tools and Techniques of mapping** (Value Proposition Canvas, Problem–Solution Matrix, User Journey Mapping, Prototyping and testing for validation).
Core Teaching Tool: Several types of activities including Class, game, Gen AI, Journey Mapping Exercise (Pick a common activity (e.g., ordering food online, booking tickets, paying college fees) Students map the customer journey step by step, highlighting touchpoints and problems faced at each stage.

Unit III: Opportunity assessment and Prototype development

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

Unit IV: Sustainable Design Approaches / Models:

Introduction to Sustainable Design – Meaning, importance, and role in today's context. **Principles of Sustainable Design** (Reduce, Reuse, Recycle, Circular Economy, Cradle-to-Cradle approach). **Models of Sustainable Design:** Product Life Cycle Design (from raw material to disposal), Eco-Design Model, Systems Thinking Approach. **Strategies for Sustainable Design**: Green materials, energy efficiency, waste reduction, ethical sourcing. Applications – Sustainable product and service design.

Core Teaching Tool: Case Studies – Examples from industries adopting sustainable design

Unit V: IPR Management:

Meaning and importance of Intellectual Property (IP), **Types of Intellectual Property**: Patents, Trademarks, Copyrights, Industrial Designs, Trade Secrets, Geographical Indications. Role of IPR in innovation and technology development. **Patents and Patent System:** Scope and criteria for patentability (novelty, utility, non-obviousness), Procedure for grants of patents. Indian Scenario of Patenting.

IPR Management in Engineering: Protecting innovations: Licensing, Technology transfer, Commercialization, infringement issues. Emerging issues: IPR in Artificial Intelligence, Biotechnology, Software, and Digital Platforms.

Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

TEXTBOOKS/ SUGGESTED READINGS:

1. A Textbook on Design Thinking: Principles, Processes & Applications – Srinivasan R., Mohammed Ismail, and Arulmozhi Srinivasan, S. Chand Publishing, 2025.
2. Design Thinking: A Comprehensive Textbook – Shalini Rahul Tiwari and Rohit Rajendra Swarup, Wiley India, 2024.
3. Design Thinking for Engineering: A Practical Guide – Edited by Iñigo Cuiñas and Manuel José Fernández Iglesias, Institution of Engineering and Technology (IET), 2023.
4. Management of Innovation and Product Development: Integrating Business and Technological Perspectives – Marco Cantamessa and Francesca Montagna, Springer London, 2023.

Managing Innovation: Integrating Technological, Market and Organizational Change (8th Edition) – Joe Tidd and John Bessant, Wiley, Latest Edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING WORKSHOP

Course Code: GR25A1024 **L/T/P/C: 1/0/3/2.5**
I Year I Semester

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

1. Identify workshop tools and their operational capabilities
2. Practice on manufacturing components using workshop trades including Carpentry, Fitting, Tin Smithy, Welding, Foundry and Black Smithy
3. Apply basic electrical engineering knowledge for House Wiring Practice
4. Develop various trades applicable to industries
5. Create hands on experience for common trades with taking safety precautions

TRADES FOR EXERCISES: At least two tasks from each trade

1. **Carpentry:** Demonstration and practice of carpentry tools
   Task 1: Preparation of T- Lap Joint
   Task 2: Preparation of Dove Tail Joint.

2. **Fitting -** Demonstration and practice of fitting tools
   Task 3: Preparation of Straight Fit
   Task 4: Preparation of V-Fit

3. **Tin-Smithy -** Demonstration and practice of Tin Smithy tools
   Task 5: Preparation of Rectangular Tray
   Task 6: Preparation of Open Scoop

4. **Welding:** Demonstration and practice on Arc Welding tools
   Task 7: Preparation of Lap joint,
   Task 8: Preparation of Butt Joint

5. **House-wiring:** Demonstration and practice on House Wiring tools
   Task 9: Exercise on One way switch controlled two bulbs in series one bulb in Parallel.
   Task 10: Exercise on Staircase connection.

6. **Foundry:** Demonstration and practice on Foundry tools
   Task 11: Preparation of Mould using Single Piece Pattern.
   Task 12: Preparation of Mould using Split Piece Pattern.

7. **Black Smithy:** Demonstration and practice on Black Smithy tools
   Task 13: Preparation of U-Hook
   Task 14: Preparation of S-Hook

TRADES FOR DEMONSTRATION: Plumbing, Machine Shop, Power tools in construction and Wood Working

Preparation of a prototype model of any trade under G-LOB activity

TEXT BOOKS:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019.
2. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5thEdn. 2015.
3. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

REFERENCE BOOKS:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Elements of Workshop Technology, Vol. II by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 12th edition
3. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
4. Technology of machine tools, Steve F. Krar, Arthur R. Gill and Peter Smid, McGraw Hill Education (India) Pt. Ltd., 2013.
5. Engineering Practices Laboratory Manual, Ramesh Babu.V., VRB Publishers Private Limited, Chennai, Revised edition, 2013 – 2014.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING CHEMISTRY LAB
(Common to all branches)

Course Code: GR25A1018 **L/T/P/C: 0/0/2/1**
I Year I Semester

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

1. Identify key water quality parameters such as hardness, chloride by volumetric analysis.
2. Apply analytical techniques such as conductometry to estimate acids, and colorimetry to validate theoretical principles like Beer–Lambert's law.
3. Determine the concentrations of acids, base, and ferrous ions by potentiometric titration.
4. Synthesize polymers like Bakelite and Nylon-6,6 to gain practical experience.
5. Estimate the physicochemical properties of materials such as viscosity, acid value, and corrosion rate.

List of Experiments

1. Estimation of Hardness of water by EDTA Complexometric method.
2. Determination of chloride content of water by Argentometric method.
3. Estimation of the concentration of a strong acid by Conductometry.
4. Estimation of the concentration of strong and weak acids in an acid mixture by Conductometry.
5. Estimation of the concentration of Fe^{+2} ion by Potentiometry using $K_2Cr_2O_7$.
6. Estimation of the concentration of a strong acid with a strong base by Potentiometry using quinhydrone.
7. Colorimetric analysis of Potassium Permanganate: Verification of Beer–Lambert's Law.
8. Preparations:
   a. Preparation of Bakelite.
   b. Preparation Nylon – 6, 6.
9. Determination of corrosion rate of mild steel in the presence and absence of inhibitor.
10. Estimation of the acid value of the given lubricant oil.
11. Estimation of viscosity of lubricant oil using Ostwald's Viscometer.
12. **Virtual Labs:**
    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.

REFERENCES:

1. Vogel's text book of Practical organic chemistry, 8th Edition.
2. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROGRAMMING FOR PROBLEM SOLVING LAB

Course Code: GR25A1020 **L/T/P/C: 0/0/3/1.5**
I Year I Semester

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

1. Develop C programs from algorithms using C elements, selection constructs, and test and debug them for correctness.
2. Employ loops and functions effectively to design modular solutions for computational problems.
3. Utilize arrays and strings to organize, manipulate, and process data in problem-solving contexts.
4. Apply searching and sorting methods and structure-based representations to manage and process data efficiently.
5. Demonstrate the use of pointers, and apply file handling along with preprocessor directives to enhance C program execution and management.

TASK 1

a. Write the program for the simple, compound interest.
b. Write a C program to implement relational, logical, and bitwise operators.
c. Write a C program for finding the maximum, minimum of three numbers.
d. Write a C program to Convert Celsius temperature to Fahrenheit and vice versa using type conversion.

TASK 2

a. Write a C program to find the roots of a quadratic equation using if-else.
b. Write a C program to check the triangle type based on sides using nested if- else. (Equilateral, Isosceles, Scalene, invalid).
c. 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).

TASK 3

a. Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
b. Write a C program check whether a given number is Armstrong number or not.
c. Write a C program check whether a given number is Strong number or not.

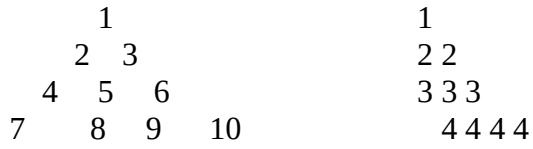
TASK 4

a. Write a program to display prime numbers between X to Y.
b. Write a C program to calculate the sum of following series:
   i. $S1= 1+x/1+x^2/2+ x^3/3. +x^n/n$ (ii) $S2= 1+x/1!-x^2/2!+ x^3/3! . +x^n/n!$

TASK 5

a. Write a C program to display the following patterns:

i) ii)



b. Write a C program to display the following patterns:

i) ii)

TASK 6

a. Write a C program to swap two numbers using parameter passing techniques.
b. Write a C program to implement factorial of a given integer using recursive and non-recursive functions.
c. Write a C program to print first 'n' terms of Fibonacci series using recursive and non-recursive functions.

TASK 7

a. Write a C program to find the minimum, maximum and average in an array of integers.
b. Write a C program to perform Addition of Two Matrices using functions.
c. Write a C program to implement Multiplication of Two Matrices

TASK 8

a. Write a C program that uses non-recursive function to search for a Key value in each list of integers using linear search method.
b. Write a C program that uses non-recursive function to search for a Key value in each sorted list of integers using binary search method.

TASK 9

a. Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.
b. Write a C program that sorts the given array of integers using selection sort in descending order
c. Write a C program that sorts the given array of integers using insertion sort in ascending order

TASK 10

a. 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

b. 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.)

TASK 11

a. Write a C program to sort the 'n' strings in the alphabetical order using functions.
b. Write a C program to count the lines, words and characters in a given text.

TASK 12

a. Write a C program to implement function pointer to find sum and product of two numbers.
b. Write a program for reading elements using a pointer into an array and display the values using the array.
c. Write a program for display values reverse order from an array using a pointer.

TASK 13

a. Define a structure Date with members day, month, and year. Create another structure Employee with members: emp_id, emp_name, and a nested structure Date for joining_date. Write a program to store details of 5 employees in an array of structures and display employees who joined after the year 2020.
b. Write a C program that uses structures and functions to perform addition and product of two complex numbers? (use structures and functions)

TASK 14

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

TASK 15

a. Write a C program to find sum of 'n' numbers using command line arguments.
b. Write a C program to implement following pre-processor directives:
   i. Define ii. Undef iii. Ifdef iv. ifndef.
c. Write a C program to create a user defined header file to find sum, product and greatestof two numbers.

TEXT BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
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, PrenticeHall of India
2. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education
4. Herbert Schildt, C: The Complete Reference, McGraw Hill, 4th Edition

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FUNDAMENTALS OF ELECTRICAL ENGINEERING LAB
(Common to CSE, CSE(AIML), CSE(DS) and ECE)

Course Code: GR25A1022 **L/T/P/C: 0/0/2/1**
I Year I Semester

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

1. Demonstrate the common electrical components and their ratings.
2. Summarize the fundamental laws of electric circuits.
3. Distinguish the measurement and relation between the basic electrical parameters
4. Examine the response of different types of electrical circuits with three phase excitations.
5. Outline the basic characteristics of Electrical machines.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Verification of Ohms Law, KVL and KCL.
2. Verification of Thevenin's & Norton's Theorems.
3. Verification of Superposition and Reciprocity Theorems.
4. Resonance in series RLC circuit.
5. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
6. Verification of Voltage and Current relations in Three Phase Circuits (Star-Delta)
7. Measurement of Active and Reactive Power in a balanced Three-phase circuit.
8. Torque – speed characteristics of a Separately Excited DC Shunt Motor.
9. Torque-Slip Characteristics of a Three-phase Induction Motor.
10. No-Load Characteristics of a Three-phase Alternator.
11. Verification of Maximum Power Transfer Theorem.
12. Power factor improvement by using capacitor bank in parallel with inductive load.

TEXTBOOKS:

1. "Basic Electrical Engineering", D.P. Kothari and I.J. Nagrath, Third edition 2010, Tata McGraw Hill.
2. "Electrical Engineering Fundamentals", Vincent Deltoro, Second Edition, Prentice Hall India, 1989.

REFERENCE BOOKS:

1. "A Textbook of Electrical Technology",- BL Theraja volume-I, S.Chand Publications.
2. "Electrical Machinery", P. S. Bimbhra, Khanna Publishers, 2011.
3. "Electrical and Electronics Technology", E. Hughes, 10th Edition, Pearson, 2010.

I-II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(Common to all branches)

Course Code: GR25A1002 **L/T/P/C: 3/1/0/4**
I Year II Semester

Pre-requisites: Mathematical Knowledge at pre-university level

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

1. Identify whether the given differential equation of first order is exact or not
2. Solve higher differential equation and apply the concept of differential equation to real world problems.
3. Use the Laplace Transforms techniques for solving Ordinary Differential Equations.
4. Evaluate the line integrals and use them to calculate work done
5. Evaluate surface and volume integrals and apply fundamental theorems of vector calculus to relate line integrals and surface integrals

UNIT-I: First Order Ordinary Differential Equations

Exact differential equations – Equations reducible to exact differential equations – linear and Bernoulli's equations –Applications: Newton's law of cooling – Law of natural growth and decay. - modelling of R-L circuit and R-C Circuit

UNIT-II: Ordinary Differential Equations of Higher Order

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

UNIT-III: Laplace Transforms

Laplace Transforms: Laplace Transform of standard functions – First shifting theorem – Laplace transforms of functions multiplied by 't' and divided by 't' – Laplace transforms of derivatives and integrals of function – Inverse Laplace transform by different methods, Applications: solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation and Line Integration

Vector differentiation: Scalar and vector point functions, Concepts of gradient, Directional derivatives, divergence, and curl of functions in cartesian framework- solenoidal field, irrotational field, scalar potential

Vector line integration**:** Evaluation of the line integral, concept of work done by a force field, Conservative fields

UNIT-V: Surface Integration and Vector Integral Theorems

Surface integration: Evaluation of surface and volume integrals, flux across a surface

Vector integral theorems: Green's, Gauss and Stokes theorems (without proof) and their applications

TEXT BOOKS:

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

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

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ADVANCED ENGINEERING PHYSICS
(Common to all branches)

Course Code: GR25A1003 **L/T/P/C: 3/0/0/3**
I Year II Semester

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

1. Apply quantum mechanical principles to explain particle behaviour and energy band formation in solids.
2. Comprehend the characteristics of semiconductor devices and characterization of nanomaterials.
3. Classify magnetic and dielectric materials based on their properties for various applications.
4. Analyze the principles of Laser and fibre optics and their applications.
5. Outline quantum computing concepts and use of quantum gates.

UNIT - I: Quantum Mechanics

Principles of Quantum Mechanics: Introduction, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of wave function, postulates of quantum mechanics: operators in quantum mechanics, eigen values and eigen functions, Schrödinger's time independent wave equation, particle in a 1D box.

Band Theory of Solids: Blochs theorem (qualitative), Kronig-Penney model (qualitative): E-k diagram, effective mass of electron, discrete energy levels, formation of energy bands, classification of solids into metals, semiconductors and insulators.

UNIT - II: Semiconductors & Nanomaterials

Semiconductors: Intrinsic and extrinsic semiconductors(qualitative), Variation of Fermi level with temperature and doping(qualitative), Hall Effect and its applications, direct and indirect band gap semiconductors, Construction and principle of operation of p-n junction diode, I-V characteristics of p-n junction diode and Zener diode. Principle, Construction, Working, Characteristics and Applications: LED and Solar cell.

Nanomaterials: Introduction, quantum confinement in nanomaterials, Surface to volume ratio, Synthesis methods: Top-Down Technique: Ball milling method, Bottom-Up technique: Sol-Gel method, X-ray diffraction: Bragg's law, calculation of average crystallite size using Debye Scherrer's formula, scanning electron microscopy (SEM): block diagram, working principle.

UNIT - III: Magnetic and Dielectric Materials

Magnetic materials: Introduction to magnetic materials, origin of magnetic moment - classification of magnetic materials – Dia, Para, Ferro, Weiss domain theory of ferromagnetism, hysteresis curve based on domain theory of ferromagnetism, soft and hard magnetic materials, applications: magnetic hyperthermia for cancer treatment, magnets for EV.

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

UNIT - IV: Laser and Fibre Optics

Lasers: Introduction to laser, Radiative transition: Absorption, Spontaneous and Stimulated emissions, characteristics of laser, Einstein coefficients and their relations, metastable state,

population inversion, pumping, lasing action, Ruby laser, He-Ne laser, semiconductor diode laser, applications: Bar code scanner, LIDAR for autonomous vehicle.
Fiber 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.

UNIT - V: 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,
entanglement, quantum gates (Pauli's X,Y,Z gate, Hadamard gate), quantum computing system for information processing, evolution of quantum systems, challenges and advantages of quantum computing over classical computation.

TEXT BOOKS:

1. Charles Kittel, Introduction to Solid State Physics, John Wiley & Sons, Inc.
2. Thomas G. Wong, Introduction to Classical and Quantum Computing, Rooted Grove
3. Engineering Physics, B.K. Pandey, S. Chaturvedi – Cengage Learing
4. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand.

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.
4. Fundamentals of Semiconductor Devices, Second Edition, Anderson and Anderson, McGraw Hill.

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGLISH FOR SKILL ENHANCEMENT
(Common to all branches)

Course Code: GR25A1005 **L/T/P/C: 3/0/0/3**
I Year II Semester

UNIT –I

Theme:	Perspectives Lesson on 'The Generation Gap' by Benjamin M. Spock from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan Pvt. Ltd.
Vocabulary:	The Concept of Word Formation -The Use of Prefixes and Suffixes - Words Often Misspelt - Synonyms and Antonyms
Grammar:	Identifying Common Errors in Writing with Reference to Parts of Speech particularly Articles and Prepositions — Degrees of Comparison
Reading:	Reading and Its Importance- Sub Skills of Reading – Skimming and Scanning.
Writing:	Sentence Structures and Types -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing Precisely –Nature and Style of Formal Writing.

UNIT –II

Theme:	Digital Transformation Lesson on '*Emerging Technologies*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.
Vocabulary:	Homophones, Homonyms and Homographs
Grammar:	Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
Reading:	Reading Strategies-Guessing Meaning from Context – Identifying Main Ideas – Exercises for Practice
Writing:	Paragraph Writing — Types, Structures and Features of a Paragraph - Creating Coherence — Linkers and Connectives - Organizing Principles in a Paragraph — Defining- Describing People, Objects, Places and Events — Classifying- Providing Examples or Evidence - Essay Writing - Writing Introduction and Conclusion.

UNIT –III

Theme:	Attitude and Gratitude Poems on '*Leisure'* by William Henry Davies and '*Be Thankful'* - Unknown Author from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.
Vocabulary:	Words Often Confused - Words from Foreign Languages and their Use in English.
Grammar:	Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading:	Sub-Skills of Reading – Identifying Topic Sentence and Providing

Supporting Ideas - Exercises for Practice.

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

UNIT –IV

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

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

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

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

Writing: Writing Practices- Note Making-Précis Writing.

UNIT –V

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

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

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

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

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

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

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

TEXT BOOK:

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.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATA STRUCTURES

Course Code: GR25A1016 **L/T/P/C: 2/0/0/2**

I Year II Semester

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

1. Analyze the computational complexity of algorithms and implement operations on stack, queue and their applications.
2. Develop algorithms for various operations on linked lists and convert them to programs.
3. Interpret operations on non-linear data structure binary tree and BST.
4. Explain the principles of balanced trees and heaps, and implement efficient sorting algorithms in C.
5. Summarize the operations on graphs and apply graph traversals techniques and interpret hashing techniques.

UNIT I

Algorithms and Complexities: Analysis of algorithms, order of complexity, Asymptotic Notations -Big Oh, Omega, Theta, little oh and little omega notation.

Stacks: Introduction to Data Structures and types, Stack – Operations: pop, push, display, peek, Representation and implementation of stack operations using arrays, stack applications- recursion, infix to postfix transformation, evaluating postfix expressions.

Queues: Queue – Operations: enqueue, dequeue, display, representation and implementation of queue operations using array, applications of queues, circular queues - representation and implementation.

UNIT II

LIST: Introduction, dynamic memory allocation, self-referential structures, lists vs arrays Singly linked list - operations-insertion, deletion, display, search. Circular Linked Lists operations-insertion, deletion, display, search. Doubly Linked List operations-insertion, deletion, display, search.

UNIT III

Trees: Basic tree concepts, Binary trees**:** properties, types, representation of binary trees using arrays and linked lists, traversals of binary tree.

Binary Search Tree –Representation and implementation of operations, Binary Search Tree Traversals (recursive), creation of binary tree and BST from given traversals.

UNIT IV

Balanced Trees and Heaps: Introduction,AVL Trees and its operations (no implementation) . Binary Heaps (no implementation)

Multi way Search Trees: Introduction, B+ Trees operations. (no implementation)

Sorting : Quick Sort, Merge Sort, Radix Sort, Heap sort, Tree Sort

UNIT V

Graphs: Introduction, basic terminology, representation of graphs, graph traversal techniques – Breadth First Traversal, Depth First Traversal.

Hashing - Hashing and Collision: Introduction, Hash Tables, Hash Functions, Different Hash

Functions: Division Method, Multiplication Method, Mid-square Method, Folding Method; collisions: Collision Resolution by Open Addressing, Collision Resolution by Chaining (no implementation).

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

TEXT BOOKS:

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. S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTRONIC DEVICES AND CIRCUITS

Course Code: GR25A1025 **L/T/P/C: 3/0/0/3**
I Year II Semester

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

1. Describe the working of diode, BJT and FET, their biasing methods, and deduce the expressions for device parameters/ current/ and current-voltage relationships.
2. Discuss and analyze the various diode circuits such as rectifiers, filters, clippers and clampers.
3. Design appropriate biasing circuits using BJT and analyze the low frequency transistor (BJT) amplifier circuits.
4. Analyze the low frequency FET amplifier circuits and understand the MOSFET operation.
5. Acquire the knowledge about the role of special purpose electronic devices and their applications.

UNIT - I:
Diode: PN junction as a Diode, V-I characteristics, Diode resistance, Transition and Diffusion capacitance, Diode equivalent circuit, Specifications.
Diode Applications: Rectifiers - Half-wave, Full-wave (center-tap and bridge), Capacitor filter for rectifiers, Clippers, and clampers.

UNIT - II:
Bipolar Junction Transistor (BJT): Working principle, Current components, Common Base (CB), Common Emitter (CE), Common Collector (CC) configurations, Input and output characteristics, Transistor as an Amplifier.
BJT Biasing: Load line and operating point, Biasing techniques: Fixed bias, Collector-to-base bias, Self bias, Bias Stability, Thermal runaway, Bias compensation using diodes..

UNIT - III:
BJT Amplifiers: Transistor Hybrid parameter model, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

UNIT - IV:
Field Effect Transistors (FET): Junction FET: Structure, operation, and characteristics, MOSFET: Enhancement and Depletion mode, Comparison of BJT and FET, FET Small Signal Model, Analysis of CS and CD JFET Amplifiers, Introduction to FinFET and CNTFET.

UNIT - V:
Special Purpose Devices: Breakdown mechanisms in Zener Diodes, Zener diode characteristics and application, Structure, operation and characteristics of SCR and UJT, Principle of operation and characteristics of Tunnel diode, Varactor Diode, Photo diode, Solar cell, LED, Schottky diode.

TEXT BOOKS:

1. Jacob Millman, Christos C. Halkias, Satyabrata Jit - Electronic Devices and Circuits, McGraw-Hill Education, 4ed., 2016.

2. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory. Pearson, 11ed., 2015.

REFERENCE BOOKS:

1. David A. Bell, Electronic Devices and Circuits, Oxford University Press, 5ed., 2008.
2. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, Oxford University Press, 7ed., 2014.
3. G.K. Mithal, Electronic Devices and Circuits, Khanna Publishers, 23ed., 2017.
4. S. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, McGraw-Hill Education, 4ed., 2017.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GRAPHICS FOR ENGINEERS

Course Code: GR25A1015 **L/T/P/C: 1/0/4/3**

I Year II Semester
Prerequisites: Mathematics, Physics.

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

1. Generate two dimensional drawings and curves by using AutoCAD commands.
2. Interpret projection methods and draw projections of a line or point objects located in different positions.
3. Imagine and generate multi-view projections of planes and solid objects located in different positions
4. Construct and interpret sectional views of an object and develop its solid surfaces.
5. Create isometric drawings from given orthographic views and familiar with isometric to orthographic transformations.

UNIT I
Introduction to AutoCAD software: user interface, tool bar -draw, modify, dimension, layers, setting drawing area, status bar, print setup, generation of two-dimensional drawings.
Engineering curves- Conic sections – ellipse, parabola and hyperbola- general method only; Cycloidal curves- Cycloid, epi-cycloid and Hypocycloid.

UNIT II
Orthographic projection – Introduction, definition, and classification of projections; pictorial and multi-view, significance of first and third angle methods of projections;
Projections of points -a point situated in the first, second, third and fourth quadrants.
Projections of straight lines – Line inclined to one reference plane and parallel to the other.

UNIT III
Projections of planes - definition and types of regular plane figures like triangle, square, pentagon, hexagon, and circle; projections of planes -a plane inclined to one reference plane and perpendicular to the other.
Projections of solids - definition and types of right regular solids objects like prism, cylinder, pyramid, and cone; Projections of Solids -with an axis inclined to one reference plane and parallel to the other.

UNIT IV
Sections of solids- Section and sectional views of regular solids- Prisms, Cylinders, Pyramids and Cone – concept of Auxiliary Views.
Development of surfaces- Development of lateral surfaces of right regular solids - Prisms, Pyramids, Cylinders and Cone.

UNIT V
Isometric views– isomeric views of lines, planes (polygons) and solids (Prisms, Cylinders, Pyramids, and Cone); compound solids, generation of Isometric line diagrams. Introduction to World Coordinate System and User Coordinate System.
Conversion of views - Isometric Views to Orthographic Views and Vice-versa, and Conventions.

TEXT BOOKS:

1. Engineering Drawing by N. D. Bhatt, Fiftieth Revised and Enlarged Edition:2011, Charotar Publishing House Pvt. Ltd.
2. Engineering Graphics by Basant Agrawal and C M Agrawal, fifth re-print 2011, Tata McGraw Hill Education Private Limited, New Delhi.

REFERENCE BOOKS:

1. Engineering Graphics with AutoCAD 2020 by James D. Bethune, Copyright © 2020 by Pearson Education, Inc. All rights reserved.
2. Engineering Graphics by M. B. Shah, B. C. Rana, S. N. Varma, Copyright © 2011 Dorling Kindersley (India) Pvt. Ltd, Licensees of Pearson Education in South Asia.
3. Engineering Drawing and Graphics by K Venu Gopal /New Age International Pvt. Ltd, Publishers, fifth edition, 2002.
4. Engineering Graphics by Koushik Kumar, Apurba Kumar Roy, Chikesh Ranjan, S Chand and Company limited, first edition 2019.
5. Engineering Drawing with Auto Cad by B. V. R. Gupta, M. Raja Roy, IK International Pub., 2009.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ADVANCED ENGINEERING PHYSICS LAB

Course Code: GR25A1017 **L/T/P/C: 0/0/2/1**
I Year II Semester

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

1. Categorize semiconductors using Hall effect and energy gap measurement techniques.
2. Illustrate working of optoelectronic devices through experimental study.
3. Analyze the behavior of magnetic fields and their applications.
4. Infer the characteristics of Lasers and study of losses in optical fibers.
5. Determine the frequency of tuning fork through the phenomena of resonance.

List of Experiments:

1. Determination of energy gap of a semiconductor.
2. Determination of Hall coefficient and carrier concertation of a given semiconductor.
3. Study of V-I characteristics of pn junction diode.
4. Study of V-I characteristics of light emitting diode.
5. Study of V-I Characteristics of solar cell.
6. Determination of magnetic field along the axis of a current carrying coil.
7. a) Determination of wavelength of a laser using diffraction grating.
   b) Study of V-I & L-I characteristics of a given laser diode.
8. Determination of numerical aperture of a given optical fibre.
9. Determination of bending losses of a given optical fibre.
10. Determination of frequency of a tuning fork using Melde's arrangement.

Note: Any 8 experiments are to be performed.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

Course Code: GR25A1019 **L/T/P/C: 0/0/2/1**
I Year II Semester

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

1. Interpret the role and importance of various forms of communication skills.
2. Demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively by listening carefully and respect others point of view.
3. Utilize various media of verbal and non-verbal communication with reference to various professional contexts.
4. Recognize the need to work in teams with appropriate ethical, social and professional responsibilities.
5. speak and pronounce English intelligibly

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

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

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

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

- **Diagnostic Test – Activity titled '*Express Your View'***

Instruction: Spoken and Written language - Formal and Informal English - Greetings - Introducing Oneself and Others
Practice: Any Ice-Breaking Activity

Exercise – II
CALL Lab:
Instruction: Listening vs. Hearing - Barriers to Listening
Practice: Listening for General Information - Multiple Choice Questions - *Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)*
ICS Lab:
Instruction: Features of Good Conversation – Strategies for Effective Communication
Practice: Role Play Activity - Situational Dialogues –Expressions used in Various Situations –Making Requests and Seeking Permissions — Taking Leave - Telephone Etiquette

Exercise – III
CALL Lab:

Instruction: Errors in Pronunciation – Tips for Neutralizing Mother Tongue Influence (MTI)
Practice: Differences between British and American Pronunciation –*Listening Comprehension Exercises*
ICS Lab:
Instruction: Describing Objects, Situations, Places, People and Events
Practice: Picture Description Activity – Looking at a Picture and Describing Objects, Situations, Places, People and Events *(A wide range of Materials / Handouts are to be made available in the lab.)*

Exercise – IV
CALL Lab:
Instruction: Techniques for *Effective* Listening
Practice: Listening for Specific Details - Listening - Gap Fill Exercises - *Listening Comprehension Exercises*
(It is essential to identify a suitable passage with exercises for practice.)
ICS Lab:
Instruction: How to Tell a Good Story - Story Star- Sequencing-Creativity
Practice: Activity on Telling and Retelling Stories - Collage

Exercise – V
CALL Lab:
Instruction: Identifying the literal and implied meaning
Practice: Listening for Evaluation - Write the Summary – Listening Comprehension Exercises
(It is essential to identify a suitable passage with exercises for practice.)
ICS Lab:
Instruction: Understanding Non-Verbal Communication
Practice: Silent Speech - Dumb Charades Activity

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

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.
System Requirement (Hardware component):
Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration
ii) High Fidelity Headphones

2. **Interactive Communication Skills (ICS) Lab:**

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

Note: English Language Teachers are requested to prepare Materials /

Handouts for each Activity for the Use of those Materials in CALL & ICS Labs.

Suggested Software:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATA STRUCTURES LAB

Course Code: GR25A1023 **L/T/P/C: 0/0/2/1**
I Year II Semester

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

1. Implement stack and queue data structures and their applications.
2. Interpret various linked list operations to produce executable codes.
3. Develop working procedure for operations on BST using DMA.
4. Develop executable code for heaps and sorting techniques
5. Demonstrate graph operations and hashing techniques.

TASK 1

a. Write a C program to implement Stack operations using arrays.
b. Write a C program to implement Queue operations using arrays.
c. Write a C program to implement Circular Queue operations using arrays

TASK 2

a. Write a C program to convert infix expression to postfix expression.
b. Write a C program to evaluate a postfix expression.

TASK 3

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

TASK 4

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

TASK 5

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

TASK 6

a. Develop a C code for preorder, in-order and post-order traversals of a Binary Search Treeusing recursion.
b. Design a C program for level order traversal of a Binary Search Tree.

TASK 7

a. Implement the following operations on Binary Search Tree
i. Create ii. Insert iii. Search
b. Implement the following operations on Binary Search Tree
i. Delete ii. Display

TASK 8

a. Implement the following operations on Binary Search Tree
i. count-nodes ii. Height iii. minimum node iv. maximum node

TASK 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.

TASK 10

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

TASK 11

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

TASK 12

a. Implement a C program for the following operations on Hashing:
   i. Insert ii. Delete iii. Search iv. Display
b. Write a program to implement the following Hash Functions:
   i. Division Method ii) Multiplication Method
   iii. Mid-square Method iv) Folding Method

TEXT BOOKS:

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

REFERENCE BOOKS:

1. 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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTRONIC DEVICES AND CIRCUITS LAB

Course Code: GR25A1031 **L/T/P/C: 0/0/2/1**
I Year II Semester

Course Outcomes:

1. Identify, test, and demonstrate the working principles of passive components, active devices, and electronic test and measurement equipment.
2. Analyze the I–V characteristics of semiconductor devices such as diodes, BJTs, FETs, and UJTs, and determine key device parameters experimentally.
3. Design and evaluate rectifier, regulator, clipper, and clamper circuits to study their performance in signal shaping and voltage regulation applications.
4. Examine the amplification and frequency response characteristics of BJT and FET amplifiers through both hardware and simulation platforms.
5. Utilize circuit simulation tools (LTspice, Multisim, or equivalent) to model, verify, and compare semiconductor device and circuit behavior with experimental results.

A. Electronic Workshop Practice (in 3 Lab sessions)

1. Identification and Testing of RLC components, Potentiometers, Switches, Transformers, Bread board, PCB.
2. Identification and Testing of Active Devices, Diodes, BJTs, FETs, LED, SCR, UJT.
3. Study and operation of Regulated Power Supply, Function Generator, Digital Multimeter, CRO.

List of Experiments (Minimum of Twelve experiments to be done):

B. Hardware-Based Experiments (7):

1. Study the I–V characteristics of a PN junction diode in forward and reverse bias to determine cut-in voltage and dynamic resistance.
2. Examine the reverse bias characteristics of a Zener diode and demonstrate its application as a voltage regulator under varying conditions.
3. Design and analyze half-wave and full-wave rectifiers (center-tap and bridge) with and without capacitor filters to evaluate ripple factor and output voltage.
4. Input and output characteristics of BJT in common base configuration.
5. Input and output characteristics of BJT in common emitter configuration.
6. Design of Self bias circuits to establish a stable operating point for a BJT amplifier and study DC load line behaviour.
7. Characteristics of a JFET
8. UJT Characteristics.

C. Software-Based Simulation Experiments (7):

1. Simulate a full-wave bridge rectifier with capacitor filter to analyze waveform smoothing and ripple reduction in DC power supply design.
2. Simulate a Zener diode-based voltage regulator to study voltage stabilization against varying supply voltages and load resistances.
3. Implement clipper and clamper circuits to observe waveform shaping through positive, negative, and biased configurations.
4. Frequency response of Common Emitter Amplifier.

5. Simulate BJT operation as a switch
6. Frequency response of Common Source FET Amplifier.
7. Enhancement-mode NMOS transistor characteristics.
8. SCR Characteristics.

Hardware Requirements:

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

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

1. LTSpice (Free from Analog Devices)
2. NI Multisim (Academic License or Student Version)
3. Windows PC or Laptop with minimum 4GB RAM and i3 processor or better

II-I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTRONIC CIRCUIT ANALYSIS

Course Code: GR25A2053 **L/T/P/C: 2/1/0/3**
II Year I Semester

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

1. Analyze and classify multistage amplifier configurations and determine the impact of coupling schemes on amplifier performance and frequency response.
2. Apply the hybrid-π transistor model to evaluate high-frequency behavior of common-emitter amplifiers and calculate gain-bandwidth product.
3. Examine feedback amplifier types and assess the influence of negative feedback on gain stability, bandwidth, and distortion.
4. Design and analyze LC, RC, and crystal oscillators based on the Barkhausen criterion to generate sinusoidal waveforms.
5. Design power amplifiers and multivibrator circuits, and evaluate their performance in terms of efficiency, distortion, and waveform generation.

UNIT - I: Multistage Amplifiers:
Classification of Amplifiers, Distortion in Amplifiers, Coupling schemes: RC, Transformer, Direct coupling, Frequency response of multistage amplifiers, Transistor configuration choice in cascade amplifiers, Cascade and Cascode amplifiers, Darlington pair amplifier.
High-Frequency Transistor Model: Hybrid-π model, Hybrid-π parameters: Conductance's and capacitances, CE short-circuit current gain, Gain with resistive load and gain-bandwidth product

UNIT - II: Feedback Amplifiers:
Concept and need for feedback in amplifiers, Types and classification of feedback amplifiers, Characteristics of negative feedback: Gain stability, bandwidth, noise, distortion, Voltage series, Voltage shunt, Current series, Current shunt configurations.

UNIT - III: Oscillators:
Principle of positive feedback, Barkhausen Criterion for oscillations, LC Oscillators: Generalized analysis, Hartley, Colpitts, RC Oscillators: RC phase shift, Wien bridge, Crystal oscillator: Working and advantages

UNIT - IV: Power Amplifiers and Tuned Amplifiers:
Classification: Class A, B, AB, C, Series-fed Class A amplifier, Transformer-coupled Class A amplifier, Class B amplifier: Push-pull, Complementary- Symmetry, Efficiency calculations and Crossover distortion, Concept of Tuned Amplifiers: Single Tuned and Double Tuned Amplifiers.

UNIT - V: Multivibrators:
Analysis and design of Bistable, Monostable and Astable multivibrators and Schmitt Trigger using transistors. **Time Base Generators:** General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators, Linearity improvement techniques

TEXT BOOKS:

1. Jacob Millman, Christos C. Halkias, Satyabrata Jit - Electronic Devices and Circuits,

McGraw-Hill Education, 4ed., 2016.
2. 2. David A. Bell, Electronic Devices and Circuits, Oxford University Press, 5ed., 2008.

REFERENCE BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson, 11ed., 2015.
2. 2. Jacob Millman and Arvin Grabel, Microelectronics, 2ed., McGraw Hill.
3. 3. Jacob Millman and Herbert Taub, Pulse, Digital, and Switching Waveforms, McGraw Hill Education, 1991.
4. 4. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, 7ed., Oxford University Press, 2015.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIGITAL ELECTRONICS

Course Code: GR25A2054 **L/T/P/C: 3/0/0/3**
II Year I Semester

Course Outcomes: Upon completion, students will be able to

1. Apply Boolean algebra and minimization techniques to simplify Boolean functions.
2. Design combinational circuits using logic gates.
3. Analyze latches and flip-flops to design sequential logic circuits.
4. Construct synchronous sequential circuits combining flip-flops and logic gates.
5. Utilize programmable logic devices in digital system design.

UNIT – I: Number Systems: Number-Base conversion, Binary Arithmetic, Complements of Numbers, Arithmetic operations with Signed numbers, Digital Codes, Error Detection and Correction codes : Parity check and Hamming code.
Boolean algebra and Logic Gates: Basic theorems and properties, Simplification using Boolean Algebra, Canonical and Standard form, Digital Logic Gates Overview.

UNIT - II: Simplification of Boolean Functions: Karnaugh Maps – 2, 3, and 4 variables, Sum-of-products (SOP) and product-of-sums (POS) simplification, NAND and NOR implementation, Don't care conditions.
Combinational Logic Design: Design procedure, Binary Adder and Subtractor, Decimal Adder, Code conversion, Magnitude comparator, Decoders and Encoders, Multiplexers and Demultiplexers, Boolean Function Implementation. Dataflow, Structural and Behavioural modelling of Combinational logic circuits using Verilog HDL..

UNIT - III: Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another. Dataflow modelling of Sequential logic circuits using Verilog HDL.

UNIT - IV: Registers and Counters: Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters. Structural modelling of Sequential logic circuits using Verilog HDL.

UNIT - V: Sequential Machines: Finite State Machines, Synthesis of Synchronous Sequential Circuits - Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo - N Counters. Behavioural modelling of Sequential logic circuits using Verilog HDL.
Programmable Logic Devices: Memory devices - RAM, ROM, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL).

TEXT BOOK:

1. M. Morris Mano and Michael D. Ciletti, Digital Design. With an Introduction to Verilog HDL, Pearson Education, 6ed., 2018.
2. Samir Palnitkar, Verilog HDL, A Guide to Digital Design and Synthesis, Pearson Education, 2ed. 2008.

REFERENCE BOOKS:

1. Zvi Kohavi & Niraj K. Jha, Switching and Finite Automata Theory, Cambridge, 3ed, 2010.
2. R.P. Jain, “Modern Digital Electronics”, Tata McGraw Hill, 4ed., 2009.
3. Thomas L. Floyd, “Digital Fundamentals”, Pearson, 11ed., 2015.
4. Charles H. Roth Jr., Larry L. Kinney, Fundamentals of Logic Design, Cengage Learning, 6ed.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SIGNALS AND SYSTEMS

Course Code: GR25A2055 **L/T/P/C: 2/1/0/3**
II Year I Semester

Course Outcomes: Upon completing this course, the student will be able to

1. Analyze and classify signals and systems, apply orthogonal function representation, and evaluate standard elementary signals.
2. Apply Fourier series and Fourier transform techniques to represent, analyze, and interpret continuous-time signals and their spectra.
3. Examine the response of linear systems using convolution, transfer functions, and filtering concepts, and assess conditions for distortion less transmission.
4. Utilize Laplace and correlation techniques to characterize signals and systems in terms of energy, power spectra, and noise performance.
5. Apply sampling theorem and Z-transform methods to discrete-time signals for signal reconstruction, system analysis, and solving difference equations.

UNIT-I: Signal Analysis: Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

UNIT-II: Fourier series: Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.
Fourier Transforms: Concept of Fourier Transform from Fourier series, Fourier Transform of arbitrary signal and standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

UNIT-III: Signal Transmission through Linear Systems: Linear System, Impulse response, Response of a Linear System, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution. Extraction of Signal from Noise by Filtering. Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and risetime.

UNIT-IV: Laplace Transforms: Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.
Correlation: Auto Correlation and Cross Correlation Functions, Relation between Convolution and Correlation, Properties of Correlation Functions, Energy Density Spectrum, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density relation, Parseval's Theorem for energy / power signals, Detection of Periodic Signals in the presence of Noise by Correlation.

UNIT-V: Sampling theorem: Sampling Theorem for Base band/Band Limited and Band Pass

Signals, Types of Sampling: Impulse Sampling, Natural and Flattop Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing.

Z–Transforms: Concept of Z- Transform of a Discrete Sequence, Comparison of Laplace, Fourier and Z Transforms, Region of Convergence of Z-Transform, Properties of ROC for various classes of signals, Inverse Z-transform, Properties of Z-transform, Application of Z-Transform to solve difference equation.

TEXT BOOKS:

1. B.P. Lathi, Signals, Systems & Communications, BS Publications, 2008.
2. Alan V. Oppenheim, Alan. S. Willsky, S. Hamid Nawab, Signals and Systems, Pearson, 2ed., 2015.

REFERENCE BOOKS:

1. Simon Haykin, Barry Van Veen, Signals and Systems, Wiley, 2ed.
2. A. Rama Krishna Rao, Signals and Systems, TMH, 2008.
3. Michel J. Roberts, Govind Sharma, Fundamentals of Signals and Systems, McGraw Hill, 2ed.
4. Signals, Systems and Transforms, Charles. L. Philips, John M. Parr and Eve A. Riskin, 4ed., 2008, Pearson Education.
5. A. Anand Kumar, Signals and Systems, PHI, 3ed., 2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROBABILITY THEORY AND STOCHASTIC PROCESSES

Course Code: GR25A2056 **L/T/P/C: 2/1/0/3**
II Year I Semester

Course Outcomes: Upon completing this course, the student will be able to

1. Describe probability theory basics, random variable basics and apply the knowledge of mathematics to solve problems on Bayes Theorem.
2. Explain distribution and density functions of various single random variable, and apply the knowledge of mathematics to solve problems on mean, variance etc.
3. Discuss multiple random variables and analyze the properties and operations on multiple random variables.
4. Determine the temporal and spectral characteristics of Random Signals.
5. Apply the knowledge of random process for understanding the noise characteristics.

UNIT-I: Probability: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events.
Random Variables: Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.

UNIT-II: Operations on single Random Variable: Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable - Monotonic and Non-monotonic Transformations of Continuous and Discrete Random Variable, Generation of a Random Variable of a given PDF/CDF.

UNIT-III: Multiple random variables and Operations on Multiple random variables: Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density– Point and Interval conditioning, Statistical Independence, Sum of Two and more Random Variables, Central Limit Theorem, Equal and Unequal Distribution (Proof not expected).
Expected Value of a Function of Random Variables- Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT-IV: Random processes – Temporal characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second- Order and Wide- Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean- Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross- Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. Random Signal Response of Linear Systems: System Response – Convolution, Mean and

Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

UNIT-V: Random processes – Spectral characteristics: The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.
Noise sources: Resistive / Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties.

TEXT BOOKS:

1. Peyton Z. Peebles - Probability, Random Variables & Random Signal Principles - TMH, 4th Edition
2. Murray R Spiegel, John Schiller, R Alu Srinivasan. – Probability and Statistics – Schaum's Outlines, 2nd Edition, TMH

REFERENCES:

1. P Ramesh Babu - Probability Theory and Random Processes – McGraw Hill Education
2. Athanasios Papoulis and S. Unnikrishna Pillai - Probability, Random Variables and StochasticProcesses – McGraw Hill Education, 4th Edition
3. K. N. Hari Bhat, K. Anitha Sheela and Jayant Ganguly - Probability Theory and Stochastic Processes for Engineers - Pearson, 1st Edition, 2011
4. Tau b and Schilling - Principles of Communication systems by (TMH), 2008
5. Y Mallikarjuna Reddy - Probability Theory and Stochastic Processes, 4th Edition, University Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
NETWORK ANALYSIS AND SYNTHESIS

Course Code: GR25A2057 **L/T/P/C: 3/0/0/3**
II Year I Semester

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

1. Discuss the concepts of network topology and magnetically coupled circuits.
2. Compute the transient and steady state response of RLC circuits.
3. Analyze the electrical network and two port network parameters for different applications.
4. Understand and classify various filters, attenuators and equalizers.
5. Synthesize the RL, RC & RLC networks by Foster and Cauer forms.

UNIT-I: Network Topology and Magnetically coupled circuits:
Basic cut-set and tie-set matrices for planar networks**,** Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

UNIT-II: Transient and Steady state analysis: RC, RL and RLC Circuits, Sinusoidal, Step and Square responses, RC Circuits as integrator and differentiators. 2nd order series and parallel RLC Circuits, Root locus, damping factor, over damped, under damped, critically damped cases, quality factor and bandwidth for series and parallel resonance, resonance curves.

UNIT-II: Two port network parameters: Z, Y, ABCD, h and g parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard T, π, L Sections, Characteristic impedance, image transfer constants.

UNIT-IV: Filters: Classification of Filters, Filter Networks, Constant-K Filters - Low pass, High pass, Band pass, Band-stop filters; m-derived Filters - T and π filters - Low pass, high pass.
Attenuators: Types - T-Type Attenuator, π -Type Attenuator, Lattice Attenuator, Bridged T attenuator, Ladder-Type Attenuator; Equalizers.

UNIT-V: Network Synthesis: Driving point impedance and admittance, transfer impedance and admittance, network functions of Ladder and non-ladder networks, Poles, Zeros analysis of network functions, Hurwitz polynomials, Positive Real Functions, synthesis of LC, RC and RL Functions by foster and cauer methods.

TEXT BOOKS:

1. William H. Hayt and Jack E. Kemmerly, Steven M. Durbin, Engineering Circuit Analysis, Tata Mc Graw Hill Education, 8ed., 2012.
2. John D. Ryder, Networks, Lines and Fields, 2ed., PHI, 1999.
3. S.P. Ghosh and A.K. Chakraborty, Network Analysis and Synthesis, McGraw Hill Education, 2014.

REFERENCE BOOKS:

1. Van Valkenburg, Network Analysis, 3ed., Pearson, 2016.
2. A. Sudhakar and Shyammohan S. Palli, Circuits and Networks: Analysis and Synthesis, McGraw Hill Education, 5ed.
3. Ravish R. Singh, Network Analysis and Synthesis, McGraw Hill Education, 2013.
4. Mahmood Nahvi and Joseph A. Edminister, Electric Circuits, Schaum's Outlines Series, McGraw Hill Education, 4e., 2003.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
VALUE ETHICS AND GENDER CULTURE

Course Code: GR25A2002 **L/T/P/C: 1/0/0/1**
II Year I Semester

Course Outcomes:

1. To enable the student to understand the core values that shapes the ethical behaviour. And Student will be able to realize the significance of ethical human conduct and self-development
2. Students will be able to inculcate positive thinking, dignity of labour and religious tolerance.
3. The students will learn the rights and responsibilities as an employee and a team member.
4. Students will attain a finger grasp of how gender discrimination works in our society and how to counter it.
5. Students will develop a better understanding on issues related to gender and Empowering students to understand and respond to gender violence.

Unit-I: Values and Self-Development –social values and individual attitudes, Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.

- ❖ A Case study on values and self-development

Unit-II Personality and Behaviour Development-positive thinking, punctuality, avoiding fault finding, Free from anger, Dignity of labour, religious tolerance, Aware of self-destructive habits.

- ❖ A Case study on Personality

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

- ❖ A Case study on professional ethics

Unit–IV: Introduction to Gender - Definition of Gender, Basic Gender Concepts and Terminology, Attitudes towards Gender, Social Construction of Gender.

- ❖ A Case study/ video discussion on attitudes towards gender

Unit-V: **Gender-based Violence** -The concept of violence, Types of Gender-based violence, the relationship between gender, development and violence, Gender-based violence from a human rights perspective.

- ❖ A Case study/ video discussion on gender-based violence in view of human rights

TEXTBOOKS:

1. Professional Ethics Includes Human Values (2nd Edition) By R Subramanian, Oxford University Press, 2017.
2. Ethics in Engineering Practice & Research, Caroline Whit beck, 2e, Cambridge University Press 2015.
3. A Bilingual Textbook on Gender" written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu and published by Telugu Akademi, Hyderabad, Telangana State in the year 2015.

REFERENCE BOOKS:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. "I Fought For My Life…and Won."Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/
3. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e , Cengage learning, 2015.
4. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTRONIC CIRCUIT ANALYSIS LAB

Course Code: GR25A2058 **L/T/P/C: 0/0/2/1**
II Year I Semester

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

1. Design and analyze single and multistage amplifier circuits using BJTs and evaluate their gain, bandwidth, and frequency response.
2. Construct and examine various oscillator circuits (Hartley, Colpitts, RC phase shift) to determine frequency stability and practical gain conditions for sustained oscillations.
3. Design and evaluate power amplifier circuits (Class A, Class B, and push-pull) to determine efficiency and distortion characteristics.
4. Implement and simulate multivibrator and waveform generator circuits using BJTs and interpret their time-domain behavior.
5. Utilize circuit simulation tools (LTspice, Multisim, or PSpice) to analyze amplifier feedback configurations and tuned amplifier performance, and correlate simulation results with hardware observations.

List of Experiments

A. Hardware Experiments (7):

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1. Design and analyze a two-stage RC coupled amplifier to demonstrate gain enhancement and study coupling capacitance effects.
2. Design Hartley and Colpitts oscillators for a specified frequency and observe their output waveforms.
3. Design an RC phase shift oscillator and derive the practical gain condition for oscillations at a given frequency.
4. Design a class A power amplifier, observe input/output waveforms, and calculate efficiency.
5. Design a class B power amplifier, analyze input/output waveforms, and evaluate harmonic distortion.
6. Design a bistable multivibrator, analyze commutating capacitor effects, and record transistor waveforms.
7. Design an astable multivibrator and observe transistor base and collector waveforms.

B. Software Simulations (7):

1. Simulate four feedback amplifier topologies and compare their frequency responses with and without feedback.
2. Simulate a monostable multivibrator and analyze its input/output waveforms.
3. Simulate a Schmitt trigger for gain values greater than and less than one and analyze response behavior.
4. Simulate a bootstrap time base generator using BJT and observe the output sweep waveform.
5. Simulate a Miller sweep circuit using BJT and observe the time base output waveform.
6. Simulate a complementary symmetry push-pull amplifier and verify elimination of crossover distortion.
7. Simulate a single tuned amplifier and determine the quality factor (Q) of its tuned circuit.

Software Requirements:

1. Simulation Tools: LTspice / Multisim / PSpice / Proteus / NI Multisim Live or equivalent
2. Operating System: Windows 10/11 or Linux (Ubuntu preferred)

Hardware Requirements:

1. Dual Power Supply (±15V, 0–30V)
2. Function Generator (up to 1 MHz)
3. CRO / DSO (Dual Channel, 20 MHz or more)
4. Digital Multimeters
5. Breadboards and Connecting Wires
6. BJTs: BC107, 2N2222, etc.
7. Resistors, Capacitors (Wide range of values)
8. Laptop, Analog Discovery, Bread board

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIGITAL ELECTRONICS LAB

Course Code: GR25A2059 **L/T/P/C: 0/0/2/1**
II Year I Semester

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

1. Realize and verify basic logic gates and Boolean functions using discrete logic ICs and demonstrate minimization using universal gates.
2. Design and implement combinational logic circuits such as adders, subtractors, parity generators, code converters, multiplexers, and decoders using hardware logic ICs.
3. Develop Verilog HDL models for combinational and sequential circuits using dataflow, structural, and behavioural modeling approaches.
4. Simulate and analyze digital systems such as counters, shift registers, and sequence detectors using FSM-based design principles.
5. Integrate hardware realization and HDL simulation skills to verify digital circuit functionality and demonstrate practical understanding of digital design flow from logic gates to HDL implementation.

List of Experiments

A. Realization in Hardware Laboratory (Using Logic ICs)

1. Realize and minimize Boolean functions using basic gates and universal gates (NAND/NOR) in SOP/POS form.
2. Design and implement Half Adder, Full Adder, Half Subtractor, and Full Subtractor using logic gates.
3. Construct and analyze basic logic gates (AND, OR, NOT, XOR, XNOR) using only NAND and NOR gates.
4. Design and implement parity bit generators (even and odd) and a 4-input majority logic circuit.
5. Design and implement code converters such as Binary to Gray, Gray to Binary, and BCD to Excess-3 using gates.
6. Design and implement simple combinational circuits: 2-to-1 multiplexer, 1-bit comparator, and segment decoder logic.

B. Verilog HDL-Based Digital Design Experiments (Simulation-Based)

1. Design and simulate a 2-bit comparator using dataflow modeling; extend it to 4-bit using structural modeling.
2. Implement a 2:1 multiplexer using dataflow modeling and design an 8:1 multiplexer using structural modeling.
3. Design a 2-to-4 decoder using dataflow modeling and realize a 3-to-8 decoder using structural modeling.
4. Implement a given Boolean function using a decoder-based approach in behavioural modeling.
5. Design and simulate a universal n-bit shift register (left, right, hold, parallel load) using behavioural modeling.
6. Design a synchronous MOD-n counter using behavioural modeling with D or JK flip-flops.

7. Design and simulate an asynchronous (ripple) counter for a custom sequence using structural modeling.
8. Implement a sequence detector for a given binary pattern using FSM (Moore/Mealy) in behavioural modeling.

A. Required Hardware (for Hardware Lab Experiments) Digital Trainer Kit Breadboard with power supply and clock generator, Logic ICs 7400 (NAND), 7402 (NOR), 7408 (AND), 7432 (OR), 7486, (XOR), 7404 (NOT), etc. Flip-Flop ICs 7474 (D Flip-Flop), 7476 (JK Flip-Flop), MUX/Decoder ICs 74153, 74138, 74139 LEDs, switches, connecting wires For I/O interface and testing

B. Required Software Tools (for Verilog HDL Experiments) (Any one of the tool below) Xilinx Vivado HDL simulation and synthesis (preferred tool)/ Equivalent Software

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SIGNALS AND SYSTEMS LAB

Course Code: GR25A2060 **L/T/P/C: 0/0/2/1**
II Year I Semester

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

1. Generate and manipulate various standard and nonstandard continuous and discrete-time signals and perform basic operations such as shifting, scaling, folding, and energy/power computation using MATLAB or equivalent tools.
2. Analyze signal characteristics by determining even/odd and real/imaginary components, and evaluate system responses through convolution and correlation operations.
3. Verify and interpret system properties such as linearity, time invariance, stability, and physical realizability for continuous and discrete-time systems.
4. Compute and visualize frequency-domain representations of signals using Fourier, Laplace, and Z-Transforms, and interpret their magnitude, phase, and pole-zero characteristics.
5. Model and simulate continuous-time systems using Simulink or equivalent tools to study responses of RLC and other dynamic systems, and demonstrate waveform synthesis and Gibbs phenomenon.

List of Experiments

Signals and Systems (Minimum 7 Experiments)

1. Write the code / script for generating various standard viz: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc and Nonstandard Signals and Sequences generated from these standard signals /sequences using Waveform synthesis. Also for perform different operations viz: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power on them.
2. Write the code / script for finding the Even and Odd parts of Signal / Sequence and Real and Imaginary parts of Signal.
3. Write the code / script for finding the output of a System for a given input and Impulse Response and finding Auto Correlation and Cross Correlation of Signals / sequences
4. Write the code / script for Verifying whether a given Continuous/Discrete System is Linear, Time Invariant, Stable and Physically Realizable
5. Write the code / script for obtaining Sinusoidal response and Impulse response of a given Continuous / Discrete LTI System. a) Plot the Real and Imaginary part and b) Magnitude and Phase Plot of the response
6. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Fourier Transform by using the properties where ever required.
7. Write the code / script for finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Laplace Transform by using the properties where ever required. Also plot pole-zero diagram in S-plane
8. Write the code/ script for finding and plotting the Magnitude and Phase Spectrum of any given Sequence by finding its Z-Transform by using the properties wherever

required. Also plot pole – zero diagram in Z-plane

9. Design a Simulink or equivalent model for a) Solving Differential Equations b) Finding the response of any RLC Circuit with different initial Conditions for AC and DC inputs and plot the corresponding responses
10. Gibbs Phenomenon and waveform synthesis

Lab Methodology: MATLAB or Equivalent Simulation Tool

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
APPLIED PYTHON PROGRAMMING LAB

Course Code: GR25A2061 **L/T/P/C: 0/1/2/2**
II Year I Semester

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

1. Write and execute Python programs for digital and arithmetic operations.
2. Apply Python data structures to simulate logic circuits.
3. Implement combinational and sequential circuits using Python.
4. Visualize logic timing and state behavior graphically.
5. Connect Python concepts with HDL and VLSI verification fundamentals.

List of Experiments:

Task1: Basic Arithmetic Operations
Task2: Number System Conversion
Task3: Bitwise Operations
Task4: Arrays and Signal Representation
Task5: Matrix Operations
Task6: Boolean Function Evaluation
Task7: Truth Table Generator
Task8: Logic Gate Simulation
Task9: Karnaugh Map Simplification (2-4 variables)
Task10: Half Adder and Full Adder Simulation
Task11: Flip-Flop Simulation
Task12: Counter Simulation
Task13: Shift Register Simulation
Task14: Finite State Machine (FSM)
Task15: Timing Diagram Generator

NOTE:
A minimum of 12 (Twelve) experiments has to be performed and recorded by the candidate to attain eligibility for the Practical Examination.

II-II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
NUMERICAL METHODS AND COMPLEX VARIABLES

Course Code: GR25A2102 **L/T/P/C: 3/0/0/3**
II Year II Semester
Pre-requisites: Mathematics courses of first year of study.

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

1. Illustration any periodic function in terms of sine and cosine.
2. Solve algebraic and transcendental equations, and interpolate.
3. Apply numerical techniques for solving integr and first order ODE's
4. Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.
5. Explain Taylor's and Laurent's series expansions in complex function.

UNIT-I : Fourier Series & Fourier Transforms

Full Range Fourier series – Half-range Fourier series – Fourier Transforms, Fourier Sine and Cosine transforms

UNIT-II : Numerical Methods-I

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

UNIT-III : Numerical Methods-II

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

UNIT-IV : Complex Differentiation

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

UNIT-V : Complex Integration

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

TEXT BOOKS:

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

2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

Course Code: GR25A2062 **L/T/P/C: 3/0/0/3**
II Year II Semester

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

1. Apply the principles of electrostatics to analyze electric fields, potentials, boundary conditions, and capacitor structures using Maxwell's equations.
2. Analyze magnetostatic fields using Biot–Savart's law, Ampere's law, vector/scalar potentials, and Maxwell's equations, and evaluate magnetic boundary conditions.
3. Examine electromagnetic wave propagation in conducting and dielectric media, evaluate reflection and refraction phenomena, and apply Poynting theorem for energy flow.
4. Analyze transmission line parameters, propagation characteristics, impedance matching techniques, and utilize Smith charts for practical RF design.
5. Investigate wave propagation in rectangular waveguides, determine TE/TM modes and cut-off frequencies, and assess power transmission and mode characteristics.

UNIT-I: Electrostatics: Review of Coordinate Systems & Vector Calculus, Coulomb's Law, Electric Field Intensity - Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and its applications, Electric Potential, Relation between E and V, Maxwell's Equations for Electrostatic Fields in differential and integral forms, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitors - Parallel Plate, Coaxial, Spherical, Electric Boundary Conditions.

UNIT-II: Magnetostatics: Biot-Savart's Law, Ampere's Circuit Law and its applications, Magnetic Flux Density, Maxwell's equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law**,** Faraday's Law, Inconsistency in Ampere's Law and Displacement Current Density, Maxwell's Equations for Magnetostatic fields in differential and integral forms, Magnetic Boundary Conditions.

UNIT-III: EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves - Definitions, Relation between E&H, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics - Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Skin Depth, Surface Impedance, Wave Polarization. Poynting Vector and Poynting Theorem.
Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection,

UNIT-IV: Transmission Lines: Equivalent Circuit, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Condition for Distortion less transmission lines, Input Impedance, SC and OC Lines, Reflection Coefficient, VSWR, Smith Chart- Configuration and Applications, Single Stub Matching.

UNIT-V: Waveguides: Rectangular Waveguides - Solution of Wave Equations in Rectangular

Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Phase and Group Velocities, Wavelengths and Impedance Relations, Equation of Power Transmission, Impossibility of TEM Mode.

TEXT BOOKS:

1. William H. Hayt Jr. and John A. Buck, Engineering Electromagnetics, 8ed.,McGraw Hill, 2014.
2. Matthew N.O. Sadiku and S.V. Kulkarni, Principles of Electromagnetics, 6ed., Oxford University Press, Asian Edition, 2015.

REFERENCE BOOKS:

1. E.C.Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems, 2ed., PHI, 2000.
2. Nathan Ida, Engineering Electromagnetics, Springer(India) Pvt. Ltd., 2ed. New Delhi, 2005.
3. Bhag Guru and Huseyin R. Hiziroglu, Electromagnetic Field Theory Fundamentals, Cambridge University Press, 2ed., 2006.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
LINEAR CONTROL SYSTEMS

Course Code: GR25A2063 **L/T/P/C: 2/1/0/3**
II Year II Semester

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

1. Determine the Transfer function using block diagram reduction technique and signal flow graphs.
2. Evaluate steady state errors from Transfer function.
3. Apply Routh criterion/ Root locus to determine the stability of LTI systems.
4. Evaluate Bode, Polar, inverse and Nyquist plots.
5. Apply state space analysis to control systems

UNIT I

Introduction to control systems, Classification, open-loop and closed-loop systems Transfer function of SISO and MIMO, Block Diagram of a closed-loop system, procedure for drawing a block diagram, transfer function of block diagrams, construction of Signal Flow Graphs (SFG), Signal Flow Graph analysis.

UNIT II

Time response of control system, Standard test signals, Time response of first-order and second-order systems, steady state errors and error constrains, Bounded Input and Bounded Output(BIBO), Necessary conditions for stability, Routh stability criterion, applications of the Routh stability criterion, relative stability analysis.

UNIT III

Root locus concepts, construction of root loci, rules for the construction of the root locus, Correlation between time and frequency response, Polar plots and inverse polar plots.

UNIT IV

Bode plots, Basic factors of G(jw)H(jw), general procedure for constructing Bode plots, computation of Gain Margin and Phase margin, Nyquist plots, principle of argument, Nyquist stability criterion.

UNIT V

State Space Analysis: Concepts of state, state variables and state models, state-space representation, state transition matrix and state transition equation.

TEXT BOOKS:

1. A.Anand Kumar, “Control Systems”, Seventh printing, PHI Learning New Delhi, 2012
2. J. Nagrath, M. Gopal,“Control Systems Engineering”,Fifth Edition, NewAge International, New Delhi, 2007.

REFERENCE BOOKS:

1. Katsuhiko Ogata, “Discrete Time Control Systems”, Second Edition, PHI Learning New Delhi, 2006.
2. R. Ananda natarajan, P. Ramesh Babu, “Control Systems Engineering”, Second edition, Sci Tech Publications Pvt. (India) Ltd, 2008

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
LINEAR AND DIGITAL IC APPLICATIONS

Course Code: GR25A2064 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Outcomes: Upon completing this course, the student will be able to

1. Analyze the characteristics and modes of operation of operational amplifiers, and design applications such as amplifiers, comparators, and voltage regulators.
2. Design and evaluate active filters, waveform generators, and timing/control circuits using IC555 and IC565 for practical signal processing applications.
3. Compare different types of data converters, explain their principles of operation, and evaluate their performance based on specifications.
4. Examine digital IC characteristics across TTL and CMOS logic families, and implement combinational logic functions using standard ICs.
5. Analyze and design sequential circuits using flip-flops, counters, and shift registers, and explain the architecture and applications of semiconductor memories.

UNIT-I: Operational Amplifier: Ideal and Practical Op-Amp Characteristics, Features of 741 Op- Amp, Modes of Operation Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT-II: Op-Amp, IC-555 & IC565 Applications
Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and Astable Operations,
Applications, IC565 PLL - Block Schematic, principle and Applications.

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

UNIT-IV: Logic Families: Digital IC characteristics, TTL logic family, TTL series and TTL output configurations: open collector, Totem pole, Tri state logic. MOS logic family, CMOS logic family and its series characteristics, CMOS transmission gate, CMOS open drain and high impedance outputs, Comparison of TTL and CMOS logic families.
Combinational Logic ICs: Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT-V: Sequential Logic IC's and Memories: Familiarity with commonly available 74XX & CMOS40XX Series ICs– All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.
Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs..

TEXT BOOKS:

1. Ramakant A. Gayakwad, Op-Amps & Linear Integrated Circuits, PHI, 4ed., 2012.
2. Thomas L. Floyd, Digital Fundamentals, Pearson, 11ed., 2015.

REFERENCE BOOKS:

1. Roy Choudhury and Shail B. Jain, Linear Integrated Circuits, New Age International Publishers, 2ed, 2003.
2. John. F. Wakerly, Digital Design Principles and Practices, Pearson, 3ed., 2009.
3. S. Salivahanan and V.S. Kanchana Bhaaskaran, Linear Integrated Circuits, 3ed., McGraw Hil Education, 2018.
4. William D. Stanley, Operational Amplifiers with Linear Integrated Circuits, 4ed., Pearson Education, 2009.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ANALOG AND DIGITAL COMMUNICATIONS

Course Code: GR25A2065 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Outcomes: Upon completing this course, the student will be able to

1. Analyze amplitude and angle modulation schemes, explain their time and frequency domain representations, and evaluate methods of generation and detection.
2. Compare AM and FM transmitters and receivers, analyze noise performance, and explain pulse modulation techniques and multiplexing methods.
3. Apply detection and estimation principles in digital communication systems, design optimum receivers, and evaluate baseband transmission techniques for minimizing intersymbol interference.
4. Examine digital modulation schemes including PCM, DPCM, DM, BPSK, QPSK, QAM, and M-ary formats, and compare their performance in terms of noise, bandwidth efficiency, and spectral characteristics.
5. Apply information theory concepts to measure entropy, information rate, and channel capacity, and implement source and channel coding techniques for efficient and reliable communication.

UNIT-I: Amplitude Modulation: Need for modulation, Amplitude Modulation: Time and frequency domain description, Generation –Switching modulator, Detection - Envelope detector, DSB-SC Modulation: Generation – Balanced Modulator, Detection- Synchronous detector, COSTAS Loop, SSB Modulation: Time and frequency domain description, Generation – Phase discrimination Method and Demodulation – coherent detection, Vestigial side band modulation and demodulation.
Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis, Carson's Rule, Generation of FM Waves- Armstrong Method, Detection of FM Waves - Phase locked loop, Comparison of FM and AM.

UNIT-II: Transmitters & Receivers: Classification of Transmitters, AM Transmitters, FM Transmitters, AM Receiver - Super heterodyne receiver, FM Receivers, Stereo FM multiplex reception, Comparison of AM and FM Receiver. Noise analysis in AM, DSB, SSB and FM Modulation System, Threshold effect in Angle Modulation System, Pre- emphasis, and de-emphasis
Pulse Modulation: Types of Pulse modulation - PAM, PWM and PPM, Comparison of FDM and TDM.

UNIT-III: Detection and Estimation: Model of Digital Communication Systems, Geometric Interpretation of Signals, Gram-Schmidt Orthogonalization, Response of Bank of correlators to Noisy Input, Detection of Known Signals in Noise, Probability of error, Optimum Receivers using Coherent Detection: Matched filter Receiver and its Properties, Correlation receiver, Detection of signals with unknown Phase in Noise.
Base Band Shaping for Data Transmission: Requirements of a line encoding format, various line encoding formats - Unipolar, Polar, Bipolar, Discrete PAM signals, Inter symbol interference, Nyquist's criterion, Correlation coding: Duobinary signaling, Modified Duobinary technique, generalized form of correlation coding, Eye pattern.

UNIT-IV: Digital Modulation Techniques: PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, DM and Adaptive

DM, Noise in PCM and DM.
Digital Modulation formats, Coherent binary modulation techniques (BPSK, BFSK), Coherent quadrature modulation techniques (QPSK), Non-Coherent binary modulation techniques (BFSK, DPSK), QAM, M-ary modulation techniques (PSK, FSK, QAM), Comparison of M-ary digital modulation techniques, power spectra, bandwidth efficiency, constellation diagrams.

UNIT-V: Information theory: Entropy, Information rate, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade-off between bandwidth and SNR.
Source coding - Huffman coding, Shannon Fano coding, Channel coding - Linear block codes and cyclic codes.

TEXT BOOKS:

1. Wayne Tomasi, Electronics Communication Systems - Fundamentals through Advanced, 5ed., PHI, 2009.
2. K. Sam Shanmugam, Digital and Analog Communication System, Wiley, 2019.
3. Herbert Taub, Donald L. Schiling, Goutam Saha, Principles of Communication Systems, 3ed., McGraw Hill, 2008.

REFERENCE BOOKS:

1. Dennis Roddy and John Coolen, Electronic Communications, 4ed., Pearson, 2008.
2. George Kennedy and Bernard Davis, Electronic Communication Systems, 4ed.,TMH, 2009.
3. Communication System - Simon Haykin and Michael Moher, Wiley, 5ed., 2022.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENVIRONMENTAL SCIENCE

(Common to all Branches)

Course Code: GR25A2001 **L/T/P/C: 1/0/0/1**

II Year II Semester

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

1. Understand the structure, function, and significance of ecosystems.
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. **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.

Slogan and Poster making on Environmental Management Plan, Contemporary Environmental Issues (Climate change – Impact on air, water, biological and Socioeconomical aspects); Sustainable development goals (SDGs); Global environmental challenges; Environmental policies.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
LINUX AND SHELL SCRIPTING

Course Code: GR25A2067 **L/T/P/C: 0/1/2/2**
II Year II Semester

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

1. Use basic and advanced shell commands for automation.
2. Write shell scripts to process and extract data efficiently.
3. Automate synthesis, simulation, and verification flows.
4. Develop log analysis and report generation scripts.
5. Integrate shell scripting with VLSI design tools and methodologies.

List of Experiments

Task1: Introduction to Linux and Shell Commands
Task2: Writing Your First Shell Script
Task3: Using Variables and User Input
Task4: Conditional Statements in Shell
Task5: Looping Constructs in Shell
Task6: Working with Command-Line Arguments
Task7: Text and Log File Processing using grep, awk, sed
Task8: File Redirection and Append Operations
Task9: Automation of Simulation Flow
Task10: Generating Reports using Shell Scripting
Task11: Batch Processing of HDL Files
Task12: Extracting Timing and Area Data from Reports
Task13: Automating Testbench Execution
Task14: Converting Log Data to CSV Format
Task15: Complete Design Flow Automation Project

NOTE:
A minimum of 12 (Twelve) experiments has to be performed and recorded by the candidate to attain eligibility for the Practical Examination.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
LINEAR AND DIGITAL IC APPLICATIONS LAB

Course Code: GR25A2066 **L/T/P/C: 0/0/2/1**
II Year II Semester

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

1. Design and analyze linear applications of operational amplifiers such as inverting, non-inverting, summing, difference, integrator, and differentiator circuits.
2. Implement signal generation and waveform shaping circuits using operational amplifiers and 555 timer ICs.
3. Design and verify the functionality of data converters (DAC) and combinational logic circuits such as adders, subtractors, multiplexers, decoders, and comparators.
4. Construct and test sequential logic circuits including counters and shift registers, and analyze their timing waveforms.
5. Apply practical design and testing skills to integrate analog and digital circuit concepts for real-time signal processing and control applications.

List of Experiments

1. Design an Inverting and Non-inverting Amplifier using Op Amp and calculate gain.
2. Design Adder and Subtractor using Op Amp and verify addition and subtraction process.
3. Design a Integrator and Differentiator Circuits using IC741 and derive the required condition practically.
4. Design a Active LPF, cutoff frequency of 2 KHz and find the roll off of it.
5. Design a Circuit using IC741 to generate sine / square / triangular wave with period of 1 KHz and draw the output waveform.
6. Construct Mono-stable Multivibrator using IC555 and draw its output waveform.
7. Construct Astable Multivibrator using IC 555 and draw its output waveform and also find its duty cycle.
8. Design R-2R ladder DAC and write a truth table with respective voltages.
9. Design a 4 bit comparator using IC7485 and verify its truth table.
10. Design a 8x1multiplexer using digital ICs.
11. Design an Adder / Subtractor using digital ICs
12. Design a Decade counter and verify its truth table and draw respective waveforms.
13. Design a Up/downcounterusingIC74193anddrawread/write waveforms.
14. Design a Universal shift register using IC74194 / 195and verify its shifting operation.
15. Design a 3x8 decoder and verify its truth table.

Lab Methodology: All experiments to be realized in Hardware
Equipment: Analog Discovery, Laptop, Bread Board, Components, Digital Trainer kit.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ANALOG AND DIGITAL COMMUNICATIONS LAB

Course Code: GR25A2068 **L/T/P/C: 0/0/2/1**
II Year II Semester

List of Experiments

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

1. Demonstrate the generation and detection of various analog modulation and demodulation techniques such as AM, FM, DSB-SC, and SSB-SC through simulation and hardware implementation.
2. Apply the principles of pulse modulation (PAM, PWM, PPM) and digital modulation (ASK, FSK, PSK, DPSK, QPSK) techniques and interpret their corresponding time and frequency domain characteristics.
3. Analyze the sampling process, multiplexing, and encoding techniques to understand signal transmission and recovery mechanisms.
4. Examine the effects of noise and inter-symbol interference (ISI) on digital communication systems using eye and constellation diagrams.
5. Evaluate the performance of baseband and bandpass communication systems using MATLAB or equivalent simulation tools and verify results through hardware realization.

Note: Minimum 12 experiments should be conducted.
All these experiments are to be simulated first either using MATLAB, Commsim or any other simulation package. (1-15 Experiments) to be realized in hardware.

1. Generate Amplitude modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index.
2. Generate Frequency modulated Signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating Signal frequency and Amplitude on the modulation index.
3. Generate modulated and demodulate DSB-SC Signal for different modulation indices and plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically
4. Generate and demodulate SSB-SC modulated Signal (Phase Shift Method) for different modulation indices and plot the corresponding waveforms and their spectrum. Also calculate theoretically and practically the modulation index in each case
5. Demonstrate the Frequency Division Multiplexing & De multiplexing practically by transmitting at least 4 different signals simultaneously with respect to time and recovering without distortion.
6. Verify Sampling theorem for different sampling rates, Sampling types and Duty Cycles and Plot the sampled and reconstructed Signals. Write the conclusions, based on practical observations
7. Design and implement a Pulse Amplitude Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations
8. Design and implement a Pulse Width Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations

9. Design and implement a Pulse Position Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations
10. Generate PCM Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations
11. Generate Delta Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
12. Generate ASK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
13. Generate practically Binary PSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
14. Generate practically DPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
15. Generate practically QPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
16. Plot Signal Constellation for BPSK, BFSK and QPSK
17. Analyze the performance of BPSK, BFSK and QPSK under noisy environment through constellation diagram
18. Demonstrate ISI through eye diagram
19. Simulate raised cosine signal and duo binary signals
20. Encode data using Shannon Fano /Huffman Coding through Hardware / Simulator
21. Analyze the performance of a Matched filter.