Academic Regulations
Programme Structure
and
Detailed Syllabus

Bachelor of Technology (B.Tech)
in
Electrical and Electronics 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 either PE-I, PE-II or 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 ten short answer questions covering all units of syllabus; each question carries one 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.

9.8 UG Project Work:

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

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

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

- Objective(s) of the work done - 05 Marks
- Methodology adopted - 15 Marks
- Results and Discussions - 15 Marks
- Conclusions and Outcomes - 05 Marks
- Total - 40 Marks

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

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

9.8.5 For conducting viva-voce exam of project work, 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 $\mathbf{i^{th}}$ course and **Gi** is the grade point scored by the student in the $\mathbf{i^{th}}$ 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 $\mathbf{k \geq 2}$.

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

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.

ELECTRICAL AND ELECTRONICS ENGINEERING
B. Tech (EEE) – GR25 Course Structure

I B. Tech (EEE) - 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	EEE	ES	GR25A1010	Fundamentals of Electrical and Electronics Engineering	2	0	0	2
4	CSE	ES	GR25A1006	Programming for Problem Solving	2	0	0	2
5	Mgmt	HS	GR25A1027	Innovation and Design Thinking	1	0	0	1
6	ME	ES	GR25A1024	Engineering Workshop	1	0	3	2.5
7	ME	ES	GR25A1015	Graphics for Engineers	1	0	4	3
8	EEE	ES	GR25A1011	Elements of Electrical and Electronics Engineering Lab	0	0	2	1
9	Chemistry	BS	GR25A1018	Engineering Chemistry Lab	0	0	2	1
10	CSE	ES	GR25A1020	Programming for Problem Solving Lab	0	0	3	1.5
		TOTAL			**13**	**1**	**14**	**21**

I B. Tech (EEE) - 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	EEE	ES	GR25A1013	Electrical Circuit Analysis	2	1	0	3
6	Physics	BS	GR25A1017	Advanced Engineering Physics Lab	0	0	2	1
7	CSE	ES	GR25A1023	Data Structures Lab	0	0	2	1
8	English	HS	GR25A1019	English Language and Communication Skills Lab	0	0	2	1
9	EEE	ES	GR25A1021	Electrical Circuit Analysis Lab	0	0	2	1
		TOTAL			**13**	**2**	**8**	**19**

II B.Tech(EEE) - I 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	EEE	PC	GR25A2023	Sensors Measurements and Instrumentation	2	1	0	3
3	EEE	PC	GR25A2024	Principles of Analog Electronics	3	0	0	3
4	EEE	PC	GR25A2025	DC Machines and Transformers	3	0	0	3
5	EEE	PC	GR25A2026	Electromagnetic Fields	3	0	0	3
6	CSE	PC	GR25A2027	Database for Engineers	1	0	0	1
7	Mgmt	VAC	GR25A2002	Value Ethics and Gender Culture	1	0	0	1
8	EEE	PC	GR25A2028	Principles of Analog Electronics Lab	0	0	2	1
9	EEE	PC	GR25A2029	DC Machines and Transformers Lab	0	0	2	1
10	EEE	PC	GR25A2030	Sensors Measurements and Instrumentation Lab	0	0	2	1
11	CSE	SD	GR25A2007	Java Programming for Engineers Lab	0	0	2	1
		TOTAL			**16**	**1**	**8**	**21**

II B.Tech (EEE) - II Semester

S.No	BOS	Group	Course Code	Course Name				
					L	T	P	Credits
1	EEE	PC	GR25A2031	Power Generation and Distribution	3	0	0	3
2	EEE	PC	GR25A2032	AC Machines	2	1	0	3
3	EEE	PC	GR25A2033	Control Systems	3	0	0	3
4	EEE	PC	GR25A2034	Principles of Digital Electronics	3	0	0	3
5	EEE	PC	GR25A2035	Microprocessors and Microcontrollers	3	0	0	3
6	Chemistry	VAC	GR25A2001	Environmental Science	1	0	0	1
7	EEE	PC	GR25A2036	Principles of Digital Electronics Lab	0	0	2	1
8	EEE	PC	GR25A2037	AC Machines Lab	0	0	2	1
9	EEE	PC	GR25A2038	Control Systems Lab	0	0	2	1
10	EEE	SD	GR25A2103	PCB Design Lab	0	0	2	1
		TOTA L			**16**	**1**	**6**	**20**

III YEAR I SEMESTER

S.No	BOS	Group	Course Code	Course Name				
					L	T	P	Credits
1	EEE	PC		Power Transmis Sion Systems	2	1	0	3
2	EEE	PC		Power Electronics	3	0	0	3
3	EEE	PC		Power System Protection	3	0	0	3
4	EEE	PE		Professional Elective I	3	0	0	3
5	EEE	OE		Open Elective I	3	0	0	3
6	Englis h	HS		Effective Technica l Commun icat ion	1	0	0	1
7	Englis h	VAC		Indian Knowled ge System	1	0	0	1
8	EEE	PC		Power System Protection Lab	0	0	2	1
9	EEE	PC		Power Electronics Lab	0	0	2	1
10	EEE	PC		Microproce ssors and Microcontr ollers Lab	0	0	2	1
11	EEE	PW		Field-Based Project/Intern ship	0	0	4	2
		TOTAL			**16**	**1**	**10**	**22**

Professional Elective –I			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE		Wide Band Gap power Devices
2	EEE		Solar And Wind Energy Systems
3	EEE		Electrical Machine Design
4	MECH		Operations Research

Open Elective I			
S.No.	**BOS**	**Course Code**	**COURSE**
1	EEE		Non-Conventional Energy Sources

III YEAR II SEMESTER

S.No	BOS	Group	Course Code	Course Name				
					L	T	P	Credits
1	EEE	PC		DSP based Electromechanical Systems	3	0	0	3
2	EEE	PC		Power System Analysis	2	1	0	3
3	Mgnt	HS		Economics and Accounting for Engineers	3	0	0	3
4	EEE	PE		Professional Elective II	3	0	0	3
5	EEE	OE		Open Elective II	3	0	0	3
6	EEE	PC		Power System Analysis Lab	0	0	2	1
7	EEE	PC		DSP based Electrical Lab	0	0	2	1
		TOTAL			**14**	**1**	**4**	**17**

Professional Elective -II			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE		Modelling and Simulation of Power Electronic Converters
2	EEE		HVDC Transmission Systems
3	EEE		Advanced Control Systems
4	CSE		Operating Systems

Open Elective II			
S.No.	**BOS**	**Course Code**	**COURSE**
1	EEE		Concepts of Control Systems

IV YEAR I SEMESTER

S.No	BOS	Group	Course Code	Course Name				
					L	T	P	Credits
1	EEE	PC		Power Semiconductor Drives	2	1	0	3
2	EEE	PC		Electric and Hybrid Vehicles	3	0	0	3
3	EEE	PE		Professional Elective III	3	0	0	3
4	EEE	PE		Professional Elective IV	3	0	0	3
5	Mgnt	HS		Fundamentals of Management and Entrepreneurship	3	0	0	3
6	EEE	OE		Open Elective III	3	0	0	3
7	EEE	PC		Power Semiconductor Drives Lab	0	0	2	1
8	EEE	PW		Industry Oriented Mini Project/Summer Internship	0	0	4	2
		TOTAL			**17**	**1**	**6**	**21**

Professional Elective -III			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE		Modern Power Electronics
2	EEE		High Voltage Engineering
3	EEE		Digital Control Systems
4	EEE		Industrial Automation
Professional Elective -IV			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE		Power Quality and FACTS
2	EEE		Utilization of Electrical Energy
3	EEE		Special Electrical Machines
4	ECE		VLSI Design

Open Elective III			
S.No.	**BOS**	**Course Code**	**COURSE**
1	EEE		Artificial Neural Networks and Fuzzy Logic

IV YEAR II SEMESTER

S.No	BOS	Group	Course Code	Course Name				
					L	T	P	Credits
1	EEE	PC		Power System Monitoring and Control	2	1	0	3
2	EEE	PE		Professional Elective V	3	0	0	3
3	EEE	PE		Professional Elective VI	3	0	0	3
4	EEE	PW		Project Work	0	0	42	14
		TOTAL			**8**	**1**	**42**	**23**

Professional Elective -V			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE		Advanced Electric Drives
2	EEE		Energy Storage Systems
3	EEE		Modern Control Theory
4	EEE		Industrial IoT
Professional Elective -VI			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE		AI and ML applications to Power Electronics
2	EEE		Electric Smart Grid
3	ECE		Embedded Systems Design
4	CSE		Introduction to Big Data Analytics

PROFESSIONAL ELECTIVES – 4 THREADS

S. No.	Thread 1: Power Electronics	Thread 2: Power Systems	Thread 3: Machines and Control Systems	Thread 4: Computer and Electronics
1	Wide Band Gap Power Devices	Solar and Wind Energy Systems	Electrical Machine Design	Operations Research
2	Modelling and Simulation of Power Electronic Converters	HVDC Transmission Systems	Advanced Control Systems	Operating Systems
3	Modern Power Electronics	High Voltage Engineering	Digital Control Systems	Industrial Automation
4	Power Quality and FACTS	Utilization of Electrical Energy	Special Electrical Machines	VLSI Design
5	Advanced Electric Drives	Energy Storage Systems	Modern Control Theory	Industrial IoT
6	AI and ML applications to Power Electronics	Electric Smart Grid	Embedded Systems Design	Introduction to Big Data Analytics

OPEN ELECTIVES FOR GR25 REGULATIONS:

THREAD 1	THREAD 2	OFFERED BY
1. Soft Skills and Interpersonal Communication 2. Human Resource Development and Organizational Behavior 3. Cyber Law and Ethics 4. Economic Policies in India 5. Constitution of India	Data Science for Engineers	**CSE**
	Data Analytics	
	Augmented Reality and Virtual Reality	
	Basics of Java Programming	**CSE (AIML)**
	Introduction to DBMS	
	Introduction to Data Mining	
	Introduction to Internet of Things	**CSE (DS)**
	R Programming	
	Web and Social Media Analytics	
	Software Design with UML	**CSBS**
	Business Analytics	
	E-Commerce	
	Non-Conventional Energy Sources	**EEE**
	Concepts of Control Systems	
	Artificial Neural Networks and Fuzzy Logic	
	Digital Electronics for Engineers	**ECE**
	Automotive Electronics	
	Hardware for IoT Applications	
	Industrial Automation and Control	**ME**
	Composite Materials	
	Operations Research and Management	
	Engineering Materials for Sustainability	**CE**
	Geographic Information Systems and Science	
	Plumbing -Water and Sanitation	

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 Sem

COURSE OUTCOMES

1. 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.

TEXTBOOKS

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

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

REFERENCES

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

(Common to all Branches)

Course Code: GR25A1004 **L/T/P/C:3/0/0/3**
I Year I Sem

COURSE OUTCOMES

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. Analyse the efficacy of polymers in diverse applications
5. Interpret the role of engineering materials and emphasize the scope of spectroscopic techniques in various sectors.

UNITI
WATER AND ITS TREATMENT

Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and 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

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

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

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

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).

TEXTBOOKS

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

REFERENCES

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

FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code: GR25A1010 **L/T/P/C:2/0/0/2**
I Year I Semester

COURSE OUTCOMES

1. Summarize the basic fundamental laws of electric circuits.
2. Distinguish the single phase and three phase circuits.
3. Analyze the basics and principle of PN junction diode.
4. Illustrate the principle and operation of BJT and MOSFET transistors
5. Outline the protection principles using Switchgear components.

UNIT I
DC FUNDAMENTALS
Passive components, Voltage and Current sources, dependent and independent sources, fundamentals of circuit Laws, Source Transformation, Passive components in series and parallel, Delta – star conversion, Nodal and Mesh Analysis.

UNIT II
AC FUNDAMENTALS
Representation of sinusoidal waveforms, average and rms values, phasor representation, real power, reactive power, apparent power, power factor, impedance, Admittance. Introduction to three-phase circuits, types of connection. voltage and current relations in star and delta connections, analysis of balanced and unbalanced circuits, measurement of power by three- and two-wattmeter methods, measurement of reactive power by single wattmeter.

UNIT III
DIODE CIRCUITS
P-N junction diode, biasing, V-I characteristics of a diode, diode equivalent circuits, static resistance, dynamic resistance, Zener breakdown, & Avalanche breakdown. Working principle of Half-wave and full-wave rectifiers.

UNIT IV
TRANSISTORS
BJT Structure, construction, Principle and Operation of BJT, Types NPN, PNP, Common Emitter, Common Base and Common Collector Configurations, Input characteristics and Output Characteristics of a BJT.
MOSFET: Construction, Principle and Operation of Enhancement mode, Depletion mode devices, NMOS, PMOS, CMOS transistors, CMOS Inverter, Inverter characteristics.

UNIT V
ELECTRICAL INSTALLATION COMPONENTS
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB (Miniature Circuit Breaker), ELCB (Earth Leakage Circuit Breaker), MCCB (Moulded Case Circuit Breaker),RCCB, Earthing: Plate and pipe earthing ,Types of batteries: Primary and secondary, UPS(Uninterrupted power supply):Components, Calculation of ratings for UPS components to specific load, power factor improvement methods.

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.

REFERENCES

1. "A Textbook of Electrical Technology",-BL Theraja volume-I, S.Chand Publications.
2. "Electronic Devices and circuits" by Jacob Milliman, McGraw-Hill, 1967
3. "Electrical and Electronics Technology", E. Hughes, 10th Edition, Pearson, 2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROGRAMMING FOR PROBLEM SOLVING

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

Course Outcomes:
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

TEXTBOOKS

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)

REFERENCES

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

INNOVATION AND DESIGN THINKING

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

I Year I Semester

COURSE OUTCOMES

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

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.
5. 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

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

TEXTBOOKS

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.

REFERENCES

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

GRAPHICS FOR ENGINEERS

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

COURSE OUTCOMES

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.

TEXTBOOKS

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.

REFERENCES

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

ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB

Course Code: GR25A1011 **L/T/P/C:0/0/2/1**
I Year I Semester

COURSE OUTCOMES

1. Demonstrate the common electrical components and their ratings.
2. Summarize the basic 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 circuit connections with three phase excitation.
5. Illustrate the characteristics of BJT and MOSFET.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Verification of Ohms Law, KVL and KCL
2. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.
3. Verification of relationship between three phase voltages and currents in star and delta connection.
4. Measurement of Active & Reactive Power for star and delta connected balanced loads.
5. Power factor improvement by using capacitor bank in parallel with inductive load.
6. Measurement of Earth Electrode Resistance.
7. Volt ampere Characteristics of a PN Junction Diode.
8. Single Phase Half & Full wave diode Rectifier**.**
9. Input & Output Characteristics of NPN Bipolar Junction Transistor.
10. Drain Characteristics of MOSFET.
11. Breakdown Characteristics of a Zener Diode.
12. Transfer Characteristics of MOSFET.

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.

REFERENCES

1. "A Textbook of Electrical Technology", -BL Theraja volume-I, S.Chand Publications.
2. "Electronic Devices and circuits" by Jacob Milliman, McGraw-Hill, 1967
3. "Electrical and Electronics Technology", E. Hughes, 10th Edition, Pearson, 2010.

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

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

PROGRAMMIN G FOR PROBLEM SOLVING LAB

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

COURSE OUTCOMES

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)

```
    1
  2   3
4   5   6
7   8   9   10
```

ii)

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

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

i)

```
$
$$$
$$$$$
$$$
$
```

ii)

```
E
ED
EDC
EDCB
EDCBA
```

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 a given list of integers using linear search method.

b. Write a C program that uses non-recursive function to search for a Key value in a given 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, CengageLearning, (3rd Edition)

REFERENCES

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

I YEAR II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

(Common to all 1st year)

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

COURSE OUTCOMES

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

TEXTBOOKS

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

REFERENCES

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

Course Code: GR25A1003 (Common to all branches) L/T/P/C: 3/0/0/3
I Year II Sem

COURSE OUTCOMES

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. Understand 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.

TEXTBOOKS

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.

REFERENCES

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 Sem

COURSE OUTCOMES

1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in various contexts and different cultures.
4. Acquire proficiency in English including reading and listening comprehension, writing and speaking skills.
5. Convey complex ideas clearly and accurately in academic and professional settings.

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.)

TEXTBOOKS

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

REFERENCES

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

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 ofqueue 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

TEXTBOOKS

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

REFERENCES

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

ELECTRICAL CIRCUIT ANALYSIS

Course Code: GR25A1013 **L/T/P/C:2/1/0/3**
I Year II Semester

COURSE OUTCOMES

1. Analyze the electric circuits with suitable theorems and coupled circuits.
2. Illustrate the transient response of given DC circuits.
3. Infer electrical circuit responses using Laplace and Inverse Laplace transform.
4. Summarize the concepts of Fourier Series and Fourier transforms.
5. Simplify the network by using two port parameters.

UNIT I
NETWORK THEOREMS AND COUPLED CIRCUITS

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

Coupled Circuits: Self & Mutual Inductance, Dot convention, Coefficient of Coupling, Analysis of circuits with mutual inductance.

UNIT II
DC TRANSIENTS AND RESONANCE

Solution of first and second order differential equations for Series and Parallel RL, RC, RLC circuits, time constants, steady state and transient response. Current locus diagrams of RL and RC series circuits.

Resonance: Series and parallel circuits, Bandwidth, Q-factor, initial and final conditions in network elements

UNIT III
ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS

Introduction to Laplace Transform, Properties of Laplace Transforms, initial and Final value theorems, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, Inverse Laplace Transform, transformed network with initial conditions, Transfer function representation, Poles and Zeros.

UNIT IV
FOURIER SERIES AND FOURIER TRANSFORM

Representation of continuous-time periodic signals by Fourier series; Dirichlet's conditions; Symmetry conditions, Properties of Fourier series, Trigonometric and Exponential Fourier series.

Fourier transform: Fourier transform of periodic signals, Properties of Fourier transforms. Application to simple networks.

UNIT V
TWO PORT NETWORKS

Two Port Networks, terminal pairs, relationship of two port variables, impedance, admittance, hybrid and transmission parameters, condition for symmetry and reciprocity, interrelation ship between various parameters, interconnections of two port networks (series, parallel and

cascade).

TEXTBOOKS

1. "Fundamentals of Electric Circuits" by C.K.Alexander and M.N.O.Sadiku, McGraw Hill Education,2004.
2. "Engineering Circuit Analysis" by W.H.Hayt and J.E.Kemmerly, McGraw Hill Education,2013.

REFERENCES

1. "Basic Electrical Engineering" by A.Sudhakar and Shyam Mohan, McGraw Hill Education.
2. "Circuit Theory" (Analysis and Synthesis) by A.Chakrabarti, Dhanpat Rai & Co
3. "Networks and Systems" by D Roy Choudhury, New Age International Publications,1998.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED ENGINEERING PHYSICS LAB

(Common to all branches)

Course Code: GR25A1017 **L/T/P/C:0/0/2/1**

I Year II Sem

COURSE OUTCOMES

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

DATA STRUCTURES LAB

Course Code: GR25A1023 **L/T/P/C: 0/0/2/1**

I Year II Semester

COURSE OUTCOMES

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

TEXTBOOKS

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.

REFERENCES

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

ENGLISH LANGUAGE AND COMMUNICATI ON SKILLS LAB
Common to all branches

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

COURSE OUTCOMES

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

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

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

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

Exercise – I
CALL Lab:
Instruction: Speech Sounds-Listening Skill - Importance – Purpose - Types- Barriers- Active Listening
Practice: Listening to Distinguish Speech Sounds (Minimal Pairs) - *Testing Exercises*
ICS Lab:
❖ **Diagnostic Test – Activity titled '*Express Your View*'**
Instruction: Spoken and Written language - Formal and Informal English - Greetings - Introducing Oneself and Others
Practice: Any Ice-Breaking Activity

Exercise – II
CALL Lab:
Instruction: Listening vs. Hearing - Barriers to Listening
Practice: Listening for General Information - Multiple Choice Questions - *Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)*
ICS Lab:
Instruction: Features of Good Conversation – Strategies for Effective Communication

Practice: Role Play Activity - Situational Dialogues –Expressions used in Various Situations –Making Requests and Seeking Permissions – Taking Leave - Telephone Etiquette

Exercise – III

CALL Lab:

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

ICS Lab:

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

Exercise – IV

CALL Lab:

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

ICS Lab:

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

Exercise – V

CALL Lab:

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

ICS Lab:

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

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

Minimum Requirement of infrastructural facilities for ELCS Lab:

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

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

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration
ii) High Fidelity Headphones

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

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio- visual aids with a Public Address System, a T. V. or LCD, a

digital stereo – audio & video system and camcorder etc.

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

Suggested Software:

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

REFERENCES

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

ELECTRICAL CIRCUIT ANALYSIS LAB

Course Code: GR25A1021 **L/T/P/C:0/0/2/1**
I Year II Semester

COURSE OUTCOMES

1. Solve the circuits using various network theorems.
2. Analyze the performance of R-L, R-C and R-L-C circuits and draw the locus diagrams.
3. Measure the self and mutual inductance and determine the coefficient of coupling.
4. Determine the two-port network parameters.
5. Examine the resonance parameters and verify them practically.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Verification of Thevenin's Theorem & Norton's Theorem
2. Verification of Superposition Theorem.
3. Verification of Reciprocity Theorem.
4. Verification of Maximum Power Transfer Theorem.
5. Determination of time constant for series RL and RC circuits.
6. Draw the Locus Diagrams of RL (R-Varying) and RC (R-Varying) Series Circuits.
7. Draw the locus Diagrams of RL (L-Varying) and RC (C-Varying) Series Circuits.
8. Analysis of Series Resonant Circuit.
9. Analysis of Parallel Resonant Circuit.
10. Determination of self, mutual inductances and coefficient of coupling.
11. Determination of Z &Y parameters of a two- port network.
12. Determination of Hybrid & Transmission parameters of a two-port network.

TEXTBOOKS

1. "Fundamentals of Electric Circuits" by C.K.Alexander and M.N.O.Sadiku, McGraw Hill Education,2004.
2. "Engineering Circuit Analysis" by W.H.Hayt and J.E.Kemmerly, , McGraw Hill Education,2013.

REFERENCES

1. "Basic Electrical Engineering" by A.Sudhakar and Shyam Mohan, McGraw Hill Education.
2. "Circuit Theory" (Analysis and Synthesis) by A.Chakrabarti ,Dhanpat Rai & Co
3. "Networks and Systems" by D Roy Choudhury, New Age International Publications,1998.

II YEAR I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

NUMERICAL METHODS AND COMPLEX VARIABLES

(For 2nd year ECE and EEE)

Course Code: GR25A2102 **L/T/P/C:3/0/0/3**

II Year I Semester

COURSE OUTCOMES

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 1/3rd and 3/8th 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).

TEXTBOOKS

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

REFERENCES

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

SENSORS MEASUREMENTS AND INSTRUMENTATION

Course Code: GR25A2023 **L/T/P/C:2/1/0/3**
II Year I Semester

COURSE OUTCOMES

1. Illustrate the fundamentals and measurement of different electrical quantities.
2. Outline unknown electrical parameters.
3. Summarize Oscilloscopes and discover the usage of Digital meters.
4. Identify working principles of various Sensors/Transducers.
5. Apply Sensors/Transducers of various types in real time applications.

UNIT I

FUNDAMENTALS OF ELECTRICAL MEASUREMENTS

Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, PMMI type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters-electrometer type and attracted disc type – extension of range of E.S. Voltmeters. Instrument Transformers-C.T.s and P.Ts Ratio and Phase angle errors.

UNIT II

MEASUREMENT OF ENERGY AND OTHER ELECTRICAL QUANTITIES

Single phase & Three phase energy meters, Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type's standardization – applications

Measurement of resistance, Inductance and Capacitance by bridges: Wheatstone bridge, Kelvin Double Bridge, Maxwell's Bridge, Anderson's bridge, Desauty's Bridge, Schering Bridge Derivations (Theoretical Approach).

UNIT III

OSCILLOSCOPE AND DIGITAL VOLTMETERS

Data Acquisition system, Components of Cathode Ray Oscilloscope: Time base Generator, Horizontal & Vertical Amplifier, Electrostatic Deflection. Measurement of phase and frequency **INTRODUCTION TO SMART AND DIGITAL METERING**: Digital Multi-meter, True RMS meters, Clamp- on meters, Digital Energy Meter, Digital Storage Oscilloscope. Digital Voltmeters- Successive Approximation, Ramp, Dual slope Integration.

UNIT IV

SENSOR FUNDAMENTAL PRINCIPLES

Sensors / Transducers, Principle, Types, Basic Requirements, Classification, Selection, Resistive type, Inductive type, and Capacitive type. Linear Variable Differential Transducer (LVDT), Strain Gauge (Elementary).

UNIT V
SENSOR APPLICATIONS
Introduction and Working Principles: Flow - rate sensors: Displacement Flow Sensors, Velocity Flow Sensors, Thermistors and Thermocouples, Ultrasonic sensor, Acceleration Sensors.

TEXTBOOKS

1. "Electrical and Electronic Measurement and Instruments", by A.K.Shawney Dhanpat Rai & Sons Publications.
2. "Sensors and Transducers", by D. Patranabis , PHI Publications

REFERENCES

1. "Sensors and Their Applications XII", by S. J. Prosser, E. Lewis CRC Press
2. "Electrical Measurements and Measuring Instruments", by Er. R K Rajput by S. Chand Publishing.
3. "Measurement Systems", by Ernest O Doebelin by Mc Graw Hill.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRINCIPLES OF ANALOG ELECTRONICS

Course Code: GR25A2024 **L/T/P/C: 3/0/0/3**
II Year I Semester

COURSE OUTCOMES

1. Explain the basic principle and operation of Operational amplifier.
2. Summarize different Operational Amplifier's applications.
3. Outline frequency gain for different filters.
4. Illustrate the applications of IC 565.
5. Develop different Multivibrator circuits.

UNIT I
INTEGRATED CIRCUITS

Classification, Introduction to Operational Amplifier, block diagram, 741 OpAmp and its Features, ideal characteristics of op- amp, practical op-amp. Differential mode and common mode operation, Modes of operation-inverting, non-inverting, differential. Inverting amplifier, non-inverting amplifier and Voltage Follower Circuit.
DC Characteristics: Input bias current, Input offset current, input offset voltage and slew rate.

UNIT II
OP-AMP APPLICATIONS

Inverting summing amplifier, Non-Inverting Summing amplifier, Subtractor circuit, differential amplifier, instrumentation amplifier, integrator, differentiator, Voltage to Current and Current to Voltage Converters, Sample & Hold Circuits

UNIT III
FILTERS

Classification of Filters: Active and Passive Filters, Low Pass Filter, High Pass Filter, Narrow Band Pass Filter, Wide Band Pass Filter, Narrow Band Stop Filter, Wide Band Stop Filter, All pass filter.

UNIT IV
TIMERS & PHASE LOCKED LOOPS

Introduction to 555 Timer, Functional Diagram, Monostable Multivibrator and Astable Multivibrator IC565 PLL- Introduction, Block Schematic, Principles and Applications.

UNIT V
OSCILLATORS

Basic principle of an Oscillator, RC Phase shift and Wein bridge Oscillator, Schmitt Trigger Circuit.

TEXTBOOKS

1. "Linear Integrated Circuits", D.Roy Choudhary & Shail B Jain, New Age International Publishers, 2nd edition 2004.
2. "Op-Amps & Linear ICs", – Ramakanth A. Gayakwad, PHI, 2003.

REFERENCES

1. "Electronics Analog and Digital", by I. J. Nagrath, PHI Learning Pvt. Ltd., 2013 Edition.
2. "Electronics Principles", by Malvino, Mc. Graw Hill, Third edition. 2000.
3. "Analysis and Design of Analog Integrated Circuits", P. R. Gray, R. G. Meyer and S. Lewis, John Wiley & Sons, 2001.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DC MACHINES AND TRANSFORMERS

Course code: GR25A2025 **L/T/P/C: 3/0/0/3**
II Year I Semester

COURSE OUTCOMES

1. Interpret the magnetic field in a DC Machine.
2. Summarize concepts of generators and its applications.
3. Select the appropriate DC motors for a given applications.
4. Analyze the performance of single-phase Transformers.
5. Outline the performance of Three-phase Transformers.

UNIT I
INTRODUCTION

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, Armature windings- lap and wave windings, visualization of magnetic field producedby the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Principle Electro-mechanical energy conversion.

UNIT II
DC GENERATORS

Principle-Simple Loop generator, commutator action, construction, EMF equation, and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation. Types of field excitations – separately excited, self-excited. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. Characteristics of all generators, Applications.

UNIT III
DC MOTORS

Working principle of motor, construction, types of motors, and its applications Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction. Armature circuit equation for motoring and generation, Significance of back EMF, V-I characteristics, and torque-speed characteristics self-excited. Speed control methods, Losses,load testing and testing of DC machines.

UNIT IV
SINGLE-PHASE TRANSFORMERS

Construction and operation of single-phase transformers, types of transformers, equivalent circuit, phasor diagram of Transformer No-load and ON-load.

Voltage regulation, losses and efficiency –Maximum Efficiency-Testing - open circuit and short circuit tests,polarity test, back-to-back test, separation of hysteresis and eddy current losses- effect of frequency and supply voltage. Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current. All-day efficiency, KVA rating.

UNIT V

THREE-PHASE TRANSFORMERS

Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of and three-phase transformers, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers. Testing of three phase transformers.

TEXTBOOKS

1. "Electrical Machinery", by P. S. Bimbhra, Khanna Publishers, 2011.
2. "Electric Machines", by I.J. Nagrath and D. P. Kothari, McGraw Hill Education, 2012.

REFERENCES

1. "Performance and design of AC machines", by M. G. Say, CBS Publishers, 2002.
2. "Principles of Electric Machines", by PC Sen Second Edition.
3. "Electric Machinery and Transformers", Bhag S. Guru and Huseyin R. Hiziroglu OUP Higher Education Division Publishers, 2000.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTROMAGNETIC FIELDS

Course Code: GR25A2026 **L/T/P/C: 3/0/0/3**
II Year I Semester

COURSE OUTCOMES

1. Interpret the Electric Field Intensity with respect to free space.
2. Solve the Current Density Equation and Capacitance of different materials.
3. Evaluate Magnetic Field Intensity and Force in Magnetic Fields.
4. Analyze the Maxwell's Equations in Time Varying Fields, Displacement current.
5. Summarize the Electro-Magnetic wave equations & its applications.

UNIT I
STATIC ELECTRIC FIELD

Coulomb's law- Electric Field Intensity-Electrical Field due to Point charge, Line, Surface and Volume Charge distributions. Gauss Law and its Applications-Maxwell's First Law-Work done in moving a point charge in an electrostatic field, Electric potential- Properties of potential function, potential gradient-Electric Dipole-Potential and EFI due to an Electric Dipole-Electrostatic Energy density.

UNIT II
CONDUCTORS & INSULATORS

Behavior of conductors in an electric field-Current density-Conduction and Convection current densities- Ohms Law in Point form- Continuity equation of current-Electric field inside a dielectric material-Polarization and Permittivity-Boundary conditions-Boundary conditions for two perfect dielectric materials. Capacitance-Capacitance of parallel plates, co-axial cable, spherical capacitors- Poisson's equation- Laplace's equation.

UNIT III
STATIC MAGNETIC FIELDS

Biot-Savart's Law-Magnetic Field Intensity-MFI due to a straight current carrying conductor, MFI due to circular conductor- Maxwell's Second Equation-Ampere's Law and its Applications viz MFI due to infinitely long straight conductor only-Maxwell's Third equation-Scalar and Vector Magnetic Potentials.

FORCE IN MAGNETIC FIELDS

Force on a moving point charge-Lorentz force equation- Force on a differential current element-Force between differential current elements-Magnetic Dipole and Magnetic Dipole Moment--Classification of magnetic materials- Magnetization and Permeability-Magnetic Circuits-Inductance-Self and Mutual Inductances-Neuman's Formula only.

UNIT IV
TIME VARYING FIELDS

Faraday's laws of Electromagnetic induction-it's integral and point forms-Maxwell's Fourth Equation- statically and dynamically induced EMFs-simple problems-Modification of Maxwell's equations for time varying fields-Displacement current.

UNIT V

ELECTROMAGNETIC WAVE PROPAGATION

Waves in general- wave propagation in lossy dielectrics-Plane waves in lossless dielectrics, free space, Good conductors-power and the poynting vector, Reflection of a plane wave at normal incidence, oblique incidence.

TEXTBOOKS

1. "Principles of Electromagnetics", by Matthew N.O.Sadiku, Oxford University Publication, Fourth Edition, 2014.
2. "Engineering Electromagnetics", by W.Hayt, John A.Buck McGraw Hill Education, 2012.

REFERENCES

1. "Electromagnetism-Problems with solution", by Pramanik, Prentice Hall India, 2012.
2. "The electromagnetic field in its engineering aspects", by G. W. Carter, Longmans, 1954.
3. "Electromagnetism - Theory and applications", by Pramanik, PHI Learning Pvt. Ltd, New Delhi, 2009

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATABASE FOR ENGINEERS

Course Code: GR25A2027 **L/T/P/C: 1/0/0/1**
II Year I Semester

COURSE OUTCOMES

1. To design ER Diagrams for an application and translate to logical model.
2. To develop database with the creation of tables and populating them with data.
3. To compose queries for retrieving data from the database.
4. To analyze the necessity for normal forms and other database objects in the database.
5. To interpret the need of atomicity, consistency, isolation and durability for a transaction.

UNIT I

Introduction to DBMS, Database System Applications, Database System vs. File System, Instances and Schema, ER Diagrams – Attributes and Entity Sets, Relationships and Relationship sets, Extended ER Features, Conceptual Design with ER Model, Logical Database Design, Construction of Tables using Basic DDL Commands.

To Practice:

1) Practicing ER Diagram for Hostel Management System, Airlines Reservation System.
2) Practicing DDL commands: Creating tables for various relations (in SQL).

UNIT II

Relational Model: Introduction To The Relational Model–Basic Structure, Database Schema, Integrity Constraints over relations, Keys, Construction of tables with integrity constraints using DDL and DML commands, Form of Basic SQL Query (SELECT) , SQL Operators, Use of DISTINCT keyword, Order by Clause.

To Practice:

1) Practicing DDL and DML commands: Creating tables with integrity constraints specified.
2) Practicing DQL command: Queries for above discussed commands.

UNIT III

Exploration of SELECT statement: SQL functions, Aggregate Operators, Group by and Having clauses, Joins, Types of Joins, Nested Queries, Correlated Nested Queries, Set Operators.

To Practice:

1) Practicing DQL/ DRL command: Using Select statement for various purposes as discussed in the chapter

UNIT IV

Other Database Objects: Introduction to Views, Types of Views, Dropping views, Introduction to Sequence, Index and Synonym. Problems with Redundancy, Decomposition and its properties, Functional Dependencies, Normalization, Types of Normal Forms - 1NF, 2NF, 3NF, BCNF, 4NF.

To Practice:

1) Practicing queries to create view and retrieve data through views.
2) Practicing queries to create an index, sequence and synonym.

UNIT V

Transaction Management - Definition, Properties of Transaction, states of Transaction, Concurrent executions, Serializability, Lock based protocols, and Log based recovery.

Granting privileges to users (DCL) and Transaction Control Language (TCL) Commands

To Practice:

1) Practicing DCL commands - Grant, Revoke, Roles

2) Practicing TCL commands - Commit, Rollback, Savepoint.

TEXTBOOKS

1. "Database Management Systems", Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill, 3rd Edition.

REFERENCES

1. "Database System Concepts", Silberschatz, Korth, McGraw hill, V edition.
2. "Introduction to Database Systems", C.J. Date, Pearson Education.
3. "Database Systems design, Implementation, and Management", Rob &Coronel, 5th Edition.
4. "Database Management Systems", P. Radha Krishna, HI-TECH Publications, 2005.
5. "Database Management System", Elmasri Navate, Pearson Education.
6. "Database Management System", Mathew Leon, Leo.

GOKARAJURANGARAJU 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.

REFERENCES

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

PRINCIPLES OF ANALOG ELECTRONICS LAB

Course Code: GR25A2028 **L/T/P/C: 0/0/2/1**
II Year I Semester

COURSE OUTCOMES

1. Demonstrate the working of Operational Amplifiers.
2. Design Operational Amplifiers as inverting and non-inverting amplifier.
3. Perform mathematical operations using Operational Amplifier
4. Analyze the characteristics of Low Pass and High Pass Filters.
5. Examine the application of 555 timer.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Implement Inverting Amplifier using Operational Amplifier
2. Determine the gain of Non-Inverting Amplifier using Operational Amplifier
3. Design of Operational Amplifier as proportional Amplifier
4. Construct an Operational Amplifier based proportional Amplifier.
5. Implement Subtractor Circuit using Operational Amplifier
6. Develop a differentiator Circuit using Operational Amplifier
7. Implement mathematical Integrator Circuit using Operational Amplifier
8. Develop a mathematical Differentiator Circuit using Operational Amplifier
9. Construct the Low Pass Filter circuit to plot the frequency characteristics.
10. Analyze the High Pass Filter circuit to plot the frequency characteristics.
11. Design an inverter using operational amplifier.
12. Construct 555 timer to generate a square wave.

TEXTBOOKS

1. "Linear Integrated Circuits", D.Roy Choudhary & Shail B Jain, New Age International Publishers, 2nd edition 2004.
2. "Op-Amps & Linear ICs", – Ramakanth A. Gayakwad, PHI, 2003.

REFERENCES

1. "Electronics Analog and Digital", by I. J. Nagrath, PHI Learning Pvt. Ltd., 2013 Edition.
2. "Electronics Principles", by Malvino, Mc. Graw Hill, Third edition. 2000.
3. "Analysis and Design of Analog Integrated Circuits", P. R. Gray, R. G. Meyer and S. Lewis, John Wiley & Sons, 2001.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DC MACHINES AND TRANSFORMERS LAB

Course Code: GR25A2029 **L/T/P/C: 0/0/2/1**
II Year I Semester

COURSE OUTCOMES

1. Identify various parts of electrical DC machines and Transformers.
2. Develop knowledge helpful for application of DC machines and Transformers.
3. Explain and control of different DC Machines.
4. Distinguish the performance of different machines using different testing methods.
5. Determine the parameters of equivalent circuit of single-phase transformer and 3-phase to 2-phase conversion or vice-versa.

LIST OF EXPERIMENTS
Any ten experiments should be conducted.

1. Swinburne's Test and Speed Control of a D.C Shunt Motor
2. Brake Test on a DC Shunt Motor
3. Brake Test on a DC Compound Motor
4. Open Circuit Characteristics of a D.C. Shunt Generator
5. Load test on a D.C. Shunt Generator
6. Load test on a D.C. Series Generator
7. Load test on a D.C. Compound Generator
8. Hopkinson Test
9. Fields Test
10. Separation of Core Losses of a DC machine
11. OC, SC and Load tests on Single Phase Transformer
12. Scott connection.

TEXTBOOKS

1. "Electrical Machinery", by P. S. Bimbhra, Khanna Publishers, 2011.
2. "Electric Machines", by I.J. Nagrath and D. P. Kothari, McGraw Hill Education, 2012.

REFERENCES

1. "Performance and design of AC machines", by M. G. Say, CBS Publishers, 2002.
2. "Principles of Electric Machines", by PC Sen Second Edition.
3. "Electric Machinery and Transformers", Bhag S. Guru and Huseyin R. Hiziroglu OUP Higher Education Division Publishers, 2000.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SENSORS MEASUREMENTS AND INSTRUMENTATION LAB

Course Code:GR25A2030 **L/T/P/C:0/0/2/1**
II year I semester

COURSE OUTCOMES

1. Determine the unknown electrical parameters using various types of bridges.
2. Construct basic programs for computer-controlled data acquisition, measurement, and transfer of data across the sensor network for different types of sensors.
3. Analyze and interpret the experimental data by monitoring and capturing.
4. Experiment on various sensor output configurations using measuring instruments.
5. Measure physical and electrical quantities using Sensors/Transducers.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Measurement of unknown Resistance by Kelvin double Bridge.
2. Measurement of unknown Inductance by Anderson's Bridge.
3. Measurement of unknown Capacitance by Desauty's Bridge.
4. Measurement One-cycle data of a periodic waveform from a DSO.
5. Voltage and Current Detection Circuitry using AT mega microcontroller.
6. Temperature, Pressure and Humidity Detection Circuitry.
7. Measurement of displacement with the help of LVDT.
8. Measurement of distance with the help of Ultrasonic Sensor.
9. Measurement of Flow rate using Flow sensor.
10. Measurement of moist level using soil moisture sensor and rainfall sensor.
11. Calibration and Testing of single-phase Energy meter.
12. Measurement of three-dimensional coordinates using accelerometer sensor.

TEXTBOOKS

1. "Electrical and Electronic Measurement and Instruments", by A.K.Shawney Dhanpat Rai & Sons Publications.
2. "Sensors and Transducers", by D. Patranabis, PHI Publications.

REFERENCES

1. "Sensors and Their Applications XII", by S. J. Prosser, E. Lewis CRC Press.
2. "Electrical Measurements and Measuring Instruments", by Er. R K Rajput by S. Chand Publishing.
3. "Measurement Systems", by Ernest O Doebelin by Mc Graw Hill.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

JAVA PROGRAMMING FOR ENGINEERS LAB

Course Code: GR25A2007 **L/T/P/C:0/0/2/1**
II year I semester

Course Outcomes

1. Write basic Java programs, Identify classes, objects, members of a class and relationships among them needed for a specific problem.
2. Write Java application programs using OOP principles.
3. Demonstrate the concepts of polymorphism and inheritance.
4. Write JAVA programs to demonstrate method overloading and overriding.
5. Explain the benefits of exceptional handling, multithreading, packages and applets in Java.

Task 1:

a) Write a Java program that prints all real solutions to the quadratic equation ax2 +bx + c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2 -4ac is negative, display a message stating that there are no real solutions.

b) The Fibonacci sequence is defined by the following rule: The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that uses both recursive and non recursive functions to print the nth value in the Fibonacci sequence.

Task 2:

a) Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer. (use Scanner class to read input)

b) Write a Java program to multiply two given matrices.

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

Task 3:

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

b) Write a Java program for sorting list of names. Read input from command line.

c) Write a Java program to make frequency count of words in a given text.

Task 4:

Write java programs that implement the following

a) Create a Student class and calculate the total and average marks.

b) Constructor overloading.

Task 5:

Write a Java program to implement
a) Single inheritance
b) Multilevel inheritance

Task 6:

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

Task 7:

a) Write a java program to implement multiple inheritance.

b) Write a Java program to define an interface called **AreaCalculator** with a method **calculateArea ().** Create two classes **Circle** and **Rectangle** that implement this interface.

Task 8:

Write java programs that uses the following keywords
a) this
b) super
c) static
d) final

Task 9

a) Write a Java program for handling Checked Exceptions.

b) Write a Java program for handling Unchecked Exceptions.

Task 10

Write a Java program that creates three threads. First thread displays "Good Morning" one second, the second thread displays "Hello" every two second and the third thread displays "Welcome" every three seconds.

Task 11

Write a Java program to create a user-defined package called math operations.
Inside the package, create a class Addition with a method to add two numbers.
Import and use this package in another class to display the sum.

Task 12

a) Develop an applet that displays a simple message.

b) Develop an applet that receives an integer in one text field and computes its factorial value and returns it in another text field when the button named "Compute" is clicked

Task 13:

a) Write a Java program for handling mouse events.

b) Write a Java program for handling key events.

Text Books:

1. Java; the complete reference, 7th editon, Herbert Schildt, TMH.

2. Introduction to Java programming, Sixth edition, Y.Daniel Liang, Pearson Education.

Reference Books:

1. Java: How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, PearsonEducation/PHI.

2. Big Java, 2nd edition, Cay Horstmann, Wiley Student Edition, Wiley India Private Limited.

II YEAR II SEMESTER

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

POWER GENERATION AND DISTRIBUTION

Course Code: GR25A2031 **L/T/P/C: 3/0/0/3**

II Year II Semester

COURSE OUTCOMES

1. Illustrate the basic concepts of Conventional Power Generation.
2. Explain the environmental benefits of renewable sources of power generation.
3. Examine the impact of government policies, market trends on economics of power generation.
4. Compare the performance and suitability of DC and AC distribution systems for different applications.
5. Analyze the performance of different types of substation layouts and their specific requirements.

UNIT I

CONVENTIONAL POWER GENERATION

The History of Electricity in India, Conventional Sources (Qualitative): Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant.

UNIT II

NON CONVENTIONAL POWER GENERATION

Non-Conventional Sources (Qualitative): Ocean Energy, Tidal Energy, Wave Energy, wind Energy, Fuel Cells, and Solar Energy, Cogeneration and energy conservation and storage.

UNIT III

ECONOMICS OF POWER GENERATION

Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor,Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer.

UNIT IV

D.C. DISTRIBUTION & A.C DISTRIBUTION

Classification of DC Distribution Systems. - Comparison of DC vs. AC, Under-Ground vs. Over-Head Distribution Systems. - Requirements and Design features of Distribution Systems. -Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed at one end and both ends (equal/unequal Voltages) and Ring Main Distributor.

Introduction of AC distribution, Single phase, 3-phase, 3 phases 4 wire system, bus bar arrangement, Selection of site for substation. Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

UNIT V

SUBSTATIONS

Classification of Substations, Comparison of Outdoor and Indoor Sub-stations, Transformer Sub-stations, Pole mounted Sub-stations, Underground Sub-stations, Equipment in a transformer sub-station and its symbols, Bus-bar Arrangements in Sub-stations, Terminal and Through Sub-stations, Key diagrams of 66/11 kV & 11 kV/400 V indoor Sub-station.

TEXTBOOKS

1. "A Text Book on Power Systems Engineering", A Chakrabarti, M L Soni, P V Gupta & US Bhatnagar Dhanpat Rai & Co. Pvt..Ltd.
2. "Generation, Distribution and Utilization of Electrical Energy", C.L. Wadhwa Second Edition, New AgeInternational,2009.

REFERENCES

1. "Electrical Power systems", C.L.Wadhwa New age Publishers 7th Edition 2017.
2. "The Transmission and Distribution of Electrical Energy", H.Cotton & H. Barber- Third Edition, ELBS, B.I.Pub.,1985.
3. "Power generation technologies", Paul Breeze Third Edition, Elsevier Publishers 2019.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

AC MACHINES

Course Code: GR25A2032 **L/T/P/C: 2/1/0/3**

II Year II Semester

COURSE OUTCOMES

1. Illustrate the concepts of rotating magnetic fields.
2. Interpret the need for electrical Induction Machines.
3. Identify the working of single and three phase AC machines.
4. Analyze Machine Variables in direct and quadrature axis form for salient pole type.
5. Summarize the concept of harmonic created in supply system, need for reduction and design of synchronous machines for reducing them.

UNIT I

FUNDAMENTALS OF AC MACHINE WINDINGS

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding concentrated and distributed, sinusoidal distributed winding, winding distribution factor. Introduction to revolving magnetic field in 3-phase and 1-phase machines.

UNIT II

INDUCTION MACHINES

Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator Operation. Self-Excitation. Doubly-Fed Induction Machines.

UNIT III

SYNCHRONOUS GENERATORS

Synchronous Generator: Basic principle of operation, construction of salient & non-salient pole synchronous machines, generated EMF, effect of distribution and chording of winding, harmonics causes, reduction and elimination. Armature reaction, synchronous reactance, leakage reactance, Phasor diagram of non-salient type alternator. Voltage regulation-EMF, MMF, ZPF and ASA Methods. Two reaction theory- direct and quadrature axis reactance, Phasor diagram, slip test, synchronizing to infinite bus bars and parallel operation, steady state power-angle characteristics.

UNIT IV

SYNCHRONOUS MOTORS

Synchronous Motor: Principle of operation, Phasor diagrams, torque and torque angle, effect of change in load, effect of change in excitation, V and inverted V curves. Synchronous condenser, hunting and damping. Methods of starting of synchronous motors. Testing of Synchronous motors.

UNIT V

SINGLE-PHASE INDUCTION MOTORS

Constructional features-double revolving field theory, equivalent circuit, determination of parameters. Types of 1-phase induction motors, Split-phase starting methods and applications.

TEXTBOOKS

1. "Electric Machinery", by A.E.Fitzgerald and C.Kingsley, McGraw Hill Education,2013.
2. "Performance and design of AC machines", by M.G.Say CBSPublishers,2002.

REFERENCES

1. "Electrical Machinery", by P.S.Bimbhra Khanna Publishers,2011.
2. "Electric Machines", by I.J.Nagrath and D.P. Kothari, McGraw Hill Education,2010.
3. "Alternating Current Machines", by A.S.Langsdorf, McGraw Hill Education,1984.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONTROL SYSTEMS

Course Code: GR25A2033 **L/T/P/C: 3/0/0/3**
II Year II Semester
COURSE OUTCOMES

1. Summarize the basic elements and structures of feedback control systems.
2. Analyze the concept of time response, steady state response, errors.
3. Formulate Routh-Hurwitz table, root locus for the linear time-invariant systems.
4. Outline the stability of the system using Nyquist and Bode plots.
5. Develop control system models for state space models, to express state transition matrix and calculation of variables.

UNIT I
CONCEPTS OF CONTROL SYSTEMS AND TRANSFER FUNCTION REPRESENTATION
Open loop and closed loop control systems, different examples of control systems, classification of control systems, characteristics and effects of feedback, impulse response and transfer functions, translational and rotational mechanical systems, Transfer function of DC and AC Servomotor, Synchro transmitter and receiver, Block diagram reduction techniques, signal flow graphs, reduction using Mason's gain formula.

UNIT II
TIME RESPONSE ANALYSIS
Standard test signals, time response of first order systems, characteristic equation of feedback control systems, transient response of second order systems-time domain specifications, steady state response-steady state errors and error constants, effects of proportional derivative, proportional integral systems.

UNIT III
STABILITYANALYSIS &ROOT LOCUS TECHNIQUE
Concept of stability, Routh stability criterion, Routh Hurwitz stability criterion Root locus concept, construction of root loci, effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT IV
STABILITY ANALYSIS IN FREQUENCY DOMAIN
Frequency domain specifications, Bode diagrams, Determination of frequency domain specifications and transfer function from the Bode diagram- Phase and Gain margin, stability analysis from Bode plots. Polar plots, Nyquist plots and applications of Nyquist criterion to find the stability.

UNIT V
STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS
Concepts of state, state variables and state vector, derivative of state model from transfer function, derivative of transfer function from state model, diagonalization, Solution of State Equation, state transition matrix and its properties, Controllability and Observability.

TEXTBOOKS

1. “Control Systems”, by A. Anand Kumar 2 nd edition, PHI Learning Private Limited

2. “Automatic Control Systems”, by B.C.Kuo 8th edition, 2003, John Wiley and Son’s

REFERENCES

1. “Control Systems Engineering”, I. J. Nagrath and M. Gopal New Age International (P) Limited Publishers, 2nd edition.

2. “Control Systems Engineering”, by John Wiley by NISE 3 rd Edition.

3. “Modern Control Engineering”, by Katsuhiko Ogata Prentice Hall of India Pvt Ltd, 3rd edition,1998.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRINCIPLES OF DIGITAL ELECTRONICS

Course Code: GR25A2034 **L/T/P/C: 3/0/0/3**
II Year II Semester

COURSE OUTCOMES

1. Summarize the working of logic gates with applications, design of logic gates with diodes and transistors.
2. Develop the applications using Combinational logic circuits by minimizing the function using K-Map.
3. Make use of different types of counters for applications.
4. Examine types of Memories and application of ROM as PLDs.
5. Model Analog to Digital and Digital to Analog Converter.

UNIT I
NUMBER SYSTEMS AND LOGIC FAMILIES
Logic gates, Boolean algebra, Boolean Postulates, realization of Boolean functions with logic gates, number systems, one's and two's complements arithmetic, Binary codes: BCD, Weighted codes: -2421,8421, Gray code, error detecting and correcting codes, Hamming code.

UNIT II
MINIMIZATION TECHNIQUES
Standard and Canonical form representation for logic functions, minimization of logical functions using Boolean Postulates and Theorems, K-map representation, and simplification of logic functions using K-Map, don't care terms.
Combinational Logic Circuits: Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, carry look ahead adder, digital comparator, parity checker/generator, priority encoders.

UNIT III
SEQUENTIAL CIRCUITS:
SR Latch, the clocked SR flip flop, J- K, T and D types flip-flops, Triggering of Flip Flops, Analysis of Clocked Sequential Circuits, Flip-Flop Excitation Tables, Conversion from one Flip-Flop to other.

REGISTERS: Analysis procedure, design procedure, Registers with parallel load, Shift registers; Serial Transfer, Serial Addition. Ripple Counters; Binary Ripple Counter, BCD Ripple Counter, Synchronous Counters; Binary Counter, Up-Down Counter.

UNIT IV
MEMORIES AND PLDs
Memory organization and operation, expanding memory size, classification and characteristics of memories, ROM, EPROM, E^2PROM and RAM.

PROGRAMMABLE LOGIC DEVICES: ROM as a Programmable Read Only Memory (PROM), Programmable Array Logic (PAL) and Programmable Logic Array (PLA).

UNIT V

DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS

Digital to Analog converters: Weighted resistor D/A converter, R-2R Ladder D/A Converter, Specifications for D/A converters. Analog to Digital converters: Sample and hold circuit, Flash type A/D converter, Successive approximation type A/D converter, Counter Type A/D converter, Specifications of A/D converters.

TEXTBOOKS

1. "Fundamentals of Digital Circuits", Anand. Kumar, Prentice Hall India, 2016.
2. "Digital logic and Computer design", M. M. Mano,Pearson Education India, 2016.

REFERENCES

1. “A Textbook of Digital Electronics”, R.S. Sedha, S.Chand, 2005
2. "Modern Digital Electronics", R. P. Jain, McGraw Hill Education, 2009.
3. “Fundamentals of Logic Design’, Charles H. Roth, Jr., Larry L. Kinney, Raghunandan G. H, Cengage, 1st Edition, 2020

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MICROPROCESSORS AND MICROCONTROLLERS

Course Code: GR25A2035 **L/T/P/C:3/0/0/3**
II Year II Semester

COURSE OUTCOMES

1. Summarize the internal architecture of 8086 Microprocessor.
2. Analyze assembly level programs of 8086 Microprocessors.
3. Illustrate the internal architecture of 8051.
4. Build skills in writing assembly level programs on the 8051.
5. Develop real-time systems on the 8051 Microcontroller using external interface peripherals.

UNIT I

8086 ARCHITECTURE

8086 Architecture- Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Instruction formats, addressing modes, Instruction Set, Assembler Directives, Macros.

UNIT II

ASSEMBLY LANGUAGE PROGRAMMING OF 8086 AND INTERFACING

Simple Programs involving Logical, Branch and Call Instructions, Sorting, Evaluating Arithmetic Expressions, String manipulations, Signal Descriptions of 8086, Common Function Signals, Minimum and Maximum Mode Signals.

Memory and I/O Interfacing: Memory Interfacing of 8086,8255 PPI, Various Modes of Operation, and Interfacing to 8086, Interfacing keyboard, Display, Stepper Motor Interfacing, D/A and A/D Converter.

UNIT III

THE 8051 ARCHITECTURE

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers, and Counters

UNIT IV

INSTRUCTION SET AND PROGRAMMING

Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, indexed addressing, Bit inherent addressing, bit direct addressing.

8051 Instruction set: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs.

UNIT V

EXTERNAL COMMUNICATION INTERFACE

Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB.

Applications:

LED, LCD, and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing.

TEXTBOOKS

1. "Advanced Microprocessors and Peripherals", A. K. Ray and K. M. Bhurchandani, 2nd Edition, Tata McGraw-Hill, 2006.
2. "Microprocessors and Interfacing", D.V. Hall, 2nd Edition, Tata McGraw-Hill, 2006.

REFERENCES

1. "The 8051 Microcontroller and Embedded Systems using Assembly and C" – Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, Pearson Education, 2008.
2. "Microcontrollers: Theory and Applications", Ajay V. Deshmukh, Tata McGraw-Hill Education, 2005.
3. "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Cengage Learning, 2010.

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

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.

REFERENCES

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.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PRINCIPLES OF DIGITAL ELECTRONICS LAB

Course Code: GR25A2036 **L/T/P/C: 0/0/2/1**
II Year II Semester

COURSE OUTCOMES

1. Make use of function realization using logic gates.
2. Design Combinational logic circuits.
3. Analyze the types of Flip-Flops used in registers.
4. Develop Sequential logic circuits.
5. Construct a parity checking circuit.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Design and verification of basic logic gates.
2. Simplify the given Boolean expression realize them using universal gates.
3. Construct half and full adder circuit using basic logic gates.
4. Develop a half subtractor/full subtractor circuit using basic logic gates.
5. Construct a parallel adder circuit using basic logic gates.
6. Design and implementation of subtractor
7. Develop a Multiplexer using basic logic gates.
8. Design and implementation of Decoder
9. Construct a Magnitude comparator using basic logic gates.
10. Design and verify Odd and Even Parity.
11. Implementation and verification of truth table for R-S, J-K, D and T flip-flop.
12. Experiment with J-K flip-flop as D flip-flop.

TEXTBOOKS

1. "Fundamentals of Digital Circuits", A. Kumar, Prentice Hall India, 2016.
2. "Digital logic and Computer design", M. M. Mano, Pearson Education India, 2016.

REFERENCES

1. "A Textbook of Digital Electronics", R.S. Sedha, S.Chand, 2005
2. "Modern Digital Electronics", R. P. Jain, McGraw Hill Education, 2009.
3. "Switching Theory and Logic Design", Godse, Technical Publication, 2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

AC MACHINES LAB

Course Code: GR25A2037 **L/T/P/C: 0/0/2/1**

II Year II Semester

COURSE OUTCOMES

1. Assess the performance of different machines using different testing methods.
2. Determine the parameters of equivalent circuit of single-phase induction motor.
3. Make use of various methods to find regulation of an Alternator.
4. Analyze various characteristics of three phase induction motor.
5. Experiment with synchronous machine to find direct and quadrature axis reactance.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Sumpner's test.
2. Heat run test on transformer.
3. Hysteresis loss determination.
4. Brake Test on Slip Ring Induction Motor.
5. No load and Blocked Rotor Tests on Squirrel Cage Induction Motor.
6. Equivalent Circuit of a Single-Phase Induction Motor.
7. Regulation of an Alternator by Synchronous Impedance Method and MMF Method.
8. Determination of X_d and X_q of a Salient Pole Synchronous Machine from Slip Test.
9. V and inverted V curves of a 3-Phase Synchronous Motor.
10. Induction Generator.
11. Rotor-resistance starter for Slip Ring Induction Motor.
12. Star-delta starter for Squirrel Cage Induction Motor.

TEXTBOOKS

1. "Electric Machinery", A.E.Fitzgerald and C.Kingsley, McGraw Hill Education,2013.
2. "Performance and design of AC machines", M.G. Say CBSPublishers,2002.

REFERENCES

1. "Electrical Machinery", P.S.Bimbhra Khanna Publishers,2011.
2. "Electric Machines", I.J.Nagrath and D.P. Kothari, McGraw Hill Education,2010.
3. "Alternating Current Machines", A.S.Langsdorf, McGraw Hill Education,1984.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

CONTROL SYSTEMS LAB

Course Code: GR25A2038 **L/T/P/C: 0/0/2/1**
II Year II Semester

COURSE OUTCOMES

1. Make use of simulation packages for simple control system programs.
2. Examine the characteristics of synchros.
3. Analyze the root locus and bode plots.
4. Develop the transfer function of DC motor/generator.
5. Interpret the performance of servomotor and PID controller.

LIST OF EXPERIMENTS
Any ten experiments should be conducted.

1. Obtain the Transfer function from zeros and poles and vice versa.
2. Find the Step response, Ramp response and Impulse response for a given transfer function.
3. Draw Root Locus from a Transfer function.
4. Draw Bode Plot and Nyquist Plot from a Transfer function.
5. Derive State Model from a Transfer function.
6. Determine Transfer function of DC motor/Generator.
7. Derive Zeros and poles from state model.
8. Obtain the Time Response of second order system of a given transfer function.
9. Study of Characteristics of DC Servomotor.
10. Design a PID Controller for a given Control System.
11. Characteristics of Synchros.
12. Study of Characteristics of AC Servomotor

TEXTBOOKS

1. "Control Systems", by A. Anand Kumar 2 nd edition, PHI Learning Private Limited
2. "Automatic Control Systems", by B.C.Kuo 8th edition, 2003, John Wiley and Son's

REFERENCES

1. "Control Systems Engineering", I. J. Nagrath and M. Gopal New Age International (P) Limited Publishers, 2nd edition
2. "Control Systems Engineering", by John Wiley by NISE 3 rd Edition.
3. "Modern Control Engineering", by Katsuhiko Ogata Prentice Hall of India Pvt Ltd, 3rd edition,1998.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PCB DESIGN LAB

Course Code: GR25A2103 **L/T/P/C: 0/0/2/1**

II Year II Semester

COURSE OUTCOMES

1) Understand the design and fabrication process of PCBs.
2) Design schematic diagrams and convert them to PCB layouts.
3) Apply routing and layout techniques using EDA tools.
4) Generate Gerber files and perform DRC/ERC effectively.
5) Fabricate, assemble, and test basic single-layer PCBs.

Module I: Fundamentals of PCB Design

 Types of PCBs: Single-layer, Double-layer, Multilayer

 PCB materials and manufacturing process

 PCB design rules and standards (IPC standards)

 Introduction to EDA tools (e.g., KiCad, Eagle, Altium, EasyEDA)

Lab Activity:

 Exploring the user interface of PCB design software.

 Setting up design rules.

Module II: Schematic Design

 Creating circuit schematics using PCB CAD tools.

 Component library management

 Electrical rule checking (ERC)

 Netlist generation

Lab Activity:

 Designing a basic power supply or LED flasher circuit.

 Performing ERC and generating netlist.

Module III: PCB Layout and Routing

 Importing netlist to layout editor.

 Footprint assignment and component placement

□ Manual vs auto-routing

□ Design Rule Check (DRC)

Lab Activity:

□ Placing components and routing for the schematic designed earlier.

□ Performing DRC and correcting errors.

Module IV: PCB Output Files and Fabrication

□ Generating Gerber files, drill files, and BOM.

□ Understanding layers (Top, Bottom, Soldermask, Silkscreen)

□ PCB printing, photoresist method, and etching.

□ Introduction to SMD and through-hole assembly

Lab Activity:

□ Generate Gerber files and preview using Gerber viewer.

□ Fabricate a basic single-layer PCB (simulation or actual lab process)

Module V: Mini Project and Testing

□ Assembling components on fabricated PCB.

□ Soldering and desoldering techniques.

□ Continuity testing and troubleshooting

□ Mini project: Design a simple power supply, logic gate trainer, or timer circuit.

Lab Activity:

□ Complete mini project: From schematic to testing of PCB.

TEXTBOOKS

1. Walter C. Bosshart “Printed Circuit Board Design and Technology” Tata McGraw Hill
2. Clyde F. Coombs “Printed Circuit Boards: Design and Technology”: McGraw-Hill
3. Peter Dalmaris “PCB Design Using KiCad 6”

REFERENCES

1. Kraig Mitzner “Complete PCB Design Using OrCAD Capture and PCB Editor.”
2. James Angus “Electronic Product Design”

IPC Standards:

1. IPC-2221: Generic Standard on Printed Board Design

2. IPC-7351: Generic Requirements for Surface Mount Design

Software Tools (Free/Open Source Recommended):

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