

**Academic Regulations
Programme Structure
and
Detailed Syllabus**

**Bachelor of Technology (B.Tech)
in
Civil Engineering**

(Four Year Regular Programme)

(Applicable for Batches admitted from 2025-26)



**GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY**
(Autonomous)

Bachupally, Kukatpally, Hyderabad- 500 090

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
HYDERABAD

Academic Regulations for B.Tech (Regular) under GR25

(Applicable for Batches Admitted from 2025-26)

Under Graduate Degree Programme in Engineering and Technology (UG)

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

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

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

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

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

3. B.Tech Programme Structure

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

3.2 UGC/ AICTE specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms.

3.2.1 Semester Scheme

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

3.2.2 Credit Courses

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

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

For example, a theory course with three credit weightage requires three hours of classroom instruction per

week, totaling approximately 45 hours of instruction over the entire semester.

3.2.3 Subject Course Classification

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

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

4. Mandatory Induction Programme

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

5. Course Registration

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

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

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

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

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

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

5.5 Provision for Early Registration of MOOCs:

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

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

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

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

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

5.8 Additional learning resources:

Students are encouraged to acquire additional course-related knowledge by auditing learning resources from MOOCs platforms for each course offered in their course structure. These additional courses are not meant for earning credits but are intended to enhance knowledge.

6. Rules to offer Elective courses

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

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

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

7. Attendance requirements:

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

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

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

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

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

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

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

8. Criteria for Earning of Credits in a Course

8.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course, if the student secures not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal

Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing 'C' grade or above in that course.

- 8.2** A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Field Based Research Project / Industry Oriented Mini Project / Internship, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he/she (i) does not submit a report on Field-Based Research Project/Industry Oriented Mini Project/ Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Field-Based Research Project / Industry Oriented Mini Project / Internship evaluations.
- 8.3** A student eligible to appear in the semester-end examination for any course, is absent from it or failed (thereby failing to secure 'C' grade or above) may re-appear for that course in the supplementary examination as and when it is conducted. In such cases, internal marks assessed in continuous internal evaluation (CIE) earlier for that course will be carried over, and added to the marks obtained in the SEE supplementary/make-up examination. If the student secures sufficient marks for passing, 'C' grade or above shall be awarded as specified in clause 10.3.

9. Distribution of Marks and Evaluation

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

9.2 Continuous Internal Evaluation (CIE)

9.2.1 Theory Courses:

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

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

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

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

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

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

2. Five marks for the assignment for 5 marks. Student shall submit two assignments and the average of 2 Assignments each for 5 marks shall be taken. The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination.
3. Five marks for the Quiz/Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject. This assessment shall be completed before II Mid-Term Examination.

9.2.2 Graphics for Engineers Course:

For this course, 20 marks will be allocated for day-to-day assessments conducted during drawing practice sessions, and another 20 marks will be allocated for the mid-term examination. In the mid-term examination, students shall attempt any four out of six given questions. Each mid examination is conducted for 90 minutes. Average of the two mid exams shall be considered.

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

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

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

9.4 Semester End Examination for theory courses

9.4.1 Theory Courses:

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

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

9.4.2 Graphics for Engineers Course:

Question paper consists of five questions carrying 12 marks each. There shall be two questions asked in the question paper from each unit with either-or choice and the student should answer either of the two questions. The student shall answer one question from each of five units. There shall be no section with short answer questions.

9.4.3 Duration of SEE:

The duration of Semester End Examination of theory and graphics for engineers courses is 3 hours.

9.5 Continuous Internal Evaluation and Semester End Examination for Practical Courses

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

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

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

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

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

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

9.6 Field-based Research Project:

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

9.7 Internship/Industry Oriented Mini Project:

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

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

9.8UG Project Work:

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

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

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

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

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

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

9.8.5 For conducting viva-voce exam of project work, Controller of Examination appoints an external examiner. The external examiner may be selected from the list of experts submitted by the Head of the department.

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

9.9 Skill Development Courses:

Skill Development Courses are included in the Curriculum. Each Skill Development Course carries one credit. The evaluation pattern will be same as that of a laboratory course including the internal and external assessments.

The objective of Skill Courses is to develop the cognitive skills as well as the psychomotor skills.

9.10 Value-Added Courses:

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

10. Grading Procedure

- 10.1** Absolute grading system is followed for awarding the grades to each course.
- 10.2** Grades will be awarded to indicate the performance of students in each Theory, Laboratory, Industry-Oriented Mini Project/ Internship/ Skill development course and Project Work. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in clause 8 above, a letter grade shall be given as explained in the following clause.
- 10.3** To measure the performance of a student, a 10-point grading system is followed. The mapping between the percentage of marks secured and the corresponding letter grade is as follows:

Letter Grade	Grade Point	Percentage of marks
O (Outstanding)	10	Marks $\geq$ 90
A+ (Excellent)	9	Marks $\geq$ 80 and Marks $<$ 90
A (Very Good)	8	Marks $\geq$ 70 and Marks $<$ 80
B+ (Good)	7	Marks $\geq$ 60 and Marks $<$ 70
B (Average)	6	Marks $\geq$ 50 and Marks $<$ 60
C (Pass)	5	Marks $\geq$ 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) **S_k** the SGPA of **kth** 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.,

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

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

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

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

- 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

$$\text{Marks \%} = (\text{CGPA} - 0.5) \times 10$$

14.2 Grace Marks

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

Grace marks for students admitted under the GR25 Academic Regulations should not exceed 0.15% of the total maximum marks in all eight semesters (excluding the marks allocated for value added courses and skill development courses).

15. Multiple Entry Multiple Exit Scheme (MEME)

15.1 Exit Option after Second Year:

Students enrolled in the 4-Year B.Tech program are permitted to exit the program after successful completion of the second year (B.Tech II Year II Semester). The students who desire to exit after the II year shall formally inform the exit plan one semester in advance i.e. at the commencement of II Year II Semester itself. Such students need to fulfil the additional requirements as specified in Clause 15.2 described below.

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

15.2 Additional Requirements for Diploma Award

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

Work-based Vocational Course:

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

Internship/Apprenticeship:

Completion of a minimum 8-week internship or apprenticeship in their related field to gain practical industry exposure. In addition, students must clear any associated course(s) and submit the internship/ apprenticeship report.

15.3 Re-entry into the B.Tech Programme

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

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

15.4 Break in Study and Maximum Duration

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

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

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

- 16.1** Transitory regulations are applicable to the students detained due to shortage of attendance as well as detained due to the shortage of credits and seek permission to re-join the B.Tech programme, where GR25 regulations are in force.
- 16.2** A student detained due to shortage of attendance and re-admitted in GR25 regulations: Such students shall be permitted to join the same semester, but in GR25 Regulations.
- 16.3** A student detained due to shortage of credits and re-admitted in GR25 regulations: Such students shall be promoted to the next semester in GR25 regulations, only after acquiring the required number of credits as per the corresponding regulations of his/her previous semester.

- 16.4** A student who has failed in any course in a specific regulation has to pass those courses in the same regulations.
- 16.5** If a student is readmitted to GR25 Regulations and has any course with 80% of syllabus common with his/her previous regulations, that particular course in GR25 Regulations will be substituted by an equivalent course of previous regulations
- 16.6** The GR25 Academic Regulations are applicable to a student from the year of re-admission. However, the student is required to complete the study of B.Tech degree within the stipulated period of eight academic years from the year of first admission.

17 Student Transfers

- 17.1** There shall be no branch transfers after the completion of admission process.
- 17.2** There shall be no transfers from one college to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.
- 17.3** The students seeking transfer to colleges affiliated to JNTUH from various other Universities/institutions is having back-logs at the previous University/institute, have to pass the courses offered at JNTUH which are equivalent to the failed courses at the previous University/institute.
- 17.4** The transferred students from other Universities/Institutions to JNTUH affiliated colleges, shall be given a chance to write CBTs for getting CIE component in the equivalent course(s) as per the clearance letter issued by the University.

18 Honors and Minor Degree Programmes

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

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

(Applicable for Batches Admitted from 2025-26)

1. All regulations as applicable for B.Tech 4-year degree programme (Regular) will hold good for B.Tech (Lateral Entry Scheme) except for the following rules:
 - a) Pursued programme of study for not less than three academic years and not more than six academic years.
 - b) A student should register 123/124 credits and secure 120 credits. The marks obtained in all 120 credits shall be considered for the calculation of the final CGPA.
 - c) The student can avail exemption of courses totaling up to 3/4 credits other than Professional core courses, Laboratory Courses, Seminars, Project Work and Field Based Research Project/ Industry Oriented Mini Project / Internship, for optional drop out.
 - d) Lateral Entry students are not permitted to exit the B.Tech. program after completion of second year (B.Tech. II Year II Semester).
 - e) Students who fail to fulfil all the academic requirements for the award of the degree within six academic years from the year of their admission, shall forfeit their seat in B.Tech programme.

2. Academic Requirements and Promotion Rules:

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

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

3	Third year first semester to Third year second semester	Regular course of study of third year first semester and fulfilment of attendance requirement.
4	Third year second semester to Fourth year first semester	Regular course of study of third year second semester and fulfilment of attendance requirement.
5	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester and fulfilment of attendance requirement.

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

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

Academic Regulations for B.Tech with Minors Programme under GR25

(Applicable for Batches Admitted from 2025-26)

1. Objectives

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

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

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

- a) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4 -Years B.Tech programme.
- b) For B.Tech with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B.Tech degree). Minor Degree programmes will commence from II Year II Semester and continue till IV Year I Semester.
- c) After registering for the Minor programme, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), he/she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of B.Tech, he/she will be awarded only B.Tech degree in the concerned programme.
- d) There is no transfer of credits from Minor programme courses to regular B.Tech degree course and vice versa.
- e) These 18 credits are to be earned from the additional Courses offered by the host department in the college as well as from the MOOCs platform.
- f) For the course selected under MOOCs platform following guidelines may be followed:
 - i) Prior to registration of MOOCs courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.
 - ii) Minimum credits for MOOCs course must be equal to or more than the credits specified in the Minor course structure provided by the University.
 - iii) Only Pass-grade/marks or above shall be considered for inclusion of grades in minor grade memo.

- iv) Any expenses incurred for the MOOCs courses are to be met by the students only.
- g) The option to take a Minor programme is purely the choice of the student.
- h) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor programme at any time; and in that case the student will be awarded only B.Tech degree in the concerned programme on earning the required credits of 160.
- i) The student can choose only one Minor programme along with his/her basic engineering degree. A student who chooses an Honors programme is not eligible to choose a Minor programme and vice-versa.
- j) A student can graduate with a Minor if he/she fulfils the requirements for his/her regular B.Tech programme as well as fulfils the requirements for Minor programme.
- k) The institute shall maintain a record of students registered and pursuing their Minor programmes, minor programme-wise and parent programme -wise. The same report needs to be sent to the University once the enrolment process is complete.
- l) The institute / department shall prepare the time-tables for each Minor course offered at their respective institutes without any overlap/clash with other courses of study in the respective semesters.

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

- a) A student can opt for B.Tech programme with Minor programme if she/he has no active backlogs till II Year I Semester (III semester) at the time of entering into II year II semester.
- b) Prior approval of mentor and Head of the Department for the enrolment into Minor programme, before commencement of II year II Semester (IV Semester), is mandatory
- c) If more than 50% of the students in a programme fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

4. Registration for the courses in Minor Programme

- a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.
- b) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied/registered for regular B.Tech programme. No course should be identical to that of the regular B.Tech course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.
- c) The maximum No. of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.
- d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.
- e) A fee for late registration may be imposed as per the norms.

5. Minor courses and the offering departments

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



GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

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

B. Tech Civil Engineering GR25 Course Structure

I B. Tech (CE)-I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	Maths	BS	GR25A1001	Linear Algebra and Function Approximation	3	1	0	4
2	Chemistry	BS	GR25A1004	Engineering Chemistry	3	0	0	3
3	CSE	ES	GR25A1006	Programming for Problem Solving	2	0	0	2
4	ME	ES	GR25A1024	Engineering Workshop	1	0	3	2.5
5	ME	ES	GR25A1015	Graphics for Engineers	1	0	4	3
6	CE	ES	GR25A1008	Elements of Civil Engineering Lab	0	0	3	1.5
7	Chemistry	BS	GR25A1018	Engineering Chemistry lab	0	0	2	1
8	CSE	ES	GR25A1020	Programming for Problem Solving Lab	0	0	3	1.5
9	Mgmt	SD	GR25A2093	Design Thinking and Tinkering lab	0	0	3	1.5
Total					10	1	18	20

I B. Tech (CE)- 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	ME	ES	GR25A1014	Engineering Mechanics	3	1	0	4
6	CSE	ES	GR25A1026	Python Programming	1	0	0	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	Physics	BS	GR25A1017	Advanced Engineering Physics Lab	0	0	2	1
TOTAL					15	2	6	20

II B. Tech (CE)- I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	CE	PC	GR25A2009	Building Materials and Construction Planning	2	0	0	2
2	CE	PC	GR25A2017	Surveying and Geomatics	2	0	0	2
3	CE	PC	GR25A2011	Solid Mechanics –I	2	1	0	3
4	Maths	BS	GR25A2005	Probability and Statistics	3	0	0	3
5	CE	PC	GR25A2012	Fluid Mechanics	3	0	0	3
6	EEE	PC	GR25A2013	Basic Electrical and Electronics Engineering	3	0	0	3
7	Mgmt	VAC	GR25A2002	Value Ethics and Gender Culture	1	0	0	1
8	CE	PC	GR25A2020	Surveying Lab	0	0	4	2
9	CE	PC	GR25A2015	Solid Mechanics Lab	0	0	4	2
TOTAL					16	1	8	21

II B. Tech (CE)- II Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	CE	PC	GR25A2016	Solid Mechanics– II	2	0	0	2
2	CE	PC	GR25A2010	Engineering Geology	2	0	0	2
3	CE	PC	GR25A2018	Structural Analysis– I	3	0	0	3
4	Mgmt	HS	GR25A2004	Economics and Accounting for Engineers	3	0	0	3
5	CE	PC	GR25A2019	Hydraulic Engineering	2	0	0	2
6	Chemistry	VAC	GR25A2001	Environmental Science	1	0	0	1
7	CE	PC	GR25A2014	Engineering Geology Lab	0	0	4	2
8	CE	PC	GR25A2021	Computer Aided Design Lab	0	0	4	2
9	CE	PC	GR25A2022	Fluid Mechanics and Hydraulic Machinery Lab	0	0	4	2
10	CE	SD	GR25A2094	Digital Surveying Lab	0	0	2	1
TOTAL					13	0	14	20

III B. Tech (CE) - I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	CE	PC		Geotechnical Engineering	2	0	0	2
2	CE	PC		Concrete Technology	2	0	0	2
3	CE	PC		Hydrology and Water Resources Engineering	3	0	0	3
4	CE	PC		Design of Reinforced Concrete Structures	2	1	0	3
5	CE	PE		Professional Elective-I	3	0	0	3
6	CE	OE		Open Elective-I	3	0	0	3
7	English	HS		Effective Technical Communication	1	0	0	1
8	CE	PC		Geotechnical Engineering Lab	0	0	2	1
9	CE	PC		Concrete Technology Lab	0	0	2	1
10	CE	SD		Building Information Modelling Lab	0	0	2	1
11	CE	PC		Field Based Project/ Internship	0	0	4	2
TOTAL					17	1	10	22

Professional Elective-I			
S.No.	BOS	Course Code	COURSE
1	CE		Structural Analysis - II
2	CE		Traffic Engineering and Management
3	CE		Surface Hydrology
4	CE		Pavement Materials

Open Elective-I			
S.No.	BOS	Course Code	COURSE
1	CE		Engineering Materials for Sustainability

III B. Tech (CE) - II Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	CE	PC		Design of Steel Structures	2	1	0	3
2	CE	PC		Foundation Engineering	3	0	0	3
3	CE	PC		Environmental Engineering	2	0	0	2
4	CE	HS		Entrepreneurship and Project Management	2	0	0	2
5	CE	PE		Professional Elective-II	3	0	0	3
6	CE	OE		Open Elective-II	3	0	0	3
7	English	VAC		Indian Knowledge Systems	1	0	0	1
8	CE	PC		Environmental Engineering Lab	0	0	2	1
9	CE	PC		GIS Lab	0	0	2	1
10	CE	SD		Structural Detailing lab	0	0	2	1
TOTAL					16	1	6	20

Professional Elective II			
S.No	BOS	Course Code	COURSE
1	CE		Masonry Structures
2	CE		Rock Mechanics
3	CE		Open Channel Flow
4	CE		Green Building Technology

Open Elective II			
S.No	BOS	Course Code	COURSE
1	CE		Geographic Information Systems and Science

IV B. Tech (CE) - I Semester

S. No	BOS	Group	Course Code	Course Name	L	T	P	Credits
1	CE	PC		Estimation and Costing	2	1	0	3
2	CE	PC		Transportation Engineering	3	0	0	3
3	CE	PE		Professional Elective-III	3	0	0	3
4	CE	PE		Professional Elective- IV	3	0	0	3
5	CE	OE		Open Elective-III	3	0	0	3
6	CE	PC		Transportation Engineering Lab	0	0	4	2
7	CE	PC		Computer Applications in Structural Engineering Lab	0	0	4	2
8	CE	PW		Industry Oriented Mini Project/ Summer Internship	0	0	4	2
TOTAL					14	1	12	21

Professional Elective III			
S.No.	BOS	Course Code	COURSE
1	CE		Bridge Engineering
2	CE		Ground Improvement Techniques
3	CE		Groundwater
4	CE		Tall Buildings

Professional Elective IV			
S.No.	BOS	Course Code	COURSE
1	CE		Finite Element Methods
2	CE		Port and Harbour Engineering
3	CE		Physico-Chemical Processes for Water and Wastewater Treatment
4	CE		Rehabilitation and Retrofitting of Structures

Open Elective III			
S.No.	BOS	Course Code	COURSE
1	CE		Plumbing (Water and Sanitation)

IVB. Tech (CE) - II Semester

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

Professional Elective V			
S. No.	BOS	Course Code	COURSE
1	CE		Design of Prestressed Concrete Structures
2	CE		Urban Transportation and Planning
3	CE		Design of Hydraulic Structures
4	CE		Construction Project Planning and Systems

Professional Elective VI			
S.No.	BOS	Course Code	COURSE
1	CE		Earthquake Engineering
2	CE		Pavement Design
3	CE		Irrigation Management
4	CE		Construction Equipment and Automation

PROFESSIONAL ELECTIVES - 4THREADS

S. No.	Structural Engineering	Geotechnical and Transportation Engineering	Environmental and Hydrology Engineering	Construction Technology & Management
1	Structural Analysis-II	Traffic Engineering and Management	Surface Hydrology	Pavement Materials
2	Masonry Structures	Rock Mechanics	Open Channel flow	Green Building Technology
3	Bridge Engineering	Ground Improvement Techniques	Groundwater	Tall Buildings
4	Finite Element Methods	Port and Harbour Engineering	Physico-Chemical Processes for Water and Wastewater Treatment	Rehabilitation and Retrofitting of Structures
5	Design of Prestressed Concrete Structures	Urban Transportation and Planning	Design of Hydraulic Structures	Construction Project Planning and Systems
6	Earthquake Engineering	Pavement Design	Irrigation Management	Construction Equipment and Automation

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	1. Principles of E-Commerce	CSE
	2. Business Analytics	
	3. Augmented Reality and Virtual Reality	
	1. Internet of Things	CSE (AIML)
	2. Augmented Reality and Virtual Reality	
	3. Human Computer Interaction	
	1. Augmented Reality and Virtual Reality	CSE (DS)
	2. Internet of Things	
	3. Human Computer Interaction	
	1. Services Science and Service Operational Management 2. IT Project Management 3. Marketing Research and Marketing Management	CSBS
	1. Artificial Intelligence	
	2. Introduction to Data Science	
	3. Human Computer Interaction	IT
	1. Non-Conventional Energy Sources	
	2. Machine Learning	
	3. Artificial Intelligence Techniques	EEE
	1. Principles of Communication	
	2. Sensor Technology	
	3. Cellular and Mobile Communications	ECE
	1. Robotics	
	2. Composite Materials	
	3. Operations Research	ME
	1. Engineering Materials for Sustainability	
	2. Geographic Information Systems and Science	
	3. Plumbing (Water and Sanitation)	CE

I YEAR I SEMESTER

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

Course Code: GR25A1001

L/T/P/C: 3/1/0/4

I Year I Semester

Pre-requisites: Mathematical Knowledge at pre-university level

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

1. 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. Discover 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 of a function by Taylor's series

UNIT IV

Multivariable Calculus (Partial Differentiation and applications) Partial Differentiation: Total derivative – Jacobian – Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

Curve Tracing: Curve tracing in cartesian coordinates

UNIT V

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

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING CHEMISTRY

Course Code: GR25A1004
I Year I Semester

L/T/P/C: 3/0/0/3

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.

UNIT-I

Water and its treatment: [8]

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

UNIT-II

Electrochemistry and Corrosion: [8]

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

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

UNIT III

Energy sources: [8]

Batteries: Definition – Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Zn-air and Lithium ion battery. Fuel Cells – Differences between a battery and a fuel cell, Construction and applications of Hydrogen –Oxygen Fuel Cell. Fuels: Definition and characteristics of a good fuel, Calorific value – Units - HCV, LCV- Dulong's formula - Numerical problems. Fossil fuels: Classification, Petroleum - Refining of Crude oil, Cracking - Types of cracking - Moving bed catalytic cracking. LPG and CNG composition and

uses. Synthetic Fuels: Fischer Tropschs Process, Introduction and applications of Hythane and Green Hydrogen.

UNIT IV

Polymers: [8]

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

UNIT V

Engineering Materials: [8]

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

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROGRAMMING FOR PROBLEM SOLVING

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

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg, C Programming and Data Structures, Cengage Learning, (3rd Edition)

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education
4. Herbert Schildt, C: The Complete Reference, McGraw-Hill, 4th Edition

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING WORKSHOP

Course Code: GR25A1024
I Year I Semester

L/T/P/C: 1/0/ 3/2.5

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

Text Books

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

GRAPHICS FOR ENGINEERS

Course Code: GR25A1015

L/T/P/C: 1/0/4/3

I Year I Semester

Prerequisites: Mathematics, Physics.

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.

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELEMENTS OF CIVIL ENGINEERING LAB

Course Code: GR25A1008
I Year I Semester

L/T/P/C: 0/0/3/1.5

Course Outcomes:

1. Identify various minerals and their properties.
2. Identify various rocks depending on geological classifications.
3. Prepare and interpret various sections of geological maps showing structures like faults, folds, and Unconformities
4. Evaluate the properties of cement, fine and coarse aggregates and determine its suitability for construction.
5. Apply the method and ways of investigations required for Civil Engineering projects

List of Experiments:

1. Identification of Minerals – Silica Group, Feldspar Group, Crystalline Group, Carbonate Group, Pyroxene Group, Mica Group, Amphibole Group.
2. Identification of Rocks – Igneous Petrology, Sedimentary Petrology, Metamorphic Petrology.
3. a. Study of topographical features from Geological maps. Identification of symbols in maps.
b. Simple structural Geology Problems (Folds, Faults & Unconformities)
4. Tests on Cement
 - a. Fineness test & Normal Consistency test.
 - b. Specific gravity test, Initial and Final setting time of cement.
5. Tests on Fine Aggregates
 - a. Specific Gravity test.
 - b. Bulking of sand & Fineness modulus of Fine aggregate.
6. Tests on Coarse Aggregate
 - a. Specific Gravity test.
 - b. Fineness modulus of Coarse aggregate.

Reference Books

1. N. Chennakesavulu, Mc-Millan, Text book of Engineering Geology, India Ltd., 2nd edition, 2013.
2. IS 269:2013 – Ordinary Portland cement, 33 grade- Specification (Fifth Revision).
3. 1. IS 383:2016 – coarse and fine aggregates for concrete- Specification (Third Revision).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING CHEMISTRY LAB

Course Code: GR25A1018
I Year I Semester

L/T/P/C: 0/0/2/1

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 $\text{K}_2\text{Cr}_2\text{O}_7$.
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.

Reference Books

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

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

Course Code: GR25A1020

L/T/P/C: 0/0/3/1.5

I Year I Semester

Course Outcomes:

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) $S1 = 1 + x/1 + x^2/2 + x^3/3 + \dots + x^n/n$
 - (ii) $S2 = 1 + x/1! - x^2/2! + x^3/3! + \dots + x^n/n!$

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

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

TASK 7

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

TASK 8

- 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.
- 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

- Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.
- Write a C program that sorts the given array of integers using selection sort in descending order
- 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 greatest of two numbers.

Text Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 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
DESIGN THINKING AND TINKERING LAB

Course Code: GR25A2093
I Year I Semester

L/T/P/C: 0/0/3/1.5

Course Outcomes:

1. Apply design thinking methodology (Empathize, Define, Ideate, Prototype, Test) to solve real world problems and Use empathy-based research techniques to understand user needs and perspectives.
2. Generate innovative ideas using ideation tools like "Yes, and", "Five/Nine Whys", and "Six Thinking Hats".
3. Demonstrate the ability to collaborate in multidisciplinary teams and engage in constructive feedback and rapidly prototype and test design concepts within constrained timeframes (e.g., 48-hour challenges) and Present and pitch design solutions effectively to a target audience or jury.
4. Analyze systems and complex problems using systems thinking tools to propose sustainable solutions.
5. Reflect critically on team-based design experiences and iterate solutions based on feedback and testing.

Students' Responsibilities:

1. Forming diverse teams of 3–5 members each to work collaboratively throughout the semester.
2. Proactively engaging to observe the objects and interactions in their daily life and society from a design perspective.
3. Identifying general societal and social problems that may be effectively addressed using design thinking principles
4. Presenting and reporting the tasks to the concerned faculty members using their creative communication and people skills.

Activities:

1. Introduction and briefing (15 minutes)
2. Ice-breaker activity (20 minutes)
3. Introduction to Design Thinking (20 minutes)
4. Building empathy for the user (1 hour)
5. Define a problem statement (1 hour)
6. Ideation part 1: Generate ideas and potential solutions (1 hour) Presentation (5 minutes): What is ideation?
Activity—worst possible idea (10 minutes) Activity—coming up with solutions (10 minutes) Activity—
sharing ideas and getting feedback (10 minutes) Activity—refining your
solution (10 minutes) Reflection and discussion (5 minutes)
7. Ideation part 2: User journey mapping (1 hour) Presentation (10 minutes): What is a user
journey map? Activity—define the activities and steps in the customer's experience (15
minutes) Activity—group the steps into phases (10 minutes) Activity—adding goals and painR25
B.Tech. Civil Engineering JNTUH Hyderabad
points (15 minutes) Sharing user journey maps, reflection and discussion (10 minutes)
8. Prototype and test ideas (1 hour) Presentation (5 minutes): Activity—create mobile screens (15

minutes) Activity—add functionality to mobile screens (15 minutes) Activity—user testing (15 minutes) Activity—decide on a winning approach (10 minutes):

9. Debrief and outline next steps (15 minutes)

Exercises:

1. The Pin-Up Exercise
2. The Systems Thinking Exercise
3. The 48-Hour Crash Course Exercise
4. The Design with Empathy Exercise
5. The Tinker Toy Exercise
6. The Wallet Exercise
7. The Pitch Competition Exercise
8. “Yes, but” vs. “Yes, and” exercise
9. “Five whys” or “Nine Whys” exercise
10. The “Six Thinking Hats” exercise

Text Books:

1. Kumandari Ranga Chari (2024) Applied Design Thinking for Problem Solving - A Tool Kit for Business Practitioners and Managers, BS Publications
2. Tim Brown, “Change by Design”, Harper Business, 2012 (ISBN: 978-0062337382)
3. Donald A. Norman, “The Design of Everyday Things”, MIT Press, 2013 (ISBN: 978-0262525671)
4. Daniel Ling, “Complete Design Thinking Guide for Successful Professionals”, Create Space Independent Publishing, 2015 (ISBN: 978-1514202739)
5. Design Thinking: A guide to creative problem solving for everyone, Andrew Pressman, Routledge Taylor and Francis group, 2019, 1st edition.
6. Engineering Design, George E. Dieter, Linda C. Schmidt, McGraw-Hill Education, 2019, 5th edition.
7. Product design and development, Ulrich, K., Eppinger, S. and Yang, M., 2020, 7th edition.

Reference Books:

1. Bruno Munari, “Design as Art”, Penguin UK, 2009 (ISBN: 978-0141035819)
2. Tom Kelly, Jonathan Littman, “The Art of Innovation”, HarperCollins Business, 2002 (ISBN: 978- 0007102938)
3. Thomas Lockwood, “Design Thinking: Integrating Innovation, Customer Experience, and Brand Value”, Allworth Press, 2009 (ISBN: 978-1581156683)
4. Joost Groot Kromelink, “Responsible Innovation: Ethics, Safety and Technology”, 2nd ed., TU Delft, Faculty of Technology, Policy and Management, 2019 (e-Book ISBN: 978-9463662024)
5. Jimmy Jain, “Design Thinking for Startups: A Handbook for Readers and Workbook for Practitioners”, Notion Press, 2018 (ISBN: 978-1642495034)

Other Suggested Readings:

1. <https://www.arvindguptatoys.com/>
2. <https://honeybee.org/>
3. <https://dschool.stanford.edu/resources/getting-started-with-design-thinking>
4. <https://designthinking.ideo.com/>

**I YEAR
II SEMSTER**

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

Course Code: GR25A1002
I Year II Semester

L/T/P/C: 3/1/0/4

Pre-requisites: Mathematical Knowledge at pre-university level

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

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

UNIT I:

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

UNIT II:

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

UNIT III:

Laplace Transforms

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

UNIT IV:

Vector Differentiation and Line Integration

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

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

UNIT V:

Surface Integration And Vector Integral Theorems

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

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

Text Books:

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

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, 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

L/T/P/C: 3/0/0/3

I Year II Semester

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. Outline quantum computing concepts and use of quantum gates.

UNIT - I: Quantum Mechanics

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

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

UNIT - II: Semiconductors & Nanomaterials

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

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

UNIT - III: Magnetic and Dielectric Materials

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

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

UNIT - IV: Laser and Fibre Optics

Lasers: Introduction to laser, Radiative transition: Absorption, Spontaneous and Stimulated emissions, characteristics of laser, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, semiconductor diode laser, applications: Bar code scanner, LIDAR for autonomous vehicle.

Fiber Optics: Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres, losses in optical fibre, applications: optical fibre for communication system, sensor for structural health monitoring.

UNIT - V: Quantum Computing

Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits, multiple Qubit system,

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

Text Books:

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

Reference Books:

1. Jozef Gruska, Quantum Computing, McGraw Hill
2. Michael A. Nielsen & Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press.
3. John M. Senior, Optical Fiber Communications Principles and Practice, Pearson Education Limited.
4. Fundamentals of Semiconductor Devices, Second Edition, Anderson and Anderson, McGraw Hill.

Useful Links

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGLISH FOR SKILL ENHANCEMENT

Course Code: GR25A1005

L/T/P/C: 3/0/0/3

I Year II Semester

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

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

UNIT I

Theme: Perspectives

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

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

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

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

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

UNIT II

Theme: Digital Transformation

Lesson on ‘Emerging Technologies’ from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Homophones, Homonyms and Homographs

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

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

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

UNIT III

Theme: Attitude and Gratitude

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

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Identifying Topic Sentence and Providing Supporting Ideas - Exercises for Practice.

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

UNIT IV

Theme: Entrepreneurship

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

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

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

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

Writing: Writing Practices- Note Making-Précis Writing.

UNIT V

Theme: Integrity and Professionalism

Lesson on ‘Professional Ethics’ from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

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

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

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

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

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

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

of the students in their respective colleges for effective teaching/learning in the class.)

Text Books:

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

Reference Books:

1. Swan, Michael. (2016). *Practical English Usage*. Oxford University Press. New Edition.
2. Karal, Rajeevan. 2023. *English Grammar Just for You*. Oxford University Press. New 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 of queue operations using array, applications of queues, circular queues - representation and implementation.

UNIT II

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

UNIT III

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

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

UNIT IV

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

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

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

UNIT V

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

Hashing - Hashing and Collision: Introduction, Hash Tables, Hash Functions, Different Hash Functions: Division Method, Multiplication Method, Mid-square Method, Folding Method; collisions: Collision Resolution by Open Addressing, Collision Resolution by Chaining (no implementation).

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING MECHANICS

Course Code: GR25A1014

L/T/P/C: 3/1/0/4

I Year II Semester

Course Outcomes:

1. Determine resultant of forces acting on a body and analyse equilibrium of a body subjected to a system of forces.
2. Solve problem of bodies subjected to friction.
3. Find the location of centroid and calculate moment of inertia of a given section.
4. Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.
5. Solve problems using work energy equations for translation, fixed axis rotation and plane motion and solve problems of vibration.

UNIT - I: Introduction to Engineering Mechanics

Force Systems: Basic concepts, Rigid Body equilibrium, System of Forces, Parallelogram law, Coplanar Concurrent Forces, Components of forces in Space, Resultant, Moment of Forces and its Application. Couples and Resultant of Force System: Equilibrium of Force Systems, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT - II: Friction and Centre of Gravity

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction. Motion of Bodies, Wedge friction, Screw jack and Differential Screw jack.

Centroid and Centre of Gravity: Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections, Centre of Gravity and its implications, Theorem of Pappus.

UNIT - III: Moment of Inertia

Definition, Area Moment of Inertia, Moment of inertia of Plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections. Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem.

Mass Moment of Inertia: Moment of Inertia of Masses, Radius of Gyration, Transfer Formula for Mass Moments of Inertia, Mass moment of inertia of composite bodies.

UNIT - IV: Dynamics of a Particle

Rectilinear motion, Plane curvilinear motion: Rectangular and Polar coordinates. Relative and constrained motion, Newton's law of motion for a particle (rectangular, path, and polar coordinates). Work -kinetic energy, power, potential energy. Impulse and momentum: Linear, Angular, Elastic Impact (Direct and oblique).

UNIT - V: Kinetics of Rigid Bodies

Introduction, Types of motion, Instantaneous centre of rotation in plane motion and simple problems, D' Alembert's principle and its applications in plane motion and connected bodies. Work-Energy Method: Work-Energy principle and its application in plane motion of connected bodies or Systems, Work energy Applied to particle motion, Kinetics of rigid body rotation.

Text Books:

1. Singer's Engineering Mechanics – Statics and Dynamics, Reddy Vijay Kumar K. and J. Suresh Kumar. B.S Publications, 3rd Edition, Rpt. 2024.
2. Engineering Mechanics, Shames and Rao, Pearson Education, 1st Edition, 2005.

Reference Books:

1. Vector Mechanics for Engineers – Statics and Dynamics, Beer F.P and Johnston E.R Jr., Mc Graw Hill, 12th Edition, 2019.
2. Engineering Mechanics, Dumir P.C, Sengupta and Srinivas, Universities Press, 1st Edition, 2020.
3. Engineering Mechanics, Hibbeler R.C, Pearson, 14th Edition, 2017.
4. Engineering Mechanics, Arshad Noor, Zahid and Goel, Cambridge University Press, 1st Edition, 2018.
5. Engineering Mechanics, Basudeb Bhattacharyya, Oxford University Press, 2nd Edition, 2014.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PYTHON PROGRAMMING

Course Code: GR25A1026

L/T/P/C: 1/0/0/1

I Year II Semester

Course Outcomes:

1. Demonstrate the fundamental concepts and flow control in Python
2. Implement different sequence types and file handling operations.
3. Design python programs using functions and exception handling mechanisms.
4. Develop programs with object oriented programming features and modules.
5. Design GUI based applications using Tkinter.

UNIT I

Introduction: features of Python-Interactive execution, comments, types, variables, operators, expressions, Statements-assignment, input, print.

Control flow: if, if-else, if-elif-else Statements, Nested Decision Structures, Loops- while loop, for loop, Nested Loops, break, continue, pass statement.

UNIT II

Sequences: Strings, Lists and Tuples-basic operations and functions, iterating over sequences, Sets and Dictionaries- operations and functions, Python program examples.

Files-operations-opening, reading, writing, closing, file positions.

UNIT III

Exceptions: raising and handling exceptions, try/except statements, finally clause, standard exceptions, custom exceptions.

Functions: definition, call, scope and lifetime of variables, keyword arguments, default parameter values, variable length arguments, recursive functions, Lambda function.

UNIT IV

Modules: Modules, Standard Modules, Importing Modules, Namespaces and Packages.

Object Oriented Programming: Classes, constructors, objects, class variables, class methods, static methods, operator overloading. Inheritance-is-a relationship, composition, polymorphism, overriding, multiple inheritance, abstract classes, multithreaded programming, Python program examples.

UNIT V

GUI Programming: Introduction, Tkinter, Widgets (Buttons, Canvas, Frame, Label, Menu, Entry, Text, Scrollbar, Combobox, Listbox), event driven programming-events, callbacks, binding, layout management- geometry managers: pack and grid, creating GUI based applications in Python.

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

Text Books:

1. Exploring Python, Timothy A. Budd, McGraw Hill Publications.
2. Introduction to Programming using Python, Y.Daniel Liang, Pearson.
3. Python Programming, Sheetal Taneja and Naveen Kumar, Pearson.

Reference Books:

1. Introduction to Computer Science using Python, Charles Dierbach, Wiley India Edition.
2. Internet of Things - A hands on approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
3. Fundamentals of Python, K. A. Lambert, B.L. Juneja, Cengage Learning.
4. Think Python, how to think like a computer scientist, Allen B. Downey, SPD, O'Reilly.
5. Core Python Programming, Wesley J.Chun, second edition, pearson.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATA STRUCTURES LAB

Course Code: GR25A1023
I Year II Semester

L/T/P/C: 0/0/2/1

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 Tree using recursion.
- b. Design a C program for level order traversal of a Binary Search Tree.

TASK 7

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

TASK 8

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

TASK 9

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

TASK 10

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

TASK 11

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

TASK 12

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

Text Books:

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

Reference Books:

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

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

Course Code: GR25A1019

L/T/P/C: 0/0/2/1

I Year II Semester

Course Outcomes:

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).

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ADVANCED ENGINEERING PHYSICS LAB

Course Code: GR25A1017

L/T/P/C:0/0/2/1

I Year II Semester

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 concentration 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.

**II YEAR
I SEMSTER**

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BUILDING MATERIALS AND CONSTRUCTION PLANNING

Course Code: GR25A2009
II Year I Semester

L/T/P/C: 2/0/0/2

Course Outcomes:

1. Distinguish between various types of building stones, bricks and tiles and their structural requirements.
2. Recognize the need and process of manufacture of cement and lime.
3. Identify function of various materials like wood, glass, paints and building components.
4. Find the importance of masonry, finishing and form works.
5. Assess various building services and principles of building planning.

UNIT I

Building Stones, Bricks and Tiles

Stone- Ancient Building stones, classification of building stones, quarrying procedures, characteristics of good building stone, dressing, and tools for dressing of stones.

Bricks -Composition of brick earth, manufacturing of brick, characteristics of good brick, field and lab test.

Tiles - Types of tiles, manufacturing of tiles, structural requirements of tiles.

UNIT II

Cement, Lime, Admixtures

Ingredients of cement, manufacturing of cement.

Lime -Various ingredients of lime, constituents of limestone, classification of lime, manufacturing of lime.

Admixtures - physical admixtures, chemical admixtures.

UNIT III

Wood, Glass, Paints

Wood- structure, types of wood, properties of wood, seasoning, defects, alternative material for wood.

Glass-types of glasses, manufacturing of glass. Paints -Constituents of paints, types of paints.

Introduction to Building Components -Lintel, arches, staircase, floors, roofs, foundation, Doors, windows.

UNIT IV

Masonry and Finishing, Form Works

Brick Masonry- Types and bonds. Stone Masonry- Types.

Finishing- plastering, pointing, and cladding- Types of ACP (Aluminium composite panel).

Formworks - requirements, standards, Scaffolding, shoring, under pinning.

UNIT V

Building Services and Building Planning

Building Services- Water distribution, Sanitary lines and fittings, Plumbing services, ventilators, air conditioning. Characteristics- Absorption, fire safety, fire resistance materials.

Building Planning - Principles of building planning, classification of building and building by laws as per National Building code.

Text Books:

1. SK Duggal, Building Materials, New Age Publications 5th Edition, April, 2019.
2. B C Punmia, Ashok Kumar Jain and Arun Kumar Jain, Building Construction, Laxmi Publications (P) Ltd., New Delhi, 12th Edition, 2023.
3. P C Varghese, Building Construction, Prentice Hall of India Private Ltd., New Delhi, 2nd Edition, 2017.

Reference Books:

1. Rangwala, Building Construction, Charotar Publishing House Pvt. Ltd.; 34th Edition, 2022.
2. Roy Chudley “Construction Technology” Vol. – 1 & 2, 2nd Edition, Longman, UK, 2014.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SURVEYING AND GEOMATICS

Course Code: GR25A2017
II Year I Semester

L/T/P/C: 2/0/0/2

Course Outcomes:

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to Engineering and surveying activities.
2. Apply the knowledge of levelling, area, and volume calculations in construction industry.
3. Apply the knowledge on theodolite and traversing methods in surveying requirements.
4. Apply the tachymetry principles, curves, and knowledge of advanced instruments in surveying requirements
5. Implement the photogrammetry principles, methods and product generation strategies in both Analytical and digital Photogrammetry system

UNIT I

Surveying and Basic Concepts: Introduction - Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying.

Measurement of Distances and Directions

Linear distances- Approximate methods, Direct Methods-Chains- Tapes, ranging, Tape corrections.

Prismatic Compass - Bearings, included angles, Local Attraction, Magnetic Declination, and dip

UNIT II

Simple Levelling: Basic definitions; Types of levels and levelling staves – Temporary adjustments, methods of levelling- HI Method-Rise and Fall method Sources of errors in levelling - Curvature and Refraction – Contour: contour interval; Characteristics of contours; Methods of plotting of contours; Uses of contour maps (Surveyor of India toposheets).

Areas and Volumes: Introduction – Determination of areas by Trapezoidal rule, Simpsons rule, Coordinate system, MDM and DMD methods. Computation of volumes by trapezoidal and prismoidal rule - capacity of a reservoir.

UNIT - III

Theodolite Surveying: Types of Theodolites, Fundamental Lines, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations, and adjustments, Omitted measurements.

UNIT - IV

Curves: Types of curves and their necessity, elements of simple curve, setting out of simple Curves.

Tacheometric Surveying: Principles of Tacheometry, stadia, and tangential methods of Tacheometry.

Modern Surveying Methods: Principle and types of E.D.M. Instruments, Total station advantages and Applications. Field Procedure for total station survey, Errors in Total Station Survey, Global Positioning System- Principle and Applications.

UNIT - V

Photogrammetry Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping-mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes. Digital Photogrammetry – Introduction- List of softwares related to Digital photogrammetry

Text Books:

1. Surveying (Vol – 1, 2 & 3), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) ltd., New Delhi 2016
2. Arora K R “Surveying Vol 1, 2 & 3), Standard Book House, Delhi, 2004.
3. Duggal S K, “Surveying (Vol – 1 & 2), Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2004.

Reference Books:

1. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi.2012
2. Chandra A M, “Plane Surveying”, New Age International Pvt. Ltd., New Delhi, 2002.
3. Chandra A M, “Higher Surveying”, New age International Pvt. Ltd., Publishers, New Delhi, 2002.
4. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill – 2000.
5. Surveying and leveling by R. Agor Khanna Publishers 2015.
6. Hoffman. B, H. Lichtenegga and J. Collins, Global Positioning System - Theory and Practice, Springer -Verlag Publishers, 2001

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SOLID MECHANICS – I

Course Code: GR25A2011

L/T/P/C: 2/1/0/3

II Year I Semester

Prerequisite: Mathematics, Engineering Mechanics.

Course Outcomes:

1. Summarize the stresses, strains, elastic constants and also to determine the strain energy for various types of loading.
2. Analyze the shear force, bending moment diagrams and identify the point of contraflexure for different types of beams such as cantilever, simple supports under different loading conditions.
3. Examine the bending equation and shear equation to calculate the bending stresses and shear stresses for different sections of the structural members.
4. Solve the principal stresses and strains in different planes by using analytical and graphical methods
5. Analyze the slope and deflection of different beams for different end conditions and loads by using double integration, Macaulay's and Moment area methods.

UNIT I

Simple Stresses and Strains: Concept of stress and strain, St.Venant's principle, elasticity and plasticity - types of stresses and strains, Hooke's law - stress - strain diagram for mild steel - Working stress - Factor of safety- Elastic constants (E , K , G , μ) and the relationship between them - Bars of varying section - composite bars - Temperature stresses. Strain Energy - Resilience- gradual, sudden, impact and shock loadings - simple applications.

UNIT II

Shear Force and Bending Moment Diagrams: Shear force and Bending moment diagrams for cantilevers, simply supported and overhanging beams. Calculation of maximum SF, BM and the point of contra flexure under point loads, uniformly distributed load, uniformly varying load, moment couple and combination of these loads. Relationship between SF, BM and rate of loading at a section of beam.

UNIT III

Flexural Stresses: Theory of simple bending - assumptions - derivation of bending equation: $M/I = f/y = E/R$ – neutral axis - determination of bending stresses -section modulus of rectangular and circular sections (Solid and Hollow), I, T, angle and channel sections - design of simple beam sections.
Shear Stresses - Derivation of formula - Shear stress distribution across various beam sections like rectangular, circular, triangular and angle sections.

UNIT IV

Compound Stresses and Strains: Two- dimensional system, stress at a point on an inclined plane under axial loading-Normal and Tangential stresses on an inclined plane for biaxial stresses-two perpendicular normal stresses accompanied by a state of simple shear.

Principal Stresses and Strains

Analytical and graphical solutions- Mohr's circle of stresses - various theories of failures- maximum principal stress theory-maximum shear stress theory- maximum strain energy theory- maximum shear strain energy theory.

UNIT V

Slope and Deflection: Relationship between moment, slope and deflection, Double integration method, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for static determinate beams- Cantilever and simply supported beams.

Text Books:

1. Dr. R.K. Bansal, Strength of material, Laxmi Publications, New Delhi, 6th edition, 2018.
2. S. Ramamrutham, Strength of material- Dhanpat Rai Publishing Company, New Delhi, 20th edition, 2020.
3. R K Rajput, Strength of materials, S Chand Publications, 6th edition, 2015.

Reference Books:

1. Dr. B.C. Punmia, Mechanics of Materials, Laxmi publications, 11th edition, 2017.
2. B. S. Basavarajaiah, Strength of Materials, University Press, Hyderabad, 3rd Edition, 2010.
3. Ferdinand Beer and others, Mechanics of Solid, Tata Mc. Graw Hill publications, 7th Edition, 2014.
4. A.R.Basu, Strength of materials, Dhanpat Rai & Co, Nai Sarah, New Delhi, 2nd edition, 2012.
5. S S Bhavikatti, Strength of materials, New Age Publications, 4th edition, 2021.
6. R. Subramanian, Strength of materials, Oxford University Press, New Delhi, 3rd edition, 2016.
7. R.S. Khurmi, Strength of material-S. Chand & Company Ltd., New Delhi, 2010 Re-print.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROBABILITY AND STATISTICS

Course Code: GR25A2005
II Year I Semester

L/T/P/C: 3/0/0/3

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

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

1. Understand the concepts of random variable and its probability distributions.
2. Apply the theory of continuous distribution and sampling distribution in some case studies.
3. Understand sampling theory to estimate population parameters.
4. Apply hypothesis testing in real-world problems .
5. Analyze univariate and bivariate data using correlation, regression and curve fitting .

UNIT-I : Random Variables and Probability Distributions

Concept of a Random Variable – Discrete Probability Distributions – Continuous Probability Distributions – Mean, Variance and Moments about mean of a Random Variable

Discrete Probability Distributions: Binomial Distribution – Poisson distribution

UNIT-II : Continuous Distributions and Sampling

Normal Distribution – Areas under the Normal Curve – Applications of the Normal Distribution – Normal Approximation to the Binomial Distributions. **Fundamental Sampling Distributions :** Random Sampling – Some Important Statistics (Sample mean and Proportion) – Sampling Distributions – Sampling Distribution of Means – Central Limit Theorem.

UNIT-III : Estimation

Introduction – Statistical Inference – Classical Methods of Estimation – Single Sample : Estimating the mean – Standard error of a point Estimate and Interval Estimate . Two samples : Estimating the difference between two means– Single sample : Estimating a proportion – Two samples : Estimating the difference between two proportions– Two samples : Estimating the ratio of two variances.

UNIT-IV : Tests of Hypotheses (Large and Small Samples)

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

UNIT-V: Applied Statistics

Curve fitting by the method of least squares – Fitting of straight lines – Second degree parabolas , exponential and power curves. – Correlation (Karl Pearson and Spearman) and Regression of two variables

Text Books:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
2. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.

Reference Books

1. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons, Ltd, 2004.
2. Sheldon M Ross, Probability and Statistics for Engineers and Scientists, academic press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FLUID MECHANICS

Course Code: GR25A2012

L/T/P/C: 3/0/0/3

II Year I Semester

Prerequisite: Mathematics, Physics.

Course Outcomes:

1. Evaluate the various fluid properties and fluid statics in engineering problems.
2. Comprehend the broad principles of hydrostatic forces on submerged planes.
3. Analyzing fluid dynamics and kinematics.
4. Classify concept of boundary layer and predict the laminar and turbulent flows.
5. Predict the losses in pipes flows and able to calculate discharge measurement.

UNIT I

Basic Concepts and Definitions Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapor pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility. Fluid Statics - Fluid Pressure: Pressure at a point, Pascal law, pressure variation with temperature, density, and altitude. Piezometer, U- Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro manometers. pressure gauges

UNIT II

Hydrostatic Law, Hydrostatic pressure, and force: horizontal, vertical, and inclined curved surfaces. Introduction and explanatory to Buoyancy, Metacenter.

Fluid Kinematics- Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one-, two- and three-dimensional flows, Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three - Dimensional continuity equations in 3D-Cartesian coordinates

UNIT III

Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturimeter, Momentum principle; Forces exerted by fluid flow on pipe bend;

Measurement of Discharge and Velocity: Flow over rectangular, triangular and trapezoidal and Stepped notches. Venturimeter, orifice meter and pitot tube.

UNIT IV

Flow through Pipes: Reynolds experiment- laminar, Transition and Turbulent flows, Loss of head through pipes, Darcy-Wiesbatch equation, minor losses (explanatory), total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel. Laminar flow through

straight circular pipes- Haagen- Poissuelle equation derivation.

UNIT V

Boundary Layer Analysis – Assumption and concept of boundary layer theory. Boundary- layer thickness, displacement, momentum & energy thickness, laminar and turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and control of boundary layer. Navier- Stokes equation explanatory.

Text Books

1. Modi and Seth, Fluid Mechanics, Standard book house, 22nd Edition 2019
2. Dr. R.K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications (P) ltd., New Delhi, 10th Edition, 2022.
3. S.K.Som & G.Biswas, Introduction to Fluid Machines, Tata Mc.Graw Hill publishers, Pvt. Ltd.,3rd Edition, 2017.

References Books

1. J.F.Douglas, J.M. Gaserek and J.A.Swaffirld, Fluid Mechanics, 5th Edition,2005.
2. Frank.M. White, Fluid Mechanics, Tata Mc. Graw Hill Pvt. Ltd, 8th Edition, 2016.
3. A.K. Mohanty, Fluid Mehanics, Prentice Hall of India Pvt. Ltd., New Delhi, 2nd Edition,1994.
4. Edward J. Shaughnessy, M. Katz and James P. Schaffer, Introduction to Fluid Machines, Oxford University Press, New Delhi, 1st Edition, 2005

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code: GR25A2013

L/T/P/C: 3/0/0/3

II Year I Semester

Course Outcomes

1. Analyze and solve DC and AC Circuits.
2. Choose appropriate LT switchgear used for electrical installations.
3. Summarize the working principles of Electrical Machines and Transformers.
4. Categorize various types of diodes.
5. Interpret the different modes of Operations of a transistor.

UNIT I

D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation.

A.C. Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits, Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT II

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

UNIT III

Electrical Machines: Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency, Three-phase transformer connections. Construction and working principle of DC generators, EMF equation, working principle of DC motors, Torque equations and Speed control of DC motors, Construction and working principle of Three-phase Induction motor, Torques equations and Speed control of Three-phase induction motor. Construction and working principle of synchronous generators.

UNIT IV

P-N Junction and Zener Diode: Principle of Operation Diode equation, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Zener diode characteristics and applications.

Rectifiers and Filters: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, π - section Filters.

UNIT V

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations.

Field Effect Transistor (FET): Construction, Principle of Operation, Comparison of BJT and FET, Biasing FET.

Text Books

1. “Basic Electrical and electronics Engineering”, –M S Sukija TK Nagasarkar Oxford University
2. “Basic Electrical and electronics Engineering”, -D P Kothari. I J Nagarath, McGraw Hill Education

Reference Books

1. “Electronic Devices and Circuits”, – R. L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. “Electronic Devices and Circuits”, – J. Millman and C. C. Halkias, Satyabrata Jit, TMH, 2/e, 1998.
3. “Network Theory”, by Sudhakar, Shyam Mohan Palli, TMH.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

VALUE ETHICS AND GENDER CULTURE

Code: GR25A2002
II Year I Semester

L/T/P/C: 1/0/0/1

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

Text Books:

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SURVEYING LAB

Course Code: GR25A2020
II Year I Semester

L/T/P/C:0/0/4/2

Prerequisite: Surveying

Course Outcomes:

1. Demonstrate chain and compass surveying methods and calculate areas of traverses.
2. Perform levelling (simple, fly, differential) and generate longitudinal and cross-sectional profiles.
3. Operate theodolite and measure horizontal/vertical angles, heights, and distances.
4. Determine tacheometric constants, reduced levels, and distances using tacheometry.
5. Set out curves using standard methods and assess the accuracy of fieldwork.

List of Experiments

Task-1: Measurement of an area by Chain Survey (Open and Closed Traverse).

Task-2: Chaining across obstacles (Three Exercises).

Task-3: Measurement of an area by compass survey.

Task-4: Simple, fly, Differential Levelling.

Task-5: Exercise of L.S and C.S and plotting.

Task-6: Study of Theodolite- Measurement of horizontal and vertical angles (Repetition and Reiteration method).

Task-7: Trigonometric Levelling- Heights and distances problems.

Task-8: Calculation of Tacheometric constants by using tachometric surveying.

Task-9: Calculation of R.L and distance using tachometric survey.

Task-10: Curve setting by any two methods.

Reference Books:

1. B C Punmia, Surveying, Vol- III, Higher surveying, Laxmi Publications,2016.
2. S K Duggal- Vol- I & II, McGraw-Hill publications, 5th edition, 2019.
3. T P Kanetkar and S V Kulkarni, Surveying and Levelling, PVGP publications,2006.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SOLID MECHANICS LAB**

Course Code: GR25A2015
II Year I Semester

L/T/P/C:0/0/4/2

Prerequisites: Engineering Mechanics, Mathematics and Physics.

Course Outcomes:

1. Determine the important mechanical properties of materials.
2. Identify the stiffness of an elastic isotropic material.
3. Evaluate the Reciprocal theorem.
4. Measure any substance's resistance to uniform compression.
5. Resistance of various materials against abrasion and impact.

TASK- 1: Tension test on metals

TASK- 2: Torsion test on metals

TASK- 3: Hardness test on metals

TASK- 4: Spring test on metals

TASK-5: Compression test on wood or concrete or brick or block.

TASK-6: Impact test on metals.

TASK-7: Deflection test on cantilever beam.

TASK-8: Deflection test on simply supported beam.

TASK-9: Deflection test on continuous beam.

TASK-10: Verification of Maxwell's Reciprocal theorem

Reference Books:

1. Dr. R.K. Bansal, Strength of material, Laxmi Publications, New Delhi, 6th edition, 2018.
2. S. Ramamrutham, Strength of material- Dhanpat Rai Publishing Company, New Delhi, 18th Edition, 2014.
3. R K Rajput, Strength of materials, S Chand Publications, 6th edition, 2015.
4. Dr. B.C. Punmia, Mechanics of Materials, Laxmi publications, 11th edition, 2017.

II YEAR

II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SOLID MECHANICS- II

Course Code: GR25A2016

L/T/P/C: 2/0/0/2

II Year II Semester

Prerequisites: Mathematics, Physics, Engineering Mechanics and Solid Mechanics I

Course Outcomes:

1. Compute various stresses in thin and thick cylinders under fluid pressure.
2. Calculate the torsional strength of structural members and differentiate between closed and open coiled helical springs.
3. Determine the buckling failure load for axially loaded and eccentrically loaded columns.
4. Evaluate stresses in columns, dams, retaining walls and chimneys and also check the stability of dams.
5. Evaluate the behaviour of members under unsymmetrical bending and find the stresses in circular and semi-circular beams.

UNIT I

Thin Cylinders

Derivation of formula for longitudinal and hoop stress, calculation of longitudinal stress and hoop stress, longitudinal and volumetric strains, changes in diameter and volume of thin cylinders and sphere subjected to internal pressures.

Thick Cylinders

Introduction -Lame's theory for thick cylinders- derivation of Lame's formulae, distribution of hoop, radial stresses across thickness due to internal pressure, design of thick cylinders and thick spherical shells.

UNIT II

Torsion of Circular Shafts

Assumptions and derivation of torsion equation, Torsional moment of resistance, polar section modulus, power transmitted by shafts, torsional rigidity, combined bending, torsion and end thrust of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.

Springs

Introduction, types of spring, analysis of elliptical, closely and open coiled helical spring.

UNIT III

Columns and Struts

Introduction –Types of columns–Short, medium, and long columns. Axially loaded compression members, crushing load. Euler's theorem for long columns, assumptions, derivation of Euler's critical load formulae for various end conditions. Effective length of a column, slenderness ratio, Euler's critical stress, limitations of Euler's theory, Rankine's formula, Gordon formula, long columns subjected to eccentric loading, Secant formula, Empirical formulae, Johnsons straight line and parabolic formula.

Beam Columns:

Laterally loaded struts subjected to uniformly distributed and concentrated loads, Maximum B.M and stress due to transverse and lateral loading.

UNIT IV

Direct and Bending Stresses of Dams, Retaining walls and Chimneys

Stresses under the action of direct loading and bending moment, core of a section. Determination of stresses in the case of chimneys, retaining walls and dams. Conditions for stability of dams. Stresses due to direct loading and bending moment about its axis.

UNIT V

Unsymmetrical Bending of Beams

Introduction–Centroid principal axes of section–Graphical Stresses in beams subjected to unsymmetrical bending. Principal axes- Resolution of bending moment into two rectangular axes through the centroid - Location of neutral axis. Deflection of beams under unsymmetrical bending.

Curved Beams: Introduction – circular beams loaded uniformly and supported on symmetrically placed columns and Semi-circular beams simply supported on three equally spaced supports.

Text Books:

1. R.K Bansal, A textbook of Strength of materials, Laxmi Publications(P)Ltd., New Delhi, 6th Edition,2018.
2. Mechanics of Materials by Dr. B. C Punmia, Dr. Ashok Kumar Jain and Dr. Arun Kumar Jain. Laxmi Publications (P) Limited, 2001.
3. S.S. Bhavikatti, Strength of materials, Vikas Publications, 4thEdition,2010.

Reference Books:

1. Strength of Materials by R.K Rajput, S. Chand & Company Ltd. 2018.
2. Ferdinand Beer and others, Mechanics of solid, Tata Mc. Graw Hill Publications, 6thEdition.
3. S.Rama Krishna and R.Narayan, Strength of materials, Dhanpat Rai Publications.
4. A.R.Basu, Strength of materials, Dhanpat Rai & Co, NaiSarah, NewDelhi,first revised on 2005, Re-print 2009.
5. L.S.Srinath, Strength of materials, Macmillian India Ltd.
6. B.S. Basavrajiah and P. Mahadevappa, Strength of materials, University Press, Hyderabad, 3rd Edition,2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING GEOLOGY

Course Code: GR25A2010
II Year II Semester

L/T/P/C: 2/0/0/2

Course Outcomes:

1. Identify the weathering effects and various deposits.
2. Recognize the minerals and its importance from civil engineering point of view.
3. Distinguish features of igneous, sedimentary, and metamorphic rocks.
4. Recognize various geological structures and the failures of dams, reservoirs, and tunnels due to geological reasons.
5. Relate water table and the failures of earthquake and landslides

UNIT I

Physical Geology: Branches of geology useful to civil engineering, Scope of geological studies in various Civil Engineering projects. Weathering, Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Development of river, River meandering, Alluvial cones and fans, Placer Deposits, Delta deposits and natural levees.

UNIT II

Mineralogy: Mineral, origin, and composition. Physical properties of minerals, Role of study of physical properties of following common rock forming minerals: Feldspar, Quartz, Flint, Jasper, Olivine, Augite, Hornblende, Muscovite, Biotite, Asbestos, Chlorite, Kyanite, Garnet, Talc, Calcite. Megascopic identification of common primary & secondary minerals.

UNIT III

Petrology: Rock forming processes. Igneous rocks - Various forms of rocks, Structures and Classification of Igneous rocks on the basis of Chemical composition. Texture and its types. Detailed study of Igneous rocks like Granite, Pegmatite, Dolerite and Basalt. Sedimentary rocks - mode of formation, Structures and Textures. Detailed study of Conglomerate, Sandstone, Shale and Limestone. Metamorphic rocks - structures and textures in metamorphic rocks. Detailed study of Gneiss, Schist, Slate.

UNIT IV

Structural Geology: Outcrop and width of outcrop. Fold - Types and nomenclature, classification and recognition of Faults. Types of joints & unconformities. Geological structures - required geological consideration for selecting dam, reservoir and tunnel site.

UNIT V

Earthquake and Landslides: Pervious & impervious rocks and ground water. Earthquake - Magnitude and intensity of earthquake. Seismic zone in India. Consequences of failure due to Land sliding and Earthquake.

Text Books:

1. N. Chennakesavulu, Text book of Engineering Geology, Trinity India Ltd., 3rd edition, 2018
2. K.V.G.K. Gokhale, Principles of Engineering Geology, B.S publications, kindle edition, 2019
3. P. C. Varghes, Engineering Geology for Civil Engineers, PHI learning, New Delhi, 2012

Reference Books:

1. F.G. Bell, Fundamental of Engineering Geology, Butter worth Heinemann Publications London, New Delhi, 2016.
2. Krynine & Judd, Principles of Engineering Geology & Geotechnics, McGraw Hill New York, CBS publications, 2005

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
STRUCTURAL ANALYSIS - I

Course Code: GR25A2018
II Year II Semester

L/T/P/C: 3/0/0/3

Prerequisites: Engineering Mechanics, Solid mechanics.

Course Outcomes:

1. Solve the deflections of beams and trusses using energy methods.
2. Analyze three and two hinged circular and parabolic arches.
3. Analyze indeterminate beams using force method for propped cantilever and Fixed beams.
4. Apply Clapeyron's three moment theorem and Slope deflection methods to analyze statically indeterminate structures.
5. Analyze statically determinate structures using rolling load and influence line methods.

UNIT I

Energy Theorems: Introduction – strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces – Castiglione's first theorem – Deflections of simple beams and pin jointed trusses (Use Unit load method)

UNIT II

Arches: Classification of arches, advantage of arch, three and two hinged arches – Circular and parabolic arches yielding of supports, Effect of rib shortening, Effect of temperature changes, Tied and linear arch, Eddy's theorem.

UNIT III

Propped Cantilever and Fixed Beams: Determination of static and kinematic indeterminacies for beams- Analysis of Propped cantilever and fixed beams, including the beams with different moments of inertia - subjected to uniformly distributed load - point loads
- uniformly varying load, couple and combination of loads - Shear force, bending moment diagrams and elastic curve for Propped Cantilever and Fixed Beams-Deflection of Propped cantilever and fixed beams - effect of sinking of support, effect of rotation of a support.

UNIT IV

Continuous Beams: Introduction-Continuous beams - Clapeyron's theorem of three moments- Analysis of continuous beams with constant and variable moments of inertia with one or both ends fixed-continuous beams with overhang - effect of sinking of supports.

Slope Deflection Method: Derivation of slope-deflection equation, application to continuous beams with and without sinking of supports -Determination of static and kinematic indeterminacies for frames- Analysis of Single Bay, Single storey Portal Frames by Slope Deflection Method including Side Sway- Shear force and bending moment diagrams and Elastic curve.

UNIT V

Moving Loads and Influence Line Diagrams: Introduction, maximum SF and BM at a given section and absolute maximum SF and BM due to single concentrated load, UDL shorter than the span and longer than the span, two-point loads with fixed distance between them and several point loads – Equivalent uniformly distributed load – focal length.

Definition of influence line for SF, Influence line for BM- load position for maximum SF at a section – Load positions for maximum BM at a section – Point loads, UDL shorter than the span and longer than the span - Influence lines for forces in members of Pratt and Warren trusses.

Text Books:

1. K U Muthu, Azmi Ibrahim, M Vijayanand, Maganti Janardhana, Basic Structural analysis, I K International Publishing House Pvt.Ltd,2017.
2. S Ramamrutham, Theory of structures, Dhanpat Rai publications,9th edition 2014.
3. V. N. Vazirani & M. M. Ratwani, Analysis of structures –Vol. & Vol. II, Khanna Publications, New Delhi,1994.

Reference Books:

1. T.S. Thandavamoorthy, Analysis of structures, Oxford University Press, New Delhi,2005.
2. S.S Bhavikatti, Structural Analysis I, Vikas Publishing House, 4th edition,2010.
3. S.B. Junnakar, Mechanics of structures Vol II, Charotar Publishing House, Anand, Gujarat, 24th edition 2017.
4. Pandit& Gupta, Theory of structures, Vol I, Tata Mc. Graw Hill Publishing Co. Ltd., New Delhi,1st edition, 2017.
5. R. S. Khurmi, Theory of structures, S. Chand Publishers, 12th edition, 2020.
6. Dr. B.C. Punmia, Mechanics of Materials, Laxmi publications, 11th edition, 2017.
7. B.D. Nautical, Introduction to structural analysis, new age international publishers, New Delhi,2001.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ECONOMICS AND ACCOUNTING FOR ENGINEERS

Code: GR25A2004
II Year II Semester

L/T/P/C: 3/0/0/3

Course Outcomes:

1. The students will be able to understand the managerial economics, analyse demand behaviour and interpret the concepts of national income indicators.
2. The student will be able to plan the production levels in tune with maximum utilization of organizational resources to determine optimal input combinations for production processes.
3. To recognize the type of markets based on competition levels, the characteristics and determine pricing strategies for products and services.
4. Understand the importance of capital budgeting in the context of strategic financial management and identify, evaluate investment opportunities using appropriate capital budgeting techniques.
5. Learners understand the fundamental principles, concepts & conventions of accounting, including the recording of business transactions using journals, ledgers, preparation of trail balance and more emphasis on preparation of final accounts.

UNIT I: Introduction & Demand Analysis: *Definition and Scope:* Introduction to micro, macroeconomics, Nature, and Scope of Managerial Economics. National Income and its Components - GNP, NNP, GDP, NDP, ***Introduction to demand:*** Demand Determinants, Law of Demand, and its exceptions. ***Elasticity of Demand:*** Definition, Types, Measurement and Significance of Elasticity of Demand. ***Demand Forecasting,*** Factors governing demand forecasting, methods of demand forecasting, Law of supply.

UNIT II: Production & Cost Analysis: *Production Function* – Law of variable proportions, Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Laws of Returns, Internal and External Economies of Scale. ***Cost Analysis:*** Cost concepts. Break-even Analysis (BEA)- Determination of Break-Even Point (simple problems) - Managerial Significance.

Unit III: Markets and Forms of Business organizations: *Types of competition and Markets,* Features of Perfect competition, Monopoly and Monopolistic Competition. ***Pricing:*** Objectives of Pricing, Methods of Pricing. ***Business:*** Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises.

UNIT IV: Introduction to Financial Accounting: *Accounting Concepts and Conventions* - Double-Entry Bookkeeping. ***Accounting Cycle:*** Journal, Ledger, Trial Balance, Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

UNIT V: Capital Budgeting: Capital and its significance, Types of Capital, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value (NPV) Method and Internal Rate of Return (IRR) (simple problems) and Profitability Index (PI)

Textbooks:

1. Managerial Economics – International Edition, 2019, by Christopher Thomas (Author), S. Charles Maurice (Author), McGraw-Hill Education
2. Managerial Economics & Business Strategy, Michael R. Baye, Jeffrey T. Princ, McGraw-Hill Education, 2021 (10th Edition)
3. Managerial Economics, Mark Hirschey, Cengage Learning, 2016 (13th Edition)
4. Managerial Economics: Analysis, Problems and Cases - P. L. Mehta, Edition, 13. Publisher, Sultan Chand, 2016.
5. Managerial Accounting, Carl S. Warren, James M. Reeve, Jonathan Ducha, Cengage Learning, 2021
6. Managerial Accounting: Tools for Business Decision Making (9th Edition), Jerry J. Weygandt, Paul D. Kimmel, Donald E. Kieso, Wiley, 2021
7. Managerial Economics Aryasri: Managerial Economics and Financial Analysis, TMH, 2009.

Reference Books:

1. Managerial Economics 4th Edition, W. Cris Lewis, Sudhir K. Jain, H. Craig Petersen, Pearson, 2009
 2. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.2009
- Financial Accounting, 6/e, Dr S N Maheshwari, CA Sharad K Maheshwari & Dr Suneel K Maheshwari, Vikas Publishing, 2018

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
HYDRAULIC ENGINEERING

Course Code: GR25A2019
II Year II Semester

L/T/P/C: 2/0/0/2

Prerequisite: Introduction to Fluid Mechanics

Course Outcomes:

1. Analyse the most economical Rectangular, Trapezoidal and Circular channel sections and Critical flow in rectangular channels.
2. Apply dynamic equation in steady and nonuniform gradually varied and visualize surface profiles of channel flow & analyse hydraulic jump of rapidly varied flow.
3. Apply dimensional analysis and analyse the model and prototype simulation for practical problems & evaluate the hydrodynamic force of jets on vanes and flat plates
4. Evaluate the work done and efficiency of Pelton turbine, Francis turbine and Kaplan turbine & Performance Characteristic Curves
5. Evaluate the work done and efficiency of centrifugal pumps & evaluate the load factor, utilization factor, capacity factor and hydropower potential of Hydropower plants.

UNIT I

Open Channel Flow – I (Uniform Flow): Flow Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Characteristics of uniform flow, Computation of Uniform flow, Chezy's formula, Manning's and Bazin's formula. Factors affecting Manning's Roughness Coefficient 'n'. Most economical Rectangular, Trapezoidal and Circular Channel sections. Computation of Uniform flow, Normal depth.

Critical Flow: Specific energy, Specific energy curve; Critical, Subcritical and Supercritical Flows; Critical flow in rectangular channel, Specific force curve.

UNIT II

Open Channel Flow -II (Gradually Varied and Rapidly Varied Flow): Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Parshall Flume, Measurement of Velocity- Current meter, Floats, Hot wire. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile, Computation of water surface profile, Direct Step method.

Rapidly Varied Flow: Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, jump types, applications of hydraulic jump. Energy dissipation and other uses, Positive and Negative Surges (Theory only).

UNIT III

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity, Rayleigh method, Buckingham's π Method. Application of dimensional analysis and model studies to fluid flow

problems, Dimensionless groups, Similitude-Three types of similarities: Geometric similarity, Kinematic similarity and Dynamic similarity – Force Ratios – Dimensionless Numbers – Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number – Model laws -Undistorted and Distorted models.

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip of the vane, Velocity triangles at inlet and outlet, expressions for work done and efficiency.

UNIT IV

Hydraulic Turbines-I: Layout of a typical Hydropower installation Heads and Efficiencies classification of turbines-Pelton wheel, Francis turbine, Kaplan turbine-working, working proportions, velocity diagram, work done and efficiency, hydraulic design, Draft Tube Theory – different types - functions and efficiency. Angular momentum principle, Applications to radial flow turbines.

Hydraulic Turbines - II: Governing of Turbines, Surge Tanks, Unit Speed, Unit Discharge, Unit Power, Specific Speed, Performance Characteristic Curves, Model testing of turbines, Cavitation and Selection of Turbines.

UNIT V

Centrifugal Pumps: Pump installation details-classification-work done- Manometric head minimum starting speed- Losses and efficiencies-specific speed- Multistage pumps-pumps in parallel- Performance of pumps- Performance characteristic curves- NPSH-Cavitations - Reciprocating pumps- Single Acting and Double Acting -Working- Discharge- Slip- Indicator Diagrams.

Hydropower Engineering: Classification of Hydropower plants Definition of terms Load factor, utilization factor, capacity factor, estimation of hydropower potential.

Text Books:

1. Fluid Mechanics and Hydraulic Machines, K. Subramanya, Tata McGraw Hill, 2nd edition, 2018.
2. K. Subramanya, Flow in Open Channel, Tata McGraw Hill, 5th edition, 2019
3. Modi & Seth, Hydraulics and Fluid Mechanics including Hydraulics Machines, Standard Book House, 22nd edition, 2018.

Reference Books:

1. Dr. R.K. Bansal, A text of Fluid mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi, 10th Edition, 2019.
2. J.F.Douglas, J.M.Gaserek and J.A.Swaffirld, FluidMechanics, Prentice Hall, 5th edition, 2005.
2. Frank.M. White, Fluid Mechanics, Tata Mc. Graw Hill Pvt. Ltd, 4th Edition, 2013.
3. A.K. Mohanty, Fluid Mehanics, Prentice Hall ofIndia Pvt. Ltd., New Delhi, 2nd edition,1994.
4. Open Channel Hydraulics, VenTe Chow, Tata McGraw Hill,2009.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENVIRONMENTAL SCIENCE

Course Code: GR25A2001
II Year II Semester

L/T/P/C: 1/0/0/1

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.

REFERENCE BOOKS:

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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING GEOLOGY LAB**

Course Code: GR25A2014
II Year II Semester

L/T/P/C: 0/0/4/2

Course Outcomes:

1. Identify various minerals and their properties.
2. Identify various rocks and their properties.
3. Recognize various rocks and minerals used in the industries.
4. Interpret various sections of geological maps showing structures like faults, folds and Unconformities etc.
5. Resolve simple structural Geology problems.

Exercises:

1. Study of physical properties and identification of minerals referred under theory.
2. Megascopic description and identification of rocks referred under theory.
3. Study of Geological map of India.
4. Interpretation and drawing of sections for geological maps showing tilted beds, folds, faults and unconformities
5. Simple Structural Geology problems.

Lab Examination Pattern:

1. Description and identification of six minerals.
2. Description and identification of six rocks (including Igneous, Sedimentary and Metamorphic Rocks).
3. Interpretation of a Geological map along with a geological section.
4. Simple strike and Dip problems.

Reference Books:

1. N. Chennkesavulu, Mc-Millan, Text book of Engineering Geology, India Ltd., 2nd edition, 2013.
2. P. C. Varghes, Engineering Geology for Civil Engineers, PHI learning, New Delhi, 2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMPUTER AIDED DESIGN LAB

Course Code: GR25A2021
II Year II Semester

L/T/P/C:0/0/4/2

Prerequisite: Engineering Graphics

Course Outcomes:

1. Comprehend the fundamentals of building drawings and understand CAD software for drafting.
2. Draw conventional symbols in constructions and brick bonds by CAD.
3. Draft the building components detailing and sectional view of doors, windows, and trusses.
4. Develop geometric plan, section and elevation for single and multi- storeyed buildings with suitable scale and dimensions.
5. Create drawings for developing the layout of electrical and plumbing connections in building.

LIST OF EXPERIMENTS

1. Basic principles of Vastu in building planning.
2. Planning Aspects of Building systems as per National Building Code (NBC).
3. Materials, Plumbing and Electrical Symbols used in Building Construction.
4. Bonds in brick masonry
5. Detailing of Building Components
 - a. Doors
 - b. Windows
 - c. Ventilator
 - d. Stairs
 - e. Lintel Cum Sunshade
6. Drawing of different industrial trusses.
7. Drawing Plan, Section and Elevation of Building.
 - a. Single room with R.C.C flat roof.
 - b. A Residential building with single bedroom.
 - c. R.C.C framed structure with R.C.C roof slab.
 - d. Library building with R.C.C flat roof.
 - e. Planning of fully tiled gabled house (Pitched Roof).
 - f. Workshop building with north light roof truss.
8. Drawing Plan, Section and Elevation of Multi-Storeyed Building
9. Development of working drawing of building –Electrical Layout.
10. Development of working drawing of building – Plumbing Layout.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FLUID MECHANICS AND HYDRAULIC MACHINERY LAB**

Course Code: GR25A2022

L/T/P/C:0/0/4/2

II Year II Semester

Prerequisite: Fluid Mechanics and Hydraulic Engineering

Course Outcomes:

1. Predict the discharge through venturi meter and orifice meter.
2. Estimate the coefficients of impact of jets.
3. Predict the velocity distribution in pipe flows.
4. Compute the major and minor losses in pipe flow.
5. Evaluate the efficiency of Hydraulic machines.

List of Experiments

1. Calibration of Venturi meter
2. Calibration of Orifice meter
3. Calibration of Rectangular notch
4. Calibration of Triangular Notch
5. Major losses in pipe flows
6. Minor losses in pipe (Hydraulic losses due to sudden enlargement of pipe)
7. Minor losses in pipe (Hydraulic losses due to sudden contraction of pipe)
8. Verification of Bernoulli's Theorem
9. Reynolds's experiment on Laminar Flow and Turbulent flow through pipes
10. Impacts of jets on vanes
11. Pelton wheel turbine
12. Multi stage centrifugal pump
13. Hydraulic Jump

Text Books

1. Modi & Seth, Hydraulic and Fluid mechanics, Standard Book House, 22nd edition, 2018.
2. S.K. Som & G. Biswas, Introduction to Fluid Machines, Tata Mc. Graw Hill publishers, Pvt. Ltd., 3rd Edition, 2017.
3. Edward J. Shaughnessy, M. Katz and James P. Schaffer, Introduction to Fluid Machines, Oxford University Press, New Delhi, 1st Edition, 2005.

Reference Books

1. Frank. M. White, Fluid Mechanics, Tata Mc. Graw Hill Pvt. Ltd, 4th Edition, 2013.
2. Dr. R.K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications (P) ltd., New Delhi, 10th Edition, 2019.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIGITAL SURVEYING LAB

Course Code: GR25A2094

L/T/P/C:0/0/2/1

II Year II Semester

Course Outcomes:

1. Demonstrate the working principles of GPS and Total Station for advanced surveying applications.
2. Perform distance, height, gradient, and area measurements using Total Station and handheld GPS.
3. Execute traversing, contouring, and stake-out surveys using Total Station and prepare corresponding maps.
4. Compute 2D/3D areas and volumes from Total Station data and evaluate their accuracy.
5. Set out simple circular curves using Total Station and assess their effectiveness in field applications.

List of Experiments:

Task-1: Study on various electronic surveying instruments

Task-2: Measurement of Area using handheld GPS

Task-3: Determination of remote height using total station.

Task-4: Distance, gradient, diff, height between two inaccessible points using total station

Task-5: Determination of 2D & 3D area using total station.

Task-6: Determination of Volumes using total station.

Task-7: Traversing using total station

Task-8: Contouring using total station.

Task-9: Stake out using total station.

Task-10: Setting Out of Simple Circular Curve

Tools to be used:

1. Total Station (Leica, Pentax)
2. GPS Devices (Handheld)

Reference Books:

1. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Surveying Vol. 1 & 2, 18th Edition, 2020, Laxmi Publications Pvt. Ltd., ISBN: 9789380856596.
2. Satheesh Gopi, Advanced Surveying: Total Station, GIS and Remote Sensing, 2nd Edition, 2017, Pearson Education India, ISBN: 9789332587697.
3. R. Subramanian, Surveying and Levelling, 2nd Edition, 2014, Oxford University Press, ISBN: 9780199456154.
4. N.N. Basak, Surveying and Levelling, 3rd Edition, 2017, McGraw Hill Education (India), ISBN:9789353161598.
5. Satheesh Gopi, GPS Surveying: Theory and Applications, 1st Edition, 2015, Pearson Education India, ISBN: 9789332541088.
6. Total Station and GPS Surveying – User Manuals, Manufacturer Guides (Leica Geosystems, Sokkia, Topcon).