# Academic Regulations

# Programme Structure

# and

# Detailed Syllabus

# Bachelor of Technology (B.Tech)

# in

# Mechanical Engineering

(Four Year Regular

Programme)

(Applicable for Batches admitted from 2025-26)

# GOKARAJU RANGARAJU

# INSTITUTE OF ENGINEERING AND TECHNOLOGY

***(Autonomous)***

**Bachupally, Kukatpally, Hyderabad- 500 090**

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**HYDERABAD**

# Academic Regulations for B.Tech (Regular) under GR25

**(Applicable for Batches Admitted from 2025-26)**

## Under Graduate Degree Programme in Engineering and Technology (UG)

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

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

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

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

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

3. **B.Tech Programme Structure**

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

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

### 3.2.1 Semester Scheme

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

### 3.2.2 Credit Courses

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

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

- One credit is allocated for three hours per week in a semester for Project/Mini-Project session.

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

### 3.2.3 Subject Course Classification

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

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

## 4. Mandatory Induction Programme

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

## 5. Course Registration

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

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

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

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

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

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

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

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

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

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

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

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

**5.8 Additional learning resources:**

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

## 6. Rules to offer Elective courses

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

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

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

## 7. Attendance requirements:

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

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

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

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

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

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

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

## 8. Criteria for Earning of Credits in a Course

**8.1** A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course, if the student secures not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing 'C' grade or above in that course.

**8.2** A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Field Based Research Project / Industry Oriented Mini Project / Internship, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he/she (i) does not submit a report on Field-Based Research Project/Industry Oriented Mini Project/ Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Field-Based Research Project / Industry Oriented Mini Project / Internship evaluations.

**8.3** A student eligible to appear in the semester-end examination for any course, is absent from it or failed (thereby failing to secure 'C' grade or above) may re-appear for that course in the supplementary examination as and when it is conducted. In such cases, internal marks assessed in continuous internal evaluation (CIE) earlier for that course will be carried over, and added to the marks obtained in the SEE supplementary/make-up examination. If the student secures sufficient marks for passing, 'C' grade or above shall be awarded as specified in clause 10.3.

## 9. Distribution of Marks and Evaluation

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

### 9.2 Continuous Internal Evaluation (CIE)

#### 9.2.1 Theory Courses:

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

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

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

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

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

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

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

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

#### 9.2.2 Graphics for Engineers Course:

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

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

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

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

### 9.4 Semester End Examination for theory courses

#### 9.4.1 Theory Courses:

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

- Part-A is compulsory, consists of ten short answer questions covering all units of syllabus; each question carries one marks.

- Part-B consists of five questions carrying 10 marks each. There shall be two questions asked in the question paper from each unit with either-or choice and the student should answer either of the two questions. The student shall answer one question from each of five units.

### 9.4.2 Graphics for Engineers Course:

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

### 9.4.3 Duration of SEE:

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

## 9.5 Continuous Internal Evaluation and Semester End Examination for Practical Courses

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

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

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

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

1. 10 marks for write-up
2. 15 for experiment/program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment/program in the same

laboratory course and

5. 10 marks for viva-voce on concerned laboratory course.

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

### 9.6 Field-based Research Project:

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

### 9.7 Internship/Industry Oriented Mini Project:

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

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

### 9.8UG Project Work:

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

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

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

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

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

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

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

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

### 9.9 Skill Development Courses:

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

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

### 9.10 Value-Added Courses:

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

## 10. Grading Procedure

**10.1** Absolute grading system is followed for awarding the grades to each course.

**10.2** Grades will be awarded to indicate the performance of students in each Theory,

Laboratory, Industry-Oriented Mini Project/ Internship/ Skill development course and Project Work. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in clause 8 above, a letter grade shall be given as explained in the following clause.

**10.3** To measure the performance of a student, a 10-point grading system is followed. The mapping between the percentage of marks secured and the corresponding letter grade is as follows:

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

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

**10.4 Computation of SGPA and CGPA:**

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

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

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

Where **Ci** is the number of credits of the **i**$^{\mathbf{th}}$ course and **Gi** is the grade point scored by the student in the **i**$^{\mathbf{th}}$ course and **n** is the number of courses registered in that semester.

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

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

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

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

## 11. Promotion Rules

| S.No. | Promotion | Conditions to be Fulfilled |
|---|---|---|
| 1 | First year first semester to first year second semester | Regular course of study of first year first semester and fulfilment of attendance requirement. |
| 2 | First year second semester to Second year first semester | (i) Regular course of study of first year second semester and fulfilment of attendance requirement<br>(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.<br>(ii) Must have secured at least **25%** of the total credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 5 | Third year first semester to Third year second semester | Regular course of study of third year first semester and fulfilment of attendance requirement. |
| 6 | Third year second semester to Fourth year first semester | Regular course of study of third year second semester and fulfilment of attendance requirement. |
| 7 | Fourth year first semester to Fourth year second semester | Regular course of study of fourth year first semester and fulfilment of attendance requirement. |

## 12. Re-admission after Detention

- A student detained due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of credits.
- A student detained due to shortage of attendance shall be admitted in the same semester in the successive academic years.
- When a student is readmitted in the following academic years, the academic regulations under which the student seeks re-admission shall only be applicable to

this student, not the academic regulations in which he got admitted in his/her first year of study.

## 13. Credit Exemption

A student (i) shall register for all courses covering 164 credits as specified and listed in the course structure and (ii) earn 160 or more credits to successfully complete the undergraduate programme.

- Best 160 credits shall be considered for CGPA computation. The student can avail exemption of courses totaling up to 4 credits other than Professional core courses, Laboratory Courses, Seminars, Project Work and Field Based Research Project / Industry Oriented Mini Project / Internship, for optional drop out from these 164 credits registered;

- The semester grade point average (SGPA) of each semester shall be mentioned at the bottom of the grade card, when all the subjects in that semester have been passed by the student.

- Credits earned by the student in either a Minor or Honors program cannot be counted towards the required 160 credits for the award of the B.Tech degree.

## 14. Award of Degree:

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

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

Equivalence of grade to marks

Marks % = (CGPA -0.5)*10

### 14.2 Grace Marks

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

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

## 15. Multiple Entry Multiple Exit Scheme (MEME)

### 15.1 Exit Option after Second Year:

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

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

### 15.2 Additional Requirements for Diploma Award

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

**Work-based Vocational Course:**

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

**Internship/Apprenticeship:**

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

### 15.3 Re-entry into the B.Tech Programme

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

- The student must surrender the awarded UG Diploma Certificate.
- Students who wish to rejoin in III Year must join the same B.Tech program and same college from which the student exited. Before rejoining, students should

check for continuation of the same branch at the college. If the specific branch is closed in that particular college, then student should consult the University for the possible alternative solutions.

- Re-registered students will be governed by the academic regulations in effect at the time of re-entry, regardless of the original regulations under which they were admitted.

- If a student opts to continue his/her studies without a gap after being awarded the diploma, they must register for the third-year courses before the commencement of classwork.

### 15.4 Break in Study and Maximum Duration

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

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

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

**16.1** Transitory regulations are applicable to the students detained due to shortage of attendance as well as detained due to the shortage of credits and seek permission to re-join the B.Tech programme, where GR25 regulations are in force.

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

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

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

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

**16.6** The GR25 Academic Regulations are applicable to a student from the year of re-admission. However, the student is required to complete the study of B.Tech degree within the stipulated period of eight academic years from the year of first admission.

## 17 Student Transfers

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

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

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

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

## 18 Honors and Minor Degree Programmes

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

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

**(Applicable for Batches Admitted from 2025-26)**

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

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

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

**c)** The student can avail exemption of courses totaling up to 3/4 credits other than Professional core courses, Laboratory Courses, Seminars, Project Work and Field Based Research Project/ Industry Oriented Mini Project / Internship, for optional drop out.

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

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

**2. Academic Requirements and Promotion Rules:**

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

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

| S. No | Promotion | Conditions to be fulfilled |
|---|---|---|
| 1 | Second year first semester to Second year second semester | Regular course of study of second year first semester and fulfilment of attendance requirement. |
| 2 | Second year second semester to Third year first semester | (i) Regular course of study of second year second semester and fulfilment of attendance requirement.<br>(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" |

# GOKARAJURANGARAJUINSTITUTE OF ENGINEERINGANDTECHNOLOGY

## (Autonomous)

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

## MECHANICAL ENGINEERING

## B. Tech (ME) – GR25 Course Structure

**I B. Tech I Semester**

| S. No | BOS | Group | Course Code | Course Name | Credits | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total |
| 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 | GR25A1014 | Engineering Mechanics | 3 | 1 | 0 | 4 |
| 5 | ME | ES | GR25A1015 | Graphics for Engineers | 1 | 0 | 4 | 3 |
| 6 | Chemistry | BS | GR25A1018 | Engineering Chemistry Lab | 0 | 0 | 2 | 1 |
| 7 | CSE | ES | GR25A1020 | Programming for Problem Solving Lab | 0 | 0 | 3 | 1.5 |
| 8 | ME | ES | GR25A1024 | Engineering Workshop | 1 | 0 | 3 | 2.5 |
| 9 | Mgmt | HS | GR25A1027 | Innovation and Design Thinking | 1 | 0 | 0 | 1 |
| | | **TOTAL** | | | **15** | **2** | **12** | **22** |

**I B. Tech II Semester**

| S.No | BOS | Group | Course Code | Course Name | Credits | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total |
| 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 | ME | ES | GR25A1012 | Thermodynamics | 3 | 0 | 0 | 3 |
| 4 | English | HS | GR25A1005 | English for Skill Enhancement | 3 | 0 | 0 | 3 |
| 5 | CSE | ES | GR25A1016 | Data Structures | 2 | 0 | 0 | 2 |
| 6 | CSE | ES | GR25A1026 | Python Programming | 1 | 0 | 0 | 1 |
| 7 | Physics | BS | GR25A1017 | Advanced Engineering Physics Lab | 0 | 0 | 2 | 1 |
| 8 | English | HS | GR25A1019 | English Language and CommunicationSkills Lab | 0 | 0 | 2 | 1 |
| 9 | CSE | ES | GR25A1023 | Data Structures Lab | 0 | 0 | 2 | 1 |
| | | **TOTAL** | | | **15** | **1** | **7** | **19** |

**II B.Tech I Semester**

| S.No | BOS | Group | Course Code | Course Name | Credits | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total |
| 1 | ME | PC | GR25A2039 | Kinematics of Machinery | 3 | 0 | 0 | 3 |
| 2 | ME | PC | GR25A2040 | Metallurgy and Material Science | 3 | 0 | 0 | 3 |
| 3 | ME | PC | GR25A2041 | Strength of Materials | 3 | 0 | 0 | 3 |
| 4 | EEE | PC | GR25A2013 | Basic Electrical and Electronics Engineering | 3 | 0 | 0 | 3 |
| 5 | ME | PC | GR25A2047 | Manufacturing Engineering | 3 | 0 | 0 | 3 |
| 6 | ME | PC | GR25A2043 | Metallurgy and Material Science Lab | 0 | 0 | 2 | 1 |
| 7 | ME | PC | GR25A2042 | Strength of Materials Lab | 0 | 0 | 2 | 1 |
| 8 | ME | PC | GR25A2049 | Manufacturing Engineering Lab | 0 | 0 | 2 | 1 |
| 9 | CSE(DS) | SD | GR25A2095 | Data Analytics with R Programming for Engineers Lab | 0 | 0 | 2 | 1 |
| 10 | Mgmt | VAC | GR25A2002 | Value Ethics and Gender Culture | 1 | 0 | 0 | 1 |
| **Total** | | | | | **20** | **0** | **6** | **20** |

**II B.Tech II Semester**

| S. No | BOS | Group | Course Code | Course Name | Credits | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total |
| 1 | ME | PC | GR25A2044 | Thermal Engineering | 3 | 0 | 0 | 3 |
| 2 | ME | PC | GR25A2045 | Fluid Mechanics and Fluid Machines | 3 | 0 | 0 | 3 |
| 3 | ME | PC | GR25A2046 | Dynamics of Machinery | 3 | 0 | 0 | 3 |
| 4 | Maths | BS | GR25A2101 | Probability, Statistics and complex variables | 3 | 0 | 0 | 3 |
| 5 | ME | PC | GR25A2051 | Manufacturing Technology and Metrology | 3 | 0 | 0 | 3 |
| 6 | ME | PC | GR25A2048 | Thermal Engineering Lab | 0 | 0 | 2 | 1 |
| 7 | ME | PC | GR25A2050 | Fluid Mechanics and Fluid Machines Lab | 0 | 0 | 2 | 1 |
| 8 | ME | PC | GR25A2052 | Manufacturing Technology and Metrology Lab | 0 | 0 | 2 | 1 |
| **9** | ME | SD | GR25A2096 | Part Modelling and Assembly Development (skills Development Course-3) | 0 | 0 | 2 | 1 |
| 10 | Chemistry | VAC | GR25A2001 | Environmental Science | 1 | 0 | 0 | 1 |
| **Total** | | | | | **15** | **0** | **8** | **20** |

## III B.Tech I Semester

| S.No. | BOS | Group | Course Code | Course Name | Credits | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total |
| 1 | ME | PC | | Basic Machine Design | 2 | 1 | 0 | 3 |
| 2 | Mgmt | HS | | Economics and Accounting for Engineers | 3 | 0 | 0 | 3 |
| 3 | ME | PC | | CAD/CAM | 2 | 0 | 0 | 2 |
| 4 | ME | PC | | Applied Thermodynamics | 3 | 0 | 0 | 3 |
| 5 | | PE-I | | Professional Elective-I | 3 | 0 | 0 | 3 |
| 6 | | OE-I | | Open Elective-I | 3 | 0 | 0 | 3 |
| 7 | ME | PC | | Computer Aided Modeling and Analysis Lab | 0 | 0 | 3 | 1 |
| 8 | ME | PC | | Internet of Things Lab | 0 | 0 | 3 | 1 |
| 9 | ME | PW | | Field Based Project | 0 | 0 | 4 | 2 |
| 10 | Mgmt | MC | | Indian Knowledge Systems | 1 | 0 | 0 | 1 |
| | | | | **Total** | **15** | **1** | **14** | **22** |

| PROFESSIONAL ELECTIVE – I | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | ME | PE | | Robotics |
| 2 | ME | PE | | Advanced Strength of Materials |
| 3 | ME | PE | | Mechanical Vibrations |
| 4 | ME | PE | | Industrial Internet of Things |

| OPEN ELECTIVE – I | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | ME | OE | | Industrial Automation and Control |

## III B.Tech II Semester

| S.No. | BOS | Group | Course Code | Course Name | Credits | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total |
| 1 | ME | PC | | Advanced Machine Design | 3 | 0 | 0 | 3 |
| 2 | ME | PC | | Heat Transfer | 3 | 0 | 0 | 3 |
| 3 | ME | PC | | Additive Manufacturing | 3 | 0 | 0 | 3 |
| 4 | | PE-II | | Professional Elective-II | 3 | 0 | 0 | 3 |
| 5 | | OE-II | | Open Elective-II | 3 | 0 | 0 | 3 |
| 6 | ME | PC | | Computer Aided Manufacturing | 0 | 0 | 2 | 1 |
| 7 | ME | PC | | Heat Transfer Lab | 0 | 0 | 2 | 1 |
| 9 | English | BS | | Effective Technical Communication | 2 | 0 | 0 | 1 |
| 10 | | | | Additive Manufacturing skill (Skill development Course-4) | 2 | 0 | 0 | 1 |
| | | | | **Total** | **18** | **1** | **6** | **19** |

| PROFESSIONAL ELECTIVE – II | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | ME | PE | | Mechanical Measurements |
| 2 | ME | PE | | Material Characterization and Testing |
| 3 | ME | PE | | Un-Convectional Machining Processes |
| 4 | ME | PE | | Intelligent Manufacturing Systems |

| OPEN ELECTIVE – II | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | ME | OE | | Composite Materials |

## IV B. Tech I Semester

| S.No. | BOS | Group | Course Code | Course Name | Credits | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total |
| 1 | ME | PC | | Finite Element Analysis | 2 | 1 | 0 | 3 |
| 2 | ME | PC | | Instrumentation and Control Systems | 3 | 0 | 0 | 3 |
| 3 | | PE-III | | Professional Elective-III | 3 | 0 | 0 | 3 |
| 4 | | PE-IV | | Professional Elective-IV | 3 | 0 | 0 | 3 |
| 5 | | OE-III | | Open Elective-III | 3 | 0 | 0 | 3 |
| 6 | ME | PC | | Instrumentation and Control Systems Lab | 0 | 0 | 2 | 1 |
| 7 | ME | PC | | CFD Lab | 0 | 0 | 2 | 1 |
| 8 | ME | PW | | Mini Project with Internship | 0 | 0 | 4 | 2 |
| | | | | **Total** | **15** | **0** | **8** | **19** |

| PROFESSIONAL ELECTIVE – III | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | ME | PE | | Renewable Energy Resources |
| 2 | ME | PE | | Turbomachinery |
| 3 | ME | PE | | Computational Fluid Dynamics |
| 4 | EEE | PE | | Electrical and Hybrid Vehicles |

| PROFESSIONAL ELECTIVE – IV | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | ME | PE | | Tribology |
| 2 | ME | PE | | Design for Manufacturing Assembly |
| 3 | ME | PE | | Soft Computing Techniques in Mechanical Engineering |
| 4 | ME | PE | | Artificial Intelligence in Mechanical Engineering |

| OPEN ELECTIVE – III | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | ME | OE | | Operations Research and Management |

## IV B.Tech II Semester

| S.No. | BOS | Group | Course Code | Course Name | Credits | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total |
| 1 | ME | PC | | Financial Management and Accounting | 3 | 0 | 0 | 3 |
| 3 | | PE-V | | Professional Elective-V | 3 | 0 | 0 | 3 |
| 4 | | PE-VI | | Professional Elective-VI | 3 | 0 | 0 | 3 |
| 5 | ME | PW | | Project Work | 0 | 0 | 42 | 14 |
| | | | | **Total** | **11** | **0** | **12** | **23** |

| PROFESSIONAL ELECTIVE – V | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | ME | PE | | Refrigeration and Air Conditioning |
| 2 | ME | PE | | Power Plant Engineering |
| 3 | ME | PE | | Automobile Engineering |
| 4 | ME | PE | | Energy Conservation and Management |

| PROFESSIONAL ELECTIVE – VI | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | ME | PE | | Production Planning and Control |
| 2 | ME | PE | | Mechatronics |
| 3 | ME | PE | | Microprocessors Applications in Manufacturing |
| 4 | ME | PE | | Micro and Nano Manufacturing |

## PROFESSIONAL ELECTIVES – 3 THREADS

| THREAD 1:DESIGN | THREAD 2: THERMAL | THREAD3: MANUFACTURING |
|---|---|---|
| Robotics | Refrigeration and Air-Conditioning | Mechanical Measurements |
| Advanced Strength of Materials | Power Plant Engineering | Material Characterization and Testing |
| Mechanical Vibrations | Automobile Engineering | Un-Conventional Machining Processes |
| Industrial Internet of Things | Energy Conservation and Management | Intelligent Manufacturing Systems |
| Tribology | Renewable Energy Resources | Production Planning and Control |
| Design for Manufacturing Assembly | Turbomachinery | Mechatronics |
| Soft Computing Techniques in Mechanical Engineering | Computational Fluid Dynamics | Microprocessors Applications in Manufacturing |
| Artificial Intelligence in Mechanical Engineering | Electrical and Hybrid Vehicles | Micro and Nano Manufacturing |

**OPEN ELECTIVES FOR GR25 REGULATIONS**

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

# 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. Discovery the Eigen values and Eigen vectors, Reduce the quadratic form to canonical form using orthogonal transformations.
3. Identify the geometrical interpretation of mean value theorems and discovery points in an interval that satisfy the mean value theorem for a given function.
4. Estimate the extreme values of functions of two variables with/ without constraints.
5. Evaluate the multiple integrals and apply the concept to find areas, volumes.

**UNIT I**

**Matrices**

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

**UNIT II**

**Eigen values and Eigen vectors**

Eigen values – Eigen vectors and their properties – Diagonalization of a matrix – Orthogonal diagonalization of a symmetric matrix- Definiteness of a symmetric matrix

Quadratic forms and Nature of the Quadratic Forms – Reduction of Quadratic form to canonical form by Orthogonal Transformation.

**UNIT III**

**Single Variable Calculus**

Mean value theorems: Rolle's theorem – Lagrange's Mean value theorem with their Geometrical Interpretation and applications – Cauchy's Mean value Theorem – Taylor's Series (All the theorems without proof). Approximation off a function by Taylor's series

**UNIT IV**

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

Curve Tracing: Curve tracing in cartesian coordinates

**UNIT V**

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

**Text Books:**


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


**Reference Books:**


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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**ENGINEERING CHEMISTRY**

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

**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- Dulongs formula - Numerical problems. Fossil fuels: Classification, Petroleum - Refining of Crude oil, Cracking - Types of cracking - Moving bed catalytic cracking. LPG and CNG composition and uses. Synthetic Fuels: Fischer Tropschs Process, Introduction and applications of Hythane and Green Hydrogen.

**UNIT IV**

**Polymers: [8]**

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

**UNIT V**

**Engineering Materials: [8]**

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

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

**Text Books:**

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

**Reference Books:**

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

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

**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 MECHANICS**

**Course Code: GR25A1014** **L/T/P/C: 3/1/0/4**
**I Year I 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**

## 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**
**ENGINEERING CHEMISTRY LABORATORY**

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

## Course Outcomes:

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

## List of Experiments

1. Estimation of Hardness of water by EDTA Complexometric method.

2. Determination of chloride content of water by Argentometric method.
3. Estimation of the concentration of a strong acid by Conductometry.
4. Estimation of the concentration of strong and weak acids in an acid mixture by Conductometry.
5. Estimation of the concentration of $Fe^{+2}$ ion by Potentiometry using $K_2Cr_2O_7$.
6. Estimation of the concentration of a strong acid with a strong base by Potentiometry using quinhydrone.
7. Colorimetric analysis of Potassium Permanganate: Verification of Beer–Lambert's Law.
8. Preparations:
   a. Preparation of Bakelite.
   b. Preparation Nylon – 6, 6.
9. Determination of corrosion rate of mild steel in the presence and absence of inhibitor.
10. Estimation of the acid value of the given lubricant oil.
11. Estimation of viscosity of lubricant oil using Ostwald's Viscometer.
12. **Virtual Labs:**
    a. Construction of Fuel cell and it's working.
    b. Smart materials for Biomedical applications
    c. Batteries for electrical vehicles.
    d. Functioning of solar cell and its applications.

**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+x2/2+ x3/3….+xn/n

(ii) S2= 1+x/1!-x2/2!+ x3/3!….+xn/n!

**TASK 5**

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

i)

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

ii)

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

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

i)

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

ii)

```
  E
 ED
EDC
EDCB
EDCBA
```

**TASK 6**

a. Write a C program to swap two numbers using parameter passing techniques.

b. Write a C program to implement factorial of a given integer using recursive and non-recursive functions.

c. Write a C program to print first ‘n’ terms of Fibonacci series using recursive and non-recursive functions.

**TASK 7**

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

**TASK 8**

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

**TASK 9**

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

**TASK 10**

a. Write a C program that uses functions to perform the following operations:
   I. To insert a sub-string into a given main string from a given position.
   II. To delete n Characters from a given position in a given string
b. Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)

**TASK 11**

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

**TASK 12**

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

**TASK 13**

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

**TASK 14**

a. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).
b. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents

**TASK 15**

a. Write a C program to find sum of 'n' numbers using command line arguments.
b. Write a C program to implement following pre-processor directives:
   i. define ii. undef iii. ifdef iv. ifndef.

c. Write a C program to create a user defined header file to find sum, product and 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**

**ENGINEERING WORKSHOP**

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

**I Year I Semester**

**Course Outcomes**

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

**TRADES FOR EXERCISES: At least two tasks from each trade**

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

**Task 3:** Preparation of Straight Fit
**Task 4:** Preparation of V-Fit

3. **Tin-Smithy -** Demonstration and practice of Tin Smithy tools
   **Task 5:** Preparation of Rectangular Tray
   **Task 6:** Preparation of Open Scoop
4. **Welding :** Demonstration and practice on Arc Welding tools
   **Task 7:** Preparation of Lap joint,
   **Task 8:** Preparation of Butt Joint
5. **House-wiring:** Demonstration and practice on House Wiring tools
   **Task 9:** Exercise on One way switch controlled two bulbs in series one bulb in Parallel.
   **Task 10:** Exercise on Staircase connection.
6. **Foundry :** Demonstration and practice on Foundry tools
   **Task 11:** Preparation of Mould using Single Piece Pattern.
   **Task 12:** Preparation of Mould using Split Piece Pattern.
7. **Black Smithy:** Demonstration and practice on Black Smithy tools
   **Task 13:** Preparation of U-Hook
   **Task 14:** Preparation of S-Hook

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

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

**Text Books**

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

**Reference Books**

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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**DESIGN THINKING AND TINKERING LAB**

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

**I Year I Semester**

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

**Pre-requisites: Mathematical Knowledge at pre-university level**

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

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



**UNIT I:**

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

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

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

**UNIT IV:**
Vector Differentiation and Line Integration
Vector differentiation: Scalar and vector point functions, Concepts of gradient, Directional derivatives, divergence and curl of functions in cartesian framework- solenoidal field, irrotational field, scalar potential
Vector line integration: Evaluation of the line integral, concept of work done by a force field, Conservative fields

**UNIT V:**
Surface Integration And Vector Integral Theorems
Surface integration: Evaluation of surface and volume integrals, flux across a surface
Vector integral theorems: Green's, Gauss and Stokes theorems (without proof) and their applications

**Text Books:**


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


**Reference Books:**


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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**ADVANCED ENGINEERING PHYSICS**

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

**UNIT - II: Semiconductors & Nanomaterials**
**Semiconductors**: Intrinsic and extrinsic semiconductors(qualitative), Variation of Fermi level with temperature and doping(qualitative), Hall Effect and its applications, direct and indirect band gap semiconductors, Construction and principle of operation of p-n junction diode, I-V characteristics of p-n junction diode and Zener diode. Principle, Construction, Working, Characteristics and Applications: LED and Solar cell.
**Nanomaterials**: Introduction, quantum confinement in nanomaterials, Surface to volume ratio, Synthesis methods: Top-Down Technique: Ball milling method, Bottom-Up technique: Sol-Gel method, X-ray diffraction: Bragg's law, calculation of average crystallite size using Debye Scherrer's formula, scanning electron microscopy (SEM): block diagram, working principle.

**UNIT - III: Magnetic and Dielectric Materials**
**Magnetic materials:** Introduction to magnetic materials, origin of magnetic moment - classification of magnetic materials – Dia, Para, Ferro, Weiss domain theory of ferromagnetism, hysteresis curve based on domain theory of ferromagnetism, soft and hard magnetic materials, applications: magnetic hyperthermia for cancer treatment, magnets for EV.
**Dielectric material:** Introduction to dielectric materials, types of polarization: electronics, ionic & orientation(qualitative), derivation of electronic and ionic polarizability; ferroelectric, piezoelectric, pyroelectric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM), load cell and fire sensor.

**UNIT - IV: Laser and Fibre Optics**
**Lasers:** Introduction to laser, Radiative transition: Absorption, Spontaneous and Stimulated emissions, characteristics of laser, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, semiconductor diode laser, applications: Bar code scanner, LIDAR for autonomous vehicle.
**Fiber Optics:** Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres, losses in optical fibre, applications: optical fibre for
communication system, sensor for structural health monitoring.

**UNIT - V: Quantum Computing**
Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits, multiple Qubit system,
entanglement, quantum gates (Pauli's X,Y,Z gate, Hadamard gate), quantum computing system for information processing, evolution of quantum systems, challenges and advantages of quantum computing over classical computation.

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

**Reference Books:**
1. Jozef Gruska, Quantum Computing, McGraw Hill
2. Michael A. Nielsen & Isaac L. Chuang, Quantum Computation and Quantum Information,

Cambridge University Press.
3. John M. Senior, Optical Fiber Communications Principles and Practice, Pearson Education Limited.
4. Fundamentals of Semiconductor Devices, Second Edition, Anderson and Anderson, McGraw Hill.

**Useful Links**

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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**THERMODYNAMICS**

**Course Code:GR25A1012** **L/T/P/C: 3/0/0/3**

**I Year II Semester**

**Course Outcomes**

1. Apply the knowledge of thermodynamics to temperature scales.
2. Solve the practical thermodynamic problems by applying first law and steady flowenergy equation.
3. Analyze the problems on heat engines, refrigeration and entropy by applyingsecond law of thermodynamics.
4. Evaluate the thermodynamic properties of the steam.
5. Evaluate the performance of air standard cycles and vapor power cycle.

**UNIT I**

**Introductory Concepts and Energy:** System, Control Volume, Surrounding, Boundaries,

Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept ofContinuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law, First Law of Thermodynamics and Steady Flow Energy Equation: Zeroth Law of Thermodynamics – Concept of quality of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale – PMM I – Joule's Experiments – First law of Thermodynamics, First law applied to a Process –applied to a flow system – Steady Flow Energy Equation, Limitations of the First Law.

**UNIT II**

**Second Law of Thermodynamics and Entropy:** Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin- Planck and Clausius Statements and their Equivalence /Corollaries, PMM-II, Carnot cycle and its significance, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the third Law of Thermodynamics.

**UNIT III**

**Pure Substances and Perfect Gas Laws:**

Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier chart – Various Thermodynamic processes and energy Transfer – Steam Calorimetry. Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander Waals Equation of State – Compressibility charts.

**UNIT IV**

**Mixtures of Perfect Gases and Air conditioning Concepts:** Mixtures of perfect Gases– Mole Fraction, Mass fraction, Gravimetric and volumetric Analysis – Dalton"s Law of partial pressure, Avogadro"s Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Equivalent Gas constant, Molecular Internal Energy, Enthalpy, Specific heat and Entropy of Mixture of perfect Gases and Vapour. **Air conditioning Concepts:** Psychrometric Properties – Atmospheric air, Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier"s Equation – Psychometric chart.

**UNIT V**

**Power Cycles:** Gas Power cycles: Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericcson Cycle, Lenoir Cycle, Brayton and Rankine cycles -Performance Evaluation – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective

Pressure on Air standard basis.

**Refrigeration Cycles:** Reversed Carnot Cycle-Bell- Coleman cycle, Vapour compression cycle-performance Evaluation.

**Text Books**

1. Engineering Thermodynamics 2/e - P K Nag /TMH, III Edition, 2010
2. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen / Johniley & sons (ASIA) Pvt Ltd.4th Edition, 2014

**Reference Books**

1. Engineering Thermodynamics – Jones & Dugan, TMH, 3rd edition, 2016
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH, 2018
3. Thermodynamics – J.P.Holman / McGraw Hill, 4th edition , 2012
4. An introduction to Thermodynamics / YVC Rao / New Age International, 6th edition, 2011
5. Thermal Engineering by Dr R K Rajput, Laksmi Publications, 11th edition , 2019

**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 2024.
3.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**
**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**
**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 concertation of a given semiconductor.
3. Study of V-I characteristics of pn junction diode.
4. Study of V-I characteristics of light emitting diode.
5. Study of V-I Characteristics of solar cell.
6. Determination of magnetic field along the axis of a current carrying coil.
7. a) Determination of wavelength of a laser using diffraction grating.
   b) Study of V-I & L-I characteristics of a given laser diode.
8. Determination of numerical aperture of a given optical fibre.
9. Determination of bending losses of a given optical fibre.
10. Determination of frequency of a tuning fork using Melde's arrangement.

**Note: Any 8 experiments are to be performed.**

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

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

**Course Outcomes:**
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**
**DATA STRUCTURES LAB**

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

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

**TASK 1**
a. Write a C program to implement Stack operations using arrays.
b. Write a C program to implement Queue operations using arrays.
c. Write a C program to implement Circular Queue operations using arrays

**TASK 2**
a. Write a C program to convert infix expression to postfix expression.
b. Write a C program to evaluate a postfix expression.

**TASK 3**
Implement the following operations on Single Linked List using a C program.
i. Create ii. Insert iii. Delete iv. Search v. Display

**TASK 4**
Write a C program to implement Circular Linked List operations –
i. Create ii. Insert iii. Delete iv. Search v. Display.

**TASK 5**
Write a C program to implement Double Linked List operations –
i. Create ii. Insert iii. Delete iv. Search v. Display.

**TASK 6**
a.Develop a C code for preorder, in-order and post-order traversals of a Binary Search Treeusing recursion.
b.Design a C program for level order traversal of a Binary Search Tree.

**TASK 7**
a.Implement the following operations on Binary Search Tree
i.Create ii. Insert iii. Search
b.Implement the following operations on Binary Search Tree
i.Delete ii. Display

**TASK 8**
a.Implement the following operations on Binary Search Tree
i.count-nodes ii. height iii. minimum node iv. maximum node

**TASK 9**
a. Develop a C program for Quick sort.
b. Demonstrate Merge sort using a C program.
c. Design a C program for Radix Sort.

**TASK 10**
a. Develop a C program for Tree sort.
b. Demonstrate Heap sort using a C program.

**TASK 11**
a. Implement a C program for DFS traversal on graph.
b. Implement a C program for BFS traversal on graph

**TASK 12**
a. Implement a C program for the following operations on Hashing:
i. Insert ii. Delete iii. Search iv. Display
b. Write a program to implement the following Hash Functions:
i) Division Method ii) Multiplication Method
iii) Mid-square Method iv) Folding Method

**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

# II YEAR
# I SEMSTER

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**KINEMATICS OF MACHINERY**

**Course Code: GR25A2039** **L/T/P/C: 3/0/0/3**
**II Year I Semester**

**Course Outcomes**

1. Understand the various elements in mechanism and the inversions of commonly used mechanisms such as four bar, slider crank and double slider crank mechanisms.
2. Draw the velocity and acceleration polygons for a given configuration of a mechanism.
3. Understand the conditions for straight line motion mechanisms, steering mechanism and the usage of Hooke's joint.
4. Draw the displacement diagrams and cam profile diagram for followers executing different

types of motions and various configurations of followers.

5. Calculate the number of teeth and velocity ratio required for a given combination of gears.

**UNIT I**

**Mechanisms:** Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully and incompletely constrained.

**Mechanism and Machines** – Mobility of Mechanisms: Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage.

**UNIT II**

**Kinematics:** Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.

**Plane motion of body:** Instantaneous center of rotation- centrodes and axodes – Three centers in line theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method. Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration

**Analysis of Mechanisms:** Analysis of slider crank chain for displacement- velocity and acceleration of slider – Acceleration diagram for a given mechanism.

**UNIT III**

**Straight-line motion mechanisms:** Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism - Pantographs

**Steering gears:** Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.

**Hooke's Joint:** Single and double Hooke's joint –velocity ratio – application – problems.

**UNIT IV**

**Cams:** Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

**Analysis of motion of followers:** Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

**UNIT V**

**Higher pair:** Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding

Forms of teeth, cycloidal and involutes profiles – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical – Bevel and worm gearing

**Gear Trains:** Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box - Differential gear for an automobile.

**Text Books**

1. Rattan, S.S, “Theory of Machines”, 4th Edition, Tata McGraw-Hill, 2014.
2. Uicker, J.J., Pennock G.R and Shigley, J.E., “Theory of Machines and Mechanisms”, 4th Edition, Oxford University Press, 2014.

**Reference Books**

1. Sadhu Sigh, “Theory of Machines”, Third Edition, Pearson Education, 2012.
2. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
3. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
4. Rao. J.S. and Dukkipati. R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
5. ASHOK G. AMBEKAR, “Mechanism and Machine Theory”, PHI Learning, 2007.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**METALLURGY AND MATERIAL SCIENCE**

**Course Code:GR25A2040** **L/T/P/C: 3/0/0/3**
**II Year I Semester**

**Course Outcomes**

1. Relate crystal structures and identify the suitable method for mechanical property measurements.
2. Relate iron-iron carbon transformation diagrams for various metals.
3. Utilize appropriate techniques in treating a metal with proper heat treatment operations.
4. Have knowledge on different types of ferrous and nonferrous metals.
5. Identify the suitable composite and ceramic material for the required application.

**UNIT I**

**Structure of metals & mechanical property measurements:** Bonds in Solids, crystallization of metals, effect of grains on the properties of metal, determination of grain size, Point and line defects, strengthening mechanisms, Tensile test, torsion test, Impact test, Fatigue test, Young's modulus, Hardness measurements by Rockwell, Brinell, Vickers method.

**UNIT II**

**Alloys & Phase diagrams:** Necessity of alloying, Solid solutions, Types of Solid Solutions, Hume Rothery's rule, Intermediate alloy phases, effects of various alloying elements on steels, Iron – Iron carbide phase diagram, eutectic, eutectoid, peritectic, peritectoid reactions and microstructures, properties of Austenite, Ferrite, Martensite.

**UNIT III**

**Heat treatment of steel:** Annealing and its types, Tempering and its types, Normalizing, Hardening, Jominey quench Test for Hardenability, Continuous cooling curves and interpretation of final microstructures, case hardening, carburizing and its types, nitriding and its types, cyaniding, carbo-nitriding, flame, induction & cryogenic hardening.

**UNIT IV**

**Ferrous & Non ferrous metals:** Steels, Types of steels, Properties and applications of Plain carbon steels, Alloy Steels, High and low alloy steels - stainless steel and tool steels, maraging steels, cast irons-grey, white, malleable and spheroidal cast irons, copper and its alloys, aluminium and its alloys, super alloys- Inconel and nimonic, Titanium and its alloys.

**UNIT V**

**Composites and Modern Ceramics:** Composite materials: Classification of composites, various methods of manufacturing composites, particle–reinforced materials, fibre-reinforced materials, metal–matrix composites, ceramics and its properties, Properties and applications of glass, cermets, WC, TiC, TaC, SiC, Si3N4, CBN.

**Text Books:**

1. W.D.Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.
2. Kenneth G.Budinski and Michael K.Budinski, "Engineering Materials", Prentice Hall.

**Reference Books:**

1. V.Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, 1999.
2. U.C.Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.
3. S.H. Avener, Introduction to Physical Metallurgy, 2nd ed., Tata McGraw-Hill Education, 2011.
4. G.E. Dieter, Mechanical Metallurgy, 2nd ed., McGraw-Hill, 1976.
5. J. Roesler, H. Harders, M. Baeker, Mechanical Behaviour of Engineering Materials: Metals, Ceramics, Polymers, and Composites, Springer-Verlag, 2007.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**STRENGTH OF MATERIALS**

**Course Code: GR25A2041** **L/T/P/C: 3/0/0/3**
**II Year I Semester**

**Course Outcomes**

1. Understand the theory of elasticity including strain displacement and Hooke's law relationships.
2. Analyze the shear Force and bending moment diagrams with various types of loads.
3. Calculate the slope and deflections in beamssubjected to transverse loads.
4. Analyze the stresses due to maximum shear Force and maximum bending momentacting on the beams.
5. Solve the torsion problems in bars and Analyze various situations involving structural members subjected with stresses on oblique planes.

**UNIT I**

**Simple stresses & strains:** Concept of stresses & strains (linear, lateral, shear,thermal and volumetric), Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus. Stress-strain diagrams for ductile & brittle materials, Factor of safety, Strain energy-Gradual, sudden andImpact Loads. Concept of stress state, relation between elastic constants, Axial forces, stresses and strains in determinate and indeterminate composite bars, bars under axial loads and self-weight.

**UNIT II**

**Shear force and Bending moment diagrams:** Shear forces and bending moments of determinate beams due to concentrated loads, uniformly distributed loads, uniformly varying loads and couples, Relation between shear Force and Bending Moment diagrams for cantilevers, simply supported beams, and their construction- Maximum bending moment & point of contraflexure.

**UNIT III**

**Slope and Deflection of beams:** Relation between BM & slope, slope & deflection of determinate beams, double integration method, Macaulay's method, Moment Area method- derivation of formula for slope & deflection for standard cases (Cantilever beams and Simply Supported beams)
.

**UNIT IV**

**Bending stresses:** Theory of simple bending, assumptions, derivation of flexural formula, Bending of common cross sections (rectangular, I,T,L ) with respectivecentroidal & parallel axes, bending stress distribution diagrams, moment of resistanceand section modulus.

**Shear stresses**: Concept, derivation of shear stress distribution formula, shear stress distribution diagrams for I, T and L symmetrical sections, maximum and average shear stresses, shear connection between flange & web.

**UNIT V**

**Torsional stresses:** Derivation of torsion equation, stresses, strain & deformations in solid & hollow Shafts, homogeneous & composite circular cross section subjected to twisting moment, stresses due to combined torsion, bending & axial force on shafts.

**Principal stresses and strains:** Normal and shear stresses on any oblique plane - Concept of principal planes, derivation for principal stresses and maximum shearstress, position of principal planes & planes of maximum shear, graphical solution using Mohr's circle of stresses.

**Text Books**


1. R.K Bansal, A Text book of Strength of Materials (in S.I units), Laxmi Publications, 6th Edition, 2022
2. R.S. Khurmi, N. Khurmi, A Text book of Strength of Materials, S Chand and Company Limited, 26th Edition, 2019


**Reference Books**


1. S S Bhavikatti, Strength of Materials, Vikas Publications, 5th Edition, 2021.
2. Dr Sadhu Singh, Strength of Materials, Khanna Book Publishing Company, 1st Edition, 2016.
3. S S Rattan, Strength of Materials, McGraw-Hill Education (India) Pvt Limited, 3rd Edition, 2017.
4. Egor P. Popov, Mechanics of Materials, Pearson, 2nd Edition, 2015.
5. Stephan Timoshenko, Strength of Materials, CBS Publications and Distributors, 3rd Edition, 2002.

**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.

**TEXTBOOKS**

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

**REFERENCES**

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**

**MANUFACTURING ENGINEERING**

**Course Code: GR25A2047** **L/T/P/C: 3/0/0/3**

**II Year I Semester**

**Course Outcomes**

1. Impart knowledge on role and value of production and identify basic productionprocesses.
2. Introduction to methods of joining that shows a comprehensive understanding oftools, materials, equipment, and processes.
3. Apply critical thinking skills for development and evaluating sheet metal formingprocesses.
4. Identify and use the materials, tools, machines, and techniques used in variousforming processes.
5. Demonstrate various ways of producing plastic products and its equipment details.

**UNIT I**

**Metal Casting Processes:** Sand casting process – Sand moulds - Type of patterns – Pattern materials– Pattern allowances –Types of Moulding sand – Properties of moulding sand, Methods of Sand testing – Core making- Gating System–Moulding machines–Types of moulding machines – Types of Melting furnaces–Working principle of Special casting processes–Shell Mould casting, investment casting – Ceramic mould– Lost Wax process – Pressure die casting – Centrifugal casting – CO2 process– Sand Casting defects – Inspection of Castings.

**UNIT II**

**Joining Processes:** Types of joining methods-Classification of welding process- Fusion welding processes- Types of Gas welding–Equipments used–Flame characteristics–Filler and Flux materials-Arc welding equipments –Types of Electrodes – Coating and specifications–Principles of Resistance welding–Spot, seam welding, Projection welding–Percussion welding-Flux cored–Submerged arc welding–Electro slag welding–Gas metal arc welding–TIG and MIG welding–Principle and application of special welding processes-Thermit welding–Ultrasonic welding-Electron beam welding- LASER beam welding-Plasma arc welding–Friction welding–Diffusion welding–Explosive Welding- Weld defects–Brazing and soldering process–Methods and process capabilities–Filler materials and fluxes–Types of Adhesive bonding.

**UNIT III**

**Bulk Deforming Processes:** Hot working and cold working of metals–Forging processes–Open, impression and closed die forging–Characteristics of the process– Types of Forging Machines – Typical forging operations–Rolling of metals–Types of Rolling mills-Flat strip rolling– Shape rolling operations–Defects in rolled parts - Principle of rod and wire drawing-Tube drawing–Principles of Extrusion–Types of Extrusion–Hot and Cold extrusion–Equipments used.

**UNIT IV**

**Sheet Metal Processes:** Sheet metal characteristics - Typical shearing operations, bending and drawing operations- Blanking and Piercing operations– Stretch forming operations —
Formability of sheet metal – Testing methods– Working principle and application of special forming processes- Hydro forming – Rubber pad forming – Metal spinning – Introduction to Explosive forming, Magnetic pulse forming, Peen forming, Super plastic forming.

**UNIT V**

**Manufacturing of Plastic Components:** Types of plastics-Characteristics of the forming and shaping processes–Moulding of Thermoplastics–Working principles and typical applications of-Injection moulding–Plunger and screw machines–Compression moulding, Transfer moulding–Typical industrial applications–Introduction to Blow moulding–Rotational moulding–Film blowing–Extrusion-Thermoforming-Bonding of Thermoplastics.

**Text books**


1. Hajra Choudhury, "Elements of Workshop Technology, Vol. I and II", MediaPromotors Pvt Ltd., Mumbai, 2008
2. S.Gowri, P.Hariharan, and A.Suresh Babu, "Manufacturing Technology 1", Pearson Education , 2008.


**Reference books**


1. P.N. Rao,"ManufacturingTechnology",Tata McGraw-Hill Publishing Limited, II Edition, 2017.
2. B.S. Magendran Parashar& R.K. Mittal,"Elements of Manufacturing Processes",Prentice Hall of India, 2003.
3. P.C. Sharma, "A text book of production technology",S. Chand and Company, IVEdition, 2003.
4. Begman, 'Manufacturing Process", John Wilely& Sons, VIII Edition, 2005.
5. Serope Kalpajian, Steven R.Schmid, Manufacturing Engineering and Technology,Pearson Education, Inc. 2002(Second Indian Reprint).
6. Beddoes.J and Bibby M.J, 'Principles of Metal Manufacturing Processes', Elsevier,2006.
7. Rajput R.K, 'A text book of Manufacturing Technology', Lakshmi Publications,2020.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**METALLURGY AND MATERIAL SCIENCE LAB**

**Course Code: GR25A2043** **L/T/P/C: 0/0/2/1**
**II Year I Semester**

**Course Outcomes**
1. Relate properties to microstructure.
2. Choose suitable metals and alloys for industrial applications.
3. Find out the hardness of various treated and untreated metals.
4. Tell the chemical composition of various ferrous and nonferrous metals.
5. Select a suitable heat treatment process for a material.

**List of Experiments**
1. Preparation and study of microstructure of Low carbon steel.
2. Preparation and study of microstructure of Medium Carbon Steel.
3. Preparation and study of microstructure of High Carbon steel.
4. Preparation and study of microstructure of Grey cast iron.
5. Preparation and study of microstructure of White cast Iron.
6. Preparation and study of microstructure of Malleable cast iron.
7. Preparation and study of microstructure of Spheroidal graphite cast iron.
8. Preparation and study of microstructure of Aluminium.
9. Preparation and study of microstructure of copper.
10. Preparation and study of microstructure of Titanium.
11. Preparation and study of the microstructure of Inconel.
12. Hardenability of steels by Jominey End Quench test.
13. Preparation and microscopic examination of case hardened metal samples.

**Teaching Methodology**: Experimental Test rigs & Microscopes

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**STRENGTH OF MATERIALS LAB**

**Course Code: GR25A2042** **L/T/P/C: 0/0/2/1**

**II Year I Semester**

**Course Outcomes**

1. Determine the Young's modulus for ductile materials and analyze the compressionstrength of both ductile and brittle materials.
2. Analyze the various points on stress strain diagram and calculate the modulus ofelasticity of ductile materials.
3. Calculate & compare the hardness values for various materials.
4. Experiment on a spring to interpret the stiffness and rigidity modulus.
5. Apply the concept of impact loading and to determine impact values for variousmaterials.

**List of Experiments:**

**Task-1:** To conduct hardness test on given material using Brinnel's Hardness testing equipment

**Task-2:** To conduct hardness test on given material using Rockwell's Hardness testingmachine

**Task-3:** To conduct hardness test on given material using Vicker's Hardness testing machine

**Task-4:** To perform the following tests on the given material using UTM (Universal Testing Machine) : Tension test to determine young's modulus and Shear test to determine ultimate shear strength

**Task-5:** To determine the stiffness and modulus of rigidity of the spring wire by performing Spring Test

**Task-6:** To perform compression test on cube to analyze compression strength of thematerial

**Task-7:** To determine the Young's modulus of the given structural material usingCantilever Beam set-up

**Task-8:** To determine the Young's modulus of given structural material using simplysupported Beam set-up

**Task-9:** To determine the Young's modulus of given structural material by Maxwell'sReciprocal Theorem

**Task-10:** To determine the Young's modulus of given structural material using Continuous Beam set-up

**Task-11:** To determine the Torsional strength and stiffness of a material using Torsiontesting machine.

**Task-12:** To determine impact strength of the given material using Impact testingequipment (Izod and Charpy).

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

**Course Code: GR25A2049** **L/T/P/C: 0/0/2/1**
**II Year I Semester**

**Course Outcomes**

1. Recommend appropriate Design and manufacture simple patterns for castings.
2. Know the principles and gain knowledge on different kinds of joining processes.
3. Acquire knowledge on Manufacturing of plastic components.
4. Acquire knowledge on different kinds of production processes available for shaping or moulding products.
5. Recognize the importance of safety devices and gain practical experience on various manufacturing processes.

**Task-1: CASTING**

1. Pattern Design and making-2 Exercises.
2. Moulding, Melting and Casting-1Exercise

**Task-2: WELDING**

1. ARC Welding Lap Joint-1 Exercise
2. ARC Welding Butt Joint-1 Exercise
3. Spot Welding-1Exercise
4. TIGWelding-1Exercise
5. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

**Task-3: MECHANICAL PRESS WORKING**

1. Blanking & Piercing operation and study of simple, compound and progressivepress tool.
2. Hydraulic Press: Deep drawing.
3. Bending and other operation

**Task-4: PROCESSING OF PLASTICS**

1. Injection Moulding
2. Blow Moulding

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DATA ANALYTICS WITH R PROGRAMMING FOR ENGINEERS LAB**

**Course Code: GR25A2095** **L/T/P/C: 0/0/2/1**
**II Year I Semester**

**Course outcomes**

1. Establish and apply the R environment for efficient data handling tasks.
2. Perform data cleaning, exploration, and visualization on engineering datasets.
3. Apply basic statistical and machine learning models to analyze engineering data.
4. Evaluate model performance using error metrics, confusion matrices, ROC curves, and cross-validation.
5. Implement advanced analytics techniques like clustering, text analysis, and time series forecasting for richer insights.

**TASK 1**

a) Install R and RStudio.
b) Write and run a script to create vectors, matrices, and data frames

**TASK 2**

a) Import a CSV containing mechanical measurements.
b) Perform data cleaning, summarization, and plot histograms, boxplots, and scatterplots.

**TASK 3**

a) Apply a simple linear regression to predict a variable (e.g., stress vs. strain).
b) Calculate error metrics: SSE, SST, RMSE, $R^2$

**TASK 4**

a) Build a multiple regression model (e.g., predicting machine output from temperature and pressure).
b) Implement Lasso and Ridge regression for regularization and analyze correlations.

**TASK 5**

a) Use logistic regression to classify a binary outcome (e.g., equipment pass/fail).
b) Generate a confusion matrix and calculate model accuracy

**TASK 6**

a) Plot the ROC curve for the above classification.
b) Compute and interpret the Area Under Curve (AUC).

**TASK 7**

a) Build and visualize a decision tree using the ctree package.
b) Practice single and multiple imputation for missing data

**TASK 8**

a) Create a Classification and Regression Tree (CART), and perform k-fold cross-validation.
b) Evaluate model performance using advanced metrics

**TASK 9**

a) Implement a random forest classifier.
b) Conduct clustering (e.g., k-means) on sensor or part measurement data and visualize results.

**TASK 10**

a) Analyze maintenance logs or technical documents.
b) Apply text preprocessing and simple word frequency analysis in R

**TASK 11**

a) Work with time series data (e.g., monthly energy usage).
b) Perform decomposition, modeling, and forecasting for trends or seasonality.

**TASK 12**

a) Implement Support Vector Machines and Naive Bayes models for mechanical datasets.
b) Compare performance with previous classification models.

**Note: Min 3 datasets for practice**

**Text/Reference Books**


1. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R. Springer, 1st Edition, 2013.
2. Hadley Wickham and Garrett Grolemund, R for Data Science. O'Reilly, 1st Edition, 2017.
3. Roger D. Peng, R Programming for Data Science. Leanpub, 1st Edition, 2016.
4. Garrett Grolemund, Hands-On Programming with R. O'Reilly, 1st Edition, 2014.
5. Hemant Jain and Anand Ojha, Data Science and Machine Learning with R. McGraw Hill, 1st Edition, 2021.

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

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

**Course Outcomes**

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

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

 A Case study on values and self-development

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

 A Case study on Personality

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

 A Case study on professional ethics

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

 A Case study/ video discussion on attitudes towards gender

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

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

**Text Books:**


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

**Reference Books**


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

# IIYEAR
# IISEMESTER

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**THERMAL ENGINEERING**

**Course Code: GR25A2044** **L/T/P/C: 3/0/0/3**

**II Year II Semester**

**Course Outcomes**

1. Ability to understand the concept on working principles and their functions of various components of internal combustion engine.
2. Ability to improve the analytical skills in finding the engineering solutions and redesign the system by combustion, electrical and electronic systems and fuel technology to improve the fuel efficiency of the engine.
3. Ability to adopt the resources available at optimum level in order to achieve the better efficiency in the performance of different types of air compressors duly reducing the operational losses.
4. Ability to explain the function and working principles of reciprocating, rotary, compressors and elaborate the factors influence performance of the compressors by analytical.
5. Ability to explain the function and working principles of dynamic and axial compressors and elaborate the factors influence performance of the compressors by analytical and graphical methods using velocity triangles.

**UNIT I**

**Introduction and Analysis of Actual Cycles I.C. ENGINES:** Classification - Working principles, Valve and Port Timing Diagrams, Air – Standard air-fuel and actual cycles. Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines. Engine systems, cooling and lubrication systems.

**UNIT II**

**Combustion S.I. Engines:** Fuel system components, Carburetor, Fuel Injection System, Ignition systems Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking – Fuel requirements and fuel rating, anti knockadditives – combustion chamber – requirements, types.

**C.I. Engines:** Four stages of combustion – Delay period and its importance – Effect ofengine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles

used – fuel requirements and fuel rating.

**UNIT III**

Testing and Performance Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heatbalance sheet and chart.

**UNIT IV**

**Reciprocating and Rotary Compressors Compressors**: Classification positive displacement and roto dynamic machinery-Power producing and power absorbingmachines, fan, blower and compressor-positive displacement and dynamic types- reciprocating and rotary types.

**Reciprocating:** Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance, stage compression, under cooling, saving of work, minimum work condition for stage compression.

**Rotary (Positive displacement type):** Roots Blower, vane sealed compressor, Lysholm compressor –mechanical details and principle of working – efficiency considerations.

**UNIT V**

**Dynamic and Axial Flow Compressors Dynamic Compressors:** Centrifugal compressors: Mechanical details and principle of operation –velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

**Axial Flow Compressors:** Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- Pressure rise calculations –Polytropic efficiency.

**Text Books**


1. I.C. Engines / V. GANESAN- TMH, Eighth Edition, 2014
2. Thermal Engineering / Rajput / Lakshmi Publications, Eleventh Edition,2020


**Reference Books**


1. I C Engines – Mathur & Sharma – DhanpathRai& Sons. 2016
2. Engineering fundamentals of IC Engines – Pulkrabek / Pearson /PHI,2nd edition, 2003
3. Thermal Engineering / Rudramoorthy– TMH, 2017
4. Thermodynamics & Heat Engines / B. Yadav/ Central Book, 7th revised edition, 2001
5. Applied Thermodynamics by Dr.R.Yadav, CP Publications, 6th revised edition,2006

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**FLUID MECHANICS AND HYDRAULIC MACHINES**

**Course Code: GR25A2045** **L/T/P/C: 3/0/0/3**

**II Year II Semester**

Prerequisites: Engineering Mechanics, Thermodynamics

**Course Outcomes:**

1. Able to explain the effect of fluid properties on a flow system.
2. Able to identify type of fluid flow patterns and describe continuity equation.
3. To analyze a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics principles in design.
4. To select and analyze an appropriate turbine with reference to given situation in power plants.
5. To estimate performance parameters of a given Centrifugal and Reciprocating pump.
6. Able to demonstrate boundary layer concepts.

**UNIT – I: Fluid statics**

Dimensions and units: Physical properties of fluids, Specific gravity, Viscosity and surface tension, Vapour pressure and their influence on fluid motion, Atmospheric, Gauge and vacuum pressures, Measurement of pressure, Piezometer, U-tube and differential manometers.

**UNIT – II: Fluid kinematics**

Stream line, Path line and streak lines and stream tube. Classification of flows: Steady and unsteady, Uniform and non, Uniform, Laminar and turbulent, Rotational and irrotational flows, Equation of continuity for one dimensional flow and three-dimensional flows.

Fluid dynamics: Surface and body forces, Euler's and Bernoulli's equations for flow along a stream line, Momentum equation and its application on force on pipe bend.

**UNIT – III: Boundary Layer Concepts**

Definition, Thicknesses, Characteristics along thin plate, Laminar and Turbulent boundary layers (No derivation), Boundary layer in transition, Separation of boundary layer, Submerged objects, Drag and lift.

Closed conduit flow: Reynold's experiment, Darcy Weisbach equation, Minor losses in pipes, Pipes in series and pipes in parallel, Total energy line, Hydraulic gradient line. Measurement of flow: Pitot tube, Venturi meter and Orifice meter, Flow nozzle.

**UNIT – IV: Basics of Turbo Machinery**

Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, Jet striking centrally and at tip, Velocity diagrams, Work done and efficiency, Flow over radial vanes.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, Impulse and Reaction Turbines, Pelton wheel, Francis turbine and Kaplan turbine, Working proportions, Work done, efficiencies, Hydraulic Design, Draft tube theory, Functions and efficiency.

Performance of Hydraulic Turbines: Geometric similarity, Unit and specific quantities,

Characteristic curves, Governing of turbines, Selection of type of turbine, Cavitation, Surge tank, Water hammer.

**UNIT – V: Centrifugal Pumps**

Classification, Working, Work done, Barometric head, Losses and efficiencies, Specific speed, Performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, Slip, Indicator diagrams.

**TEXT BOOKS:**


1. Hydraulics, Fluid mechanics and Hydraulic Machinery, Modi and Seth, standard Book House, 22nd Edition, 2019.
2. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publications, 10th Edition, 2020.


**REFERENCE BOOKS:**


1. Fluid Mechanics and Hydraulic Machines, Er. R. K. Rajput, S. Chand,2019.
2. Hydraulic Machines: Fluid Machinery, Jagdish Lal, Metropolitan Book Co., 6th Edition, 2016.
3. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria and Sons, 22nd Edition, 2018.
4. Fluid Mechanics and Machinery, D. Rama Durgaiah, New Age International publishers, 1st Edition, 2002.
5. Hydraulic Machines, T.R. Banga and S.C. Sharma, Khanna Publishers, 7th Edition, Rpt. 2019.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**DYNAMICS OF MACHINERY**

**Course Code: GR25A2046** **L/T/P/C: 3/0/0/3**

**II Year II Semester**

**Course Outcomes**

1. Analyze complete motion analysis of machines in running condition and able to know gyroscope and its effects.
2. Design various mechanisms of machines which were used in real life and explain how to get equilibrium condition of machine members while the machine is in running condition.
3. Apply the knowledge regarding use of Governor, brakes and operation of Dynamometers.
4. Explain how to balance forces and moments produced by rotating or reciprocating masses of machine members.
5. Analyze the vibrations, which is the major disturbance in machines while in the running condition and also precautions to reduce vibration.

**UNIT I**

**Gyroscopes**: Introduction, Precisional angular motion, Gyroscopic couple, effect of gyroscopic couple on an aeroplane, effect of gyroscopic couple on a naval ship during steering, gyroscopic couple on a naval ship during pitching, Gyroscopic couple on a naval ship during rolling, stability of a four wheel drive moving in a curved path, stability of a two wheel vehicle taking a turn.

**UNIT II**

**Static Force Analysis:** Introduction, Static Equilibrium, Equilibrium of Two-force and three force members, Member with Two force.

**Dynamic force Analysis**: Introduction, D'Alemberts principle, Equivalent Offset inertia force, Dynamic analysis of Four bar and Single slider mechanisms, Piston effort, Turning moment on crank shaft, Inertia of connecting rod, Inertia forces in reciprocating Engines.

**UNIT III**

**Governors:** Introduction, types of governors, Watt governor, Porter governor, Proell governor, Hartnell governor, Wilson-Hartnell governor, Spring controlled gravity governor, Inertia governors, Sensitiveness of governor, Hunting, Isochronism,

Stability,effort of governor, Power of governor, Controlling force.

**Brakes and Dynamometers:** Types of brakes: Simple block brake, band and block brake internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

**UNIT IV**

**Balancing of Rotating Masses**: Balancing of rotating masses in single and different planes. **Balancing of Reciprocating Masses:** Primary, Secondary, and higher balancing of reciprocating masses, Analytical and graphical methods. Unbalanced forces and couples - examination of "V" multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing–Hammer blow, Swaying couple, variation of tractive efforts.

**UNIT V**

**Vibrations**: Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly's method – Raleigh's method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

**Text Books**


1. Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, 2014.
2. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4th Edition, Oxford University Press, 2014.


**Reference Books**


1. Sadhu Sigh, "Theory of Machines", Third Edition, Pearson Education, 2012.
2. R. S. Khurmi, J. K. Gupta, "Theory of Machines", S Chand publishers, 2015
3. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
4. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
5. Rao. J.S. and Dukkipati. R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**PROBABILITY, STATISTICS AND COMPLEX VARIABLES**

**Course Code: GR25A2101** **L/T/P/C: 3/0/0/3**

**II Year II Semester**

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

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

1. Understand the concepts of Random variable and it's probability distribution.
2. Apply continuous distribution and sampling techniques to some case studies .
3. Make use of hypothesis testing in real-world scenarios
4. Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.
5. Explain Taylor's and Laurent's series expansions in complex function.

**UNIT – I: Random Variables and Probability Distributions**

Concept of a Random Variable – Discrete Probability Distributions – Continuous Probability Distributions – Mean of a Random Variable – Variance of a Random Variable **Theoretical 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: 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 – IV: Complex Differentiation**

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

**UNIT – V: Complex Integration**

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

**TEXT BOOKS**


1. 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**
**MANUFACTURING TECHNOLOGY AND METROLOGY**

**Course Code: GR25A2051** **L/T/P/C: 3/0/0/3**
**II Year II Semester**

**Course Outcomes**

1. Explain the importance of tool geometry in manufacturing the component.
2. Perform various operations on Lathe machines and reciprocating metal cutting machines
3. Execute different milling operations on various milling, Drilling, Boring and surface finishing machine tools.
4. Identify techniques to minimize errors in measurement.
5. Understand methods and devices for measurement of length, angle, gear& thread parameters, surface roughness and geometric features of parts.

**UNIT I**

**Theory of Metal Cutting**: Elementary treatment of metal cutting theory, Elements of cutting process, Classification of Material removal processes, Machine Tools, cutting tools (Single and multi-point) and Nomenclature of Single point cutting tool. Mechanics of metal cutting:
**Metal Cutting**: Chip formation and types of chips, Orthogonal & oblique Cutting, Tool Wear and Tool Life, Surface Finish, cutting fluids, machinability– MRR, Types of Cutting Tool Materials.

**UNIT II**

**Lathe Machines:** working principle and specifications of lathe, Constructional Features of a Centre Lathe, work holding and tool holding devices, Operations Performed on Centre Lathe.
**Capstan and Turret Lathes**: construction and differences. Introduction of automatic lathes and CNC Lathes
**Reciprocating Machine Tools:** Introduction of Shaper, Slotter and Planer machines. Principles of working, Principal parts, specifications, classification, operations performed.

**UNIT III**

**Milling machine**: working principle, specifications, classifications of milling machines, Principal features of horizontal, vertical and universal milling machines, milling cutters,Various milling operations
**Drilling and Boring Machines**: Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring machines – Fine boring machines – Jig Boring machine - Deep hole drilling machine.
**Fundamentals of grinding**: Theory of grinding– classification of grinding machines, cylindrical and surface grinding machine, Tool and cutter grinding machine, Different types of abrasives and bonds, specification of a grinding wheel and selection of a grinding wheel Introduction to Lapping, honing and broaching machines

**UNIT IV**

**Limits, fits and tolerances**- Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly.

**Limit Gauges**: Taylor's principle, Design of GO and NO-GO gaugesMeasurement of angles, Bevel protractor, Sine bar.

Measurement of flat surfaces, straight edges, surface plates, optical flat, interferometer and auto collimator.

**Measurement through comparators**: Comparators – Mechanical, Electrical and Electronic Comparators, pneumatic comparators and their uses in mass production.

**UNIT V**

**Surface Roughness Measurement**: Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf.

**Screw thread measurement**: Element of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch, profile thread gauges.,

**Gear measurement**: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch pressure angle and tooth thickness. Machine Tool Alignment Tests on lathe, milling and drilling machines.Coordinate Measuring Machines: Types and Applications of CMM.

**Text books:**

1. Production Technology by R.K. Jain and S.C. Gupta.
2. Workshop Technology – B.S.RaghuVamshi – Vol II.
3. I.C. Gupta, "A Textbook of Engineering Metrology", Dhanpat Rai & sons,4th edition 1997.
4. R.K. Jain, "Engineering Metrology", Khanna Publishers, Edition 22nd, 2022.

**References:**

1. Machine Tools :C.Elanchezhian and M. Vijayan / Anuradha Agencies Publishers.
2. Production Technology by H.M.T. (Hindustan Machine Tools).
3.Raghavendra., Krishnamurthy., Krishnamurthy. (2013). Engineering Metrology and Measurements. India: OUP India.
4.Rajput, R. K. (2009). Engineering Metrology & Instrumentation. India: S. K. Kataria & Sons.
5.Busch, T. (1989). Fundamentals of Dimensional Metrology. United States: Delmar.

**Teaching Methodology:**

- Power point Presentations
- Working models
- white board & marker

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

**Course Code: GR25A2048** **L/T/P/C: 0/0/2/1**
**II Year II Semester**

**Course Outcomes**

1. Explain the functioning of measuring devices such as manometer, thermocouples, loading devices, fuel measurements etc. by applying the conservation laws and demonstrate the function of parts of 4 stroke diesel/petrol engines by assemblingand dismantling.
2. Evaluate the properties of fuels such as flash & fire points, calorific value, Viscosityusing basic concepts by conducting experimentation.
3. Assess the performance parameters of different thermal systems such as diesel/Petrol engines, refrigeration system, air compressors, Boilers etc.,
4. Enumerate and calculate the amount of dissipation of heat/energy in different ways by drawing balance sheets for an IC Engine.
5. Represent the processes, performance of the system in the form of graphs, period of suction, compression, expansion, exhaust and injection/ignition in the form of diagrams.

**LIST OF EXPERIMENTS:**

**Task-1:** Disassemble and Assemble of 4 stroke single cylinder diesel and petrolengine.
**Task-2:** Valve timing diagram for 4 stroke single cylinder diesel and petrol engine.
**Task-3: P**erformance test on 4-stroke single cylinder diesel engine with Electricalloading.
**Task-4:** Heat balance test on 4 stroke single cylinder diesel engine with Electricalloading.
**Task-5:** Performance test on 4- stroke single cylinder diesel engine with Mechanicalloading.
**Task-6:** Heat balance test on 4-stroke single cylinder diesel engine with Mechanicalloading.
**Task-7**: Determination of the calorific value of a given fuel.
**Task-8:** Determination of the flash & fire points of a given fuel.
**Task-9:** Determination of the density and viscosity of a given oil.
**Task-10:** Performance test on two stage reciprocating Air Compressor
**Task-11:** Study of Babcock and Wilcox boiler.
**Task-12:** Determination of COP of a Vapour compression refrigeration system.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**FLUID MECHANICS AND FLUID MACHINES LAB**

**Course Code: GR25A2050** **L/T/P/C: 0/0/2/1**
**II Year II Semester**

**Course Outcomes**

1. Demonstrate practical knowledge in fluid flow principles.
2. Demonstrate the knowledge in calculating performance analysis in turbines and pumps understand to analyse practical problems in all power plants and chemical industries.
3. Conduct experiments in pipe flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
4. Analyse a variety of fluid-flow devices and utilize fluid mechanics principles in design.
5. Analyze flow rate and pressure rise, select the proper pump to optimize the pumping efficiency.

**LIST OF EXPERIMENTS:**

**Task-1:** Verification of Bernoulli's theorem and draw the HGL, TEL
**Task-2:** Determination of Coefficient discharge of Venturi meter and Orificemeter.
**Task-3:** Determination of Darcy's Friction factor in various diameters of pipes
**Task-4:** Determination of Minor Losses (Different Valve connections, SuddenExpansion, Sudden Contraction, Bends, joints) in various pipe fittings
**Task-5:** Determination of coefficient of impact of Jet on given Vanes
**Task-6:** Determination of overall efficiency of Pelton wheel Turbine at ConstantSpeed and Constant Head
**Task-7:** Determination of overall efficiency of Francis Turbine at Constant Speed andConstant Head
**Task-8:** Determination of overall efficiency of Kaplan Turbine at Constant Speed andConstant Head
**Task-9:** Determination of the overall efficiency of Single Stage Centrifugal pump
**Task-10:** Determination of the overall efficiency of Multistage Centrifugal pump
**Task-11:** Determination of the overall efficiency of Reciprocating pump
**Task-12:** Determination of the laminar and turbulent flow using Reynold's apparatus.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**MANUFACTURING TECHNOLOGY AND METROLOGY LAB**

**Course Code: GR25A2052** **L/T/P/C: 0/0/2/1**
**II Year II Semester**

**Course Outcomes:**

1. Apply tool geometry in manufacturing the component
2. Operate machine tool equipment commonly found in industry like lathes, milling machines, drill presses and cutting machines
3. Execute the finishing process on various machines.
4. Deploy different measuring instruments towards quality control.
5. Operate effective methods of measuring straightness, flatness, roundness, profile, screw threads and gear teeth.

**List of Experiments:**

1. Step Turning and Taper Turning operation on lathe Machine
2. Thread cutting and Knurling operations on Lathe Machine
3. Drilling, boring, operations on lathe machine
4. Drilling and internal thread cutting using Tapping
5. Edge preparation using Shaping machine and Keyway cutting operation on Slotting machine
6. Face milling operation using Milling machine
7. Grinding of tool angles using Cylindrical /Surface Grinding Machine
8. Measurement of lengths, heights, by vernier calipers, vernier height gauge.
9. Measurement of diameters by internal, external micrometers and dial bore indicator
10. Using gear tooth Vernier calipers and checking the chordal addendum and chordal height of spur gear
11. Angle measurement by Bevel protractor, Sine bars and Thread measurement by three wire method.
12. Surface roughness measurement by Surface roughness tester.
13. Measurement of screw thread by using Profile Projector and Tool makers
14. Microscope

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**PART MODELLING AND ASSEMBLY DEVELOPMENT LAB**

**Course Code: GR25A2096** **L/T/P/C: 0/0/2/1**
**II Year II Semester**

**Course Outcomes:**
1. Select an appropriate CAD tool for various applications
2. Use basic/advanced skills for 3-D part modeling, create solid 3-D model of a part for design concept
3. Create dimensioned drawings and views from a 3-D model
4. Use basic/advanced skills for 3-D assembly modeling
5. Use a solid model for motion, simulation, or manufacturing

**Syllabus**

1. Introduction to Concept of Parametric Modeling, Feature Based Modeling, User Interface, Mouse operations, File types and Management, drawing profiles.
2. **Modeling of Machined component -1**: Material Addition and Removal (Pad, Pocket, Shaft, Groove), Sketch and Positioned Sketch, Types of Fillets, Types of Chamfer, Types of Hole.
3. **Modeling of Machined component – 2:** Pattern (Rectangular, Circular, User ),Thread/Tap, Datum Features (Plane, Axes, Points),Simple Draft.
4. **Advance Design features** : Axis System, Types of draft, Shell, Stiffener, rib slot, Multisection solid, Removed multisection solid, Apply Material, Measure, Render.
5. **Advanced Surfacing:-** Adaptive Sweep, Sweep(ALL), Multisection Surface.
6. **Introduction To Multibody concept:** Copy Paste, Paste special, Insert body, Boolean Operations (Add, remove, Intersect)
7. **Transformation**: Translation, Mirror, Scaling, rotating
8. **Introduction To Drafting & Detailing Theory:-** (types Generative – Interactive), Initial Drafting setting, Sheet Background, Views (ortho, ISO), Dimensions (Types-Generate Dimension & Create Dimension).
9. **Views:-** (Aux, Section, Details, Clipping, Broken), View properties, DATUMS & Tolerance
10. **Annotations:-** GD & T, Symbols, Note, Leaders, Table, Symbols (Machining, Roughness, Welding, Custom)
11. **Introduction to Assembly:-** Types of assembly approach, Types of Constrains and DOF, placement of components in the Assembly, Manipulating Components.
12. **Assembly Drafting:-** Scene (Exploded View), Bill of material, Ballon creation, Graph Tree Reordering.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**ENVIRONMENTAL SCIENCE**

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

**II Year II Semester**

**Course Outcomes:** Student will be able to

1. Understand the structure, function, and significance of ecosystems.
2. Analyze the classification, utilization, and sustainable management of natural resources, along with alternative energy options.
3. Evaluate biodiversity at genetic, species, and ecosystem levels, its values, threats, and conservation methods under national and international frameworks.
4. Identify types, sources, and impacts of environmental pollution, and apply suitable control technologies while assessing global environmental challenges and protocols.
5. Interpret environmental policies, legislation, and the EIA process to propose management plans addressing contemporary environmental and sustainability issues.

**UNIT - I Ecosystems:**

Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, services and carrying capacity, Field visits.

**UNIT - II Natural Resources:**

Classification of Resources: Living and Non-Living resources, water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

**UNIT - III Biodiversity and Biotic Resources:**

Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

**UNIT - IV Environmental Pollution and Control Technologies:** Environmental Pollution: Classification of pollution, **Air Pollution**: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary. **Global Environmental Issues and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

**UNIT - V Environmental Policy, Legislation & EIA:** Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition.
**Slogan and Poster making** on Environmental Management Plan, Contemporary Environmental Issues (Climate change – Impact on air, water, biological and Socioeconomical aspects); Sustainable development goals (SDGs); Global environmental challenges; Environmental policies.

**TEXT BOOKS:**


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


**REFERENCE BOOKS:**


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