Academic Regulations
Programme Structure
and
Detailed Syllabus

Bachelor of Technology (B.Tech)
in
Mechanical Engineering

(Four Year Regular Programme)

(Applicable for Batches admitted from 2024-25)

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 GR24

(Applicable for Batches Admitted from 2024-25)

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)

GR24 Regulations shall govern the above programmes offered by the Departments with effect from the students admitted to the programmes in 2024-25 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. **Programme Pattern:**

a) Each Academic Year of study is divided into two semesters.
b) Minimum number of instruction days in each semester is 90.
c) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).
d) The total credits for the Programme are 160.
e) A student has a choice to register for all courses in a semester / one less or one additional course from other semesters provided the student satisfies prerequisites.
f) All the registered credits except Mandatory and Value-added Courses will be considered for the calculation of final CGPA.
g) Each semester has 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC, and course structure as suggested by AICTE are followed. The terms 'subject' and 'course' imply the same meaning.
h) All courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.
- One credit for one hour/week/semester for Theory/Lecture (L) courses and Tutorials (T).
- One credit for two hours/week/semester for Laboratory/Practical (P) courses.
- Mandatory Courses will not carry any credits.

i) Course Classification: All courses offered for all undergraduate programmes in B.Tech degree programmes are broadly classified as follows.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	BS	Basic Science	Includes Basic Science Courses
2	ES	Engineering Science	Includes Engineering Courses
3	HS	Humanities and Social Sciences	Includes Management Courses
4	PC	Professional Core	Includes Core Courses related to the parent discipline/department/ branch of Engineering
5	PE	Professional Elective	Includes Elective Courses related to the parent discipline/ department/ branch of Engineering
6	OE	Open Elective	Elective Courses from other technical and/or emerging subjects
7	PW	Project Work	Project work, seminar and internship in industry or elsewhere
8	MC	Mandatory Courses	Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge, Co and Extra Curricular Activities
9	VAC	Value Added Courses	Courses on current industry relevant topics improving breadth and depth in domain

4. **Award of B.Tech Degree:** The Undergraduate Degree of B.Tech shall be conferred by Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, on the students who are admitted to the programme and fulfill all the following academic requirements for the award of the degree

a) A student pursues the course of study and completes it successfully in not less than four academic years and not more than eight academic years.

b) A student has to register for all the 160 credits and secure all credits (with CGPA ≥ 5).

c) A student must fulfill all the academic requirements for the award of the degree.

5. Courses to be offered

a) Open Electives: Students are to register an Open Elective (OE-I) during III year I semester, an Open Elective (OE-II) during III-year II semester, and a Open Elective (OE–III) in IV year I semester from the list of Open Electives given. OE-I and OE-II are to be selected from SWAYAM courses (MOOCs platform).

b) Professional Electives: The students have to choose six Professional Electives from the list of Professional Electives given in the course structure.

c) A course may be offered to the students, only if a minimum of 15 students opts for it.

d) More than one faculty member may offer the same subject.

e) A lab/practical may be included with the corresponding theory subject in the same semester) in any semester.

f) If more students opt for a particular course, then the priority shall be given to students firstly on 'first come first serve' basis and secondly based on CGPA (student who has higher CGPA is given more preference).

g) If more students opt for a particular course, then the concerned Head of the Department shall decide whether or not to offer such a course for two or more sections.

h) In case of options coming from students of other departments, priority shall be given to the student of the 'parent department'.

6. Attendance Requirements:

a) A student shall be eligible to appear for the semester-end examinations if he/she puts in a minimum of 75% of attendance in aggregate in all the courses concerned in the semester.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in a semester may be granted. A committee headed by Dean (Academic Affairs) shall be the deciding authority for granting the condonation.

c) Students who have been granted condonation shall pay a fee as decided by the Finance Committee.

d) Shortage of Attendance more than 10% (attendance less than 65% in aggregate) shall in no case be condoned.

e) Students whose shortage of attendance is not condoned in any semester are detained and are not eligible to take their end examinations of that semester. **They get detained and their registration for that semester shall stand cancelled**, including all academic credentials (internal marks etc.,) of that semester. **They will not be promoted to the next semester**. They may seek re-registration for all those subjects registered in that semester in which the student is detained, by seeking re- admission into that semester as and when offered; if there are any professional electives and/ or open electives, the same may also be reregistered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that

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

7. Paper Setting, Evaluation of Answer Scripts, Marks and Assessment:

a) Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the Academic Council from time to time.

b) Distribution and Weightage of marks

S. No	Components	Internal	External	Total
1	Theory	40	60	100
2	Practical	40	60	100
3	Graphics for Engineers	40	60	100
4	Mini Project	40	60	100
5	Project Work	40	60	100

c) Continuous Internal Evaluation and Semester End Examinations: The assessment of the student's performance in each course will be based on Continuous Internal Evaluation(CIE) and Semester-End Examination (SEE). The marks for each of the component of assessment are fixed as shown in the following Table.

Assessment Procedure:

S. No	Componentof Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Theory	40	Internal Examination & Continuous Evaluation	1) Two mid semester examination shall be conducted for 30 marks each for a duration of 120 minutes. Average of the two mid exams shall be considered **i) Subjective – 20 marks** **ii) Objective – 10 marks** 2) Continuous Evaluation is for each unit using **i) Assignment – 05 marks** **ii) Quiz/Subject Viva-voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject – 05 marks**
		60	Semester end examination	The semester-end examination isfor a duration of 3 hours

2	Practical	40	Internal Examination & Continuous Evaluation	One internal lab examination towards the end of course for a duration of 90 minutes with a viva of 5 minutes. **i) Internal Exam-10 marks** **ii) Viva voce – 10 marks** **iii) Continuous Assessment- 10 marks** **iv) G-Lab on Board(G-LOB) (Case study inter threading of all experiments of lab)/ Laboratory Project/Prototype Presentation/App Development -10 marks**
		60	Semester end examination	The semester-end examination isfor a duration of 3 hours. **i) write-up (algorithm/flowchart/procedure) as per the task/experiment/program - 10 marks** **ii) task/experiment/program-15 marks** **iii) evaluation of results -15 marks** **iv) write-up (algorithm/flowchart/procedure) for another task/experiment/program- 10 marks** **v) viva-voce on concerned laboratory course - 10 marks**
3	Graphics for Engineers	40	Internal Examination & Continuous Evaluation	1) Two mid semester examination shall be conducted for 15 marks each for a duration of 90 minutes. Average of the two mid exams shall be considered 2) Day-to-Day activity -15 marks 3) Continuous Evaluation using • **Assignment – 05 marks** • **Quiz/Subject Viva-voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject – 05 marks**
		60	Semester end examination	The semester-end examination is for a duration of 3 hours

d) Mini Project:

S. No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Mini Project	40	Continuous Evaluation & Internal Evaluation	1) The supervisor continuously assesses the students for 20 marks **i) Continuous Assessment – 15 marks** • Abstract Presentation - 3 marks • Architectural Design Presentation - 3 marks • Modules Presentation - 3 marks • Execution Cycle 1 Presentation - 3 marks • Execution Cycle 2 Presentation - 3 marks **ii) Report – 5 marks** 2) At the end of the semester, Mini Project shall be displayed in the road show at the department level. Mini Project is evaluated by Mini Project Review Committee for **10 marks**. 3) Technical Event Participation in project area/MOOCs Course in project area/ Paper Publication/Publishing or Granting of a Patent/Hackathon participation/ Book Publication – **10 marks**
		60	External Evaluation	The mini project report shall be presented before Project Review Committee in the presence of External Examiner and the same is evaluated for **60 marks**.

Note:

i) Mini Project Review Committee consists of HoD, Mini Project Coordinator and Supervisor.

ii) Plagiarism check is compulsory for mini project report as per the plagiarism policy of GRIET.

e) Internship/Skill Development Course/ Industrial Training: Internship/Skill Development Course/Industrial Training shall be done by the student immediately after II-Year II Semester Examinations and pursue it during summer vacation/semester break & during III Year without effecting regular course work. Internship/Skill Development Course/Industrial Training at reputed organization shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination.

f) Project Work (Phase–I and Phase-II):

S. No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Project Work (Phase- I and Phase -II)	40	Continuous Evaluation & Internal Evaluation	1) The supervisor continuously assesses the students for 20 marks **i) Continuous Assessment – 15 marks** • Abstract Presentation - 3 marks • Architectural Design Presentation - 3 marks • Modules Presentation - 3 marks • Execution Cycle 1 Presentation - 3 marks • Execution Cycle 2 Presentation – 3 marks **ii) Report – 5 marks** 2) At the end of the semester, Project work shall be displayed in the road show at the department level. Project work is evaluated by Project Review Committee for **10 marks**. 3) Technical Event Participation in project area/ MOOCs Course in project area/ Paper Publication/Publishing or Granting of a Patent/Hackathon participation/Book Publication – **10 marks.**
		60	External Evaluation	The Project report shall be presented before Project Review Committee in the presence of External Examiner and the same is evaluated for **60 marks**.

Note:

i) Project Review Committee consists of HoD, Project Coordinator and Supervisor.

ii) Plagiarism check is compulsory for project work report (Phase I and Phase II) as per the plagiarism policy of GRIET.

iii) The above rules are applicable for both Phase I and Phase II.

- A student is deemed to have satisfied the academic requirements and earned the credits allotted to **Project Stage-I** if the student secures not less than 40% of marks (40 marks out of 100 marks) in the evaluation of the same.

- A student is deemed to have failed if the student does not submit a report on work carried out during Project Stage-I or does not make a presentation of the same before the evaluation committee as per schedule or secures less than minimum marks in the evaluation.
- A student who has failed may reappear once for evaluation when it is scheduled again; if the student fails in the evaluation of 'one such reappearance', the student has to reappear for the same in the subsequent semester, as and when it is offered.
- A student is deemed to have satisfied the academic requirements and earned the credits allotted to **Project Stage-II** if the student secures not less than 35% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), 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 subject/ course.
- The student is deemed to have failed if the student does not submit a report on work carried out during Project Stage-II or does not make a presentation of the same before the evaluation committee as per schedule or secures less than minimum marks in either CIE or SEE or CIE+SEE taken together.
- A student who has failed may reappear once for the evaluation when it is scheduled again; if the student fails again in the evaluation of "once such reappearance", the student has to reappear for the same in the subsequent semester as and when the evaluation is scheduled.

g) The evaluation of courses having ONLY **CIE** is as follows:

- **Elements of CE/EEE/ME/ECE/CSE as a Theory Course,** in I year I semester is evaluated for **50 marks**. The CIE for 50 marks shall be done through first and second mid-term examinations. The average marks of two mid-term examinations are taken as final marks in CIE. Student shall have to earn 40% i.e. 20 marks out of 50 marks in the average of two mid-term examinations. **There shall be no external evaluation.** The student is deemed to have failed, if he (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

  CIE is done for 50 marks as follows:
  - There shall be two mid-term examinations during the semester conducted for 40 marks consisting of two parts with a total duration of 2 hours: Part A for 20 marks and Part B for 20 marks.
  - Part A is an objective paper or a quiz and shall consist of multiple- choice questions, fill-in-the blanks, match the following, etc. for a total of 20 marks.

- Part B is a descriptive paper and shall contain 6 questions out of which, the student needs to answer 4 questions each carrying 5 marks.
- While the first mid-term examination shall be conducted for the first 50% syllabus, the second mid-term examination shall be conducted for the remaining 50% of the syllabus. The average of the two mid-term examinations shall be taken as final marks.
- Two assignments are evaluated for 5 marks each. 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. The assignments shall be given by the subject teachers. The average of the two assignments shall be taken as the final marks.
- The remaining 5 marks may be evaluated by conducting viva-voce in the subject or by evaluating the performance of the student in PPT/Poster/Case-Study presentation on a topic in the concerned subject before second mid-term examination**.**

- **Elements of CE/EEE/ME/ECE/CSE as a Lab Course,** in I year I semester is evaluated for **50 marks**.

  CIE is done for 50 marks as follows:
  - A write-up on day-to-day experiments in the laboratory (in terms of aim, components/procedure, expected outcome) shall be evaluated for 10 marks
  - 10 marks are awarded either for the performance in viva-voce (or) case study presentation (or) application development (or) poster presentation.
  - Internal practical examination shall be conducted by the concerned laboratory teacher for 15 marks.
  - The remaining 15 marks are awarded for laboratory project, which consists of the design (or) model presentation (or) prototype presentation at the end of the completion of laboratory course and before semester end practical examination.

- **Real-Time/Field-based Research Project C**ourse in II-year II Semester is evaluated for **50 marks.** The internal evaluation is for 50 marks shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be **NO external evaluation**.

  A student is deemed to have satisfied the academic requirements and earned the credits allotted to "Real-Time/Field-Based Research Project" if the student secures not less than 40% marks (i.e. 20 marks out of 50 marks) in the evaluation of the same.

  A student is deemed to have failed in Real-Time/Field-Based Research Project, if he (i) does not submit a report on the same or (ii) does not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in evaluation of the same.

A student who is failed in either Real-Time/Field-Based Research Project may reappear once for the evaluation when they are scheduled again; if the student fails again in the evaluation of 'one such reappearance', the student has to reappear for the same in the subsequent semester, as and when it is offered.

- **Mandatory Courses** are evaluated for **50 marks.** The CIE for 50 marks shall be done through first and second mid-term examinations. The average marks of two mid-term examinations are taken as final marks in CIE. Student shall have to earn 40% i.e. 20 marks out of 50 marks in the average of two mid-term examinations. There shall be **NO external evaluation**. The student is deemed to have failed, if he (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

  A mandatory course is not graded and does not carry credits. Only Pass/Fail shall be indicated in Grade Card

  The evaluation pattern for mandatory courses shall be done similar to **Elements of CE/EEE/ME/ECE/CSE as a Theory Course.**

8. **Recounting of Marks in the End Examination Answer Books:** A student can request for recounting of his/her answer book on payment of a prescribed fee.

9. **Re-evaluation of the End Examination Answer Books:** A student can request for re- evaluation of his/her answer book on payment of a prescribed fee.

10. **Supplementary Examinations:** A student who has failed to secure the required credits can register for a supplementary examination, as per the schedule announced by the College for a prescribed fee.

11. **Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/ End-examinations as per the rules framed by the Academic Council.

12. **Re-registration for mid examination:** A student shall be given one time chance to re-register for a maximum of two subjects in a semester:
    - If the internal marks secured by a student in Continuous Internal Evaluation marks for 40 (sum of average of 2 mid-term examinations, average of all assignments and Subject Viva-voce/ PPT/Poster Presentation/Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.
    - A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork when the course is offered next, it could be semester for first years and a year for others.
    - In the event of the student taking this chance, his/her Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

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

a) A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% (14 marks out of 40), not less than 35% (21 marks out of 60 marks) in the semester end examination, 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.

The student is eligible to write Semester End Examination of the concerned subject/course if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.
In case, the student appears for Semester End Examination (SEE) of the concerned subject/course but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his/her performance in that subject/course in SEE shall stand cancelled inspite of appearing the SEE.

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	First year first semester toFirst year second semester	Regular course of study of First year first semester.
2	First year second semester toSecond year first semester	**(i)** Regular course of study of First y ear second semester. **(ii)** Must have secured at least 50% 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 toSecond year second semester	Regular course of study of Second year first semester.
4	Second year second semester to Third year first semester	**(i)** Regular course of study of Second year second semester **(ii)** Must have secured at least 60% 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.

6	Third year second semesterto Fourth year first semester	**(i)** Regular course of study of Third year second semester. **(ii)** Must have secured at least 60% credits upto Third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Fourth year first semester toFourth year second semester	Regular course of study of Fourth year first semester.

14. Grade Points: A 10 - point grading system with corresponding letter grades and percentage of marks, as given below, is followed

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	

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

Computation of SGPA and CGPA:

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

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

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

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

ii) The CGPA is calculated in the same manner taking into account all the courses **m**, registered by student over all the semesters of a programme, i.e.,

up to and inclusive of **Sk**, where **k ≥ 2**.

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

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

15. **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 160 credits.

S. No	Class Awarded	CGPA Secured
1	First Class with Distinction	CGPA >= 8.00 with no F or below grade/detention anytime during the programme
2	First Class	CGPA >= 8.00 with rest of the clauses of S.No 1 not satisfied
3	First Class	CGPA ≥ 7.00 and CGPA <8.00
4	Second Class	CGPA ≥ 6.00 and CGPA <7.00
5	Pass Class	CGPA ≥ 5.00 and CGPA <6.00

Equivalence of grade to marks

Marks % = (CGPA -0.5)*10

16. **Award of 2-Year B.Tech Diploma Certificate**

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) upto B.Tech – II Year – II Semester if the student want to exit the 4-Year B.Tech program and requests for the 2-Year B.Tech (UG) Diploma Certificate.

2. The student **once opted and awarded for 2-Year UG Diploma Certificate, the student will be permitted to join** in B.Tech III Year – I Semester and continue for completion of remaining years of study for 4-Year B.Tech Degree. ONLY in the next academic year along with next batch students. However, if any student wishes to continue the study after opting for exit, he/she should register for the subjects/courses in III Year I Semester before commencement of classwork for that semester.

3. The students, who exit the 4-Year B.Tech program after II Year of study and wish to re-join the B.Tech program, must submit the 2 -Year B.Tech (UG) Diploma Certificate awarded to him, subject to the eligibility for completion of Course/Degree.

4. A student may be permitted to take one year break after completion of II Year II Semester or B.Tech III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next**

Academic Year in the same college and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

17. **Withholding of Results:** If the student has not paid dues to the Institute/ University, or if any case of indiscipline is pending against the student, the result of the student (for that Semester) may be withheld and the student will not be allowed to go into the next semester. The award or issue of the Degree may also be withheld in such cases.

18. **Transitory Regulations**

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of GR22 Regulations due to lack of attendance, shall be permitted to join I year I Semester of GR24 Regulations and he is required to complete the study of B.Tech programme within the stipulated period of eight academic years from the date of first admission in I Year.

2. A student who has been detained in any semester of II, III and IV years of GR22 regulations for want of attendance, shall be permitted to join the corresponding semester of GR24 Regulations and is required to complete the study of B.Tech within the stipulated period of eight academic years from the date of first admission in I Year. The GR24 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

3. A student of GR22 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of GR24 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both GR22 & GR24 regulations. The student is required to complete the study of B.Tech within the stipulated period of eight academic years from the year of first admission. The GR24 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in GR24 Regulations:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.

5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including GR24 Regulations. **There is NO exemption of credits in any case**.

6. If a student is readmitted to GR24 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in GR24 Regulations will be substituted by another subject to be suggested by the college academic administration.

Note:

If a student readmitted to GR24 Regulations and has not studied any courses/topics in his/her earlier regulations of study which is prerequisite for further subjects in GR24 Regulations, then the college shall conduct remedial classes to cover those courses/topics for the benefit of the students.

19. **Transfer of students from the Constituent Colleges of JNTUH or from other Colleges / Universities:**

a) Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities shall be considered only on case-to-case basis.

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

c) The students seeking transfer to GRIET from various other Universities/institutions have to pass the failed courses which are equivalent to the courses of GRIET, and also pass the courses of GRIET which the students have not studied at the earlier institution. Further, though the students have passed some of the courses at the earlier institutions, if the same courses are prescribed in different semesters of GRIET, the students have to study those courses in GRIET in spite of the fact that those courses are repeated.

d) The transferred students from other Universities/institutions to GRIET who are on rolls are to be provided one chance to write the CBT (internal marks) in the **equivalent course(s)** as per the clearance (equivalence) letter issued by the University.

20. General Rules

a. The academic regulations should be read as a whole for the purpose of any interpretation.

b. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

c. In case of any error in the above rules and regulations, the decision of the Academic Council is final.

d. The college may change or amend the academic regulations or syllabi at any time andthe changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

Academic Regulations for B.Tech (Lateral Entry) under GR24

(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 for all 120 credits and secure all credits. The marks obtained in all 120 credits shall be considered for the calculation of the final CGPA.
   - **c)** 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.
2	Second year second semester toThird year first semester.	(i) Regular course of study of Second year second semester. (ii) Must have secured at least 50% credits up to Second year second semesterfrom 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.
4	Third year second semester toFourth year first semester.	(i) Regular course of study of Third year second semester. (ii) Must have secured at least 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to Fourth year second semester.	Regular course of study of Fourth year first semester.

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 >= 8.00 with no F or below grade/ detention anytime during the Programme
2	First Class	CGPA >= 8.00 with rest of the clauses of S.no 1 not satisfied
3	First Class	CGPA ≥ 7.00 and CGPA <8.00
4	Second Class	CGPA ≥ 6.00 and CGPA <7.00
5	Pass Class	CGPA ≥ 5.00 and CGPA <6.00

Academic Regulations for B.Tech with Minors Programme under GR24

(Applicable for Batches Admitted from 2024-25)

1. Objectives

The key objectives of offering B.Tech with Minor program 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). All these 18 credits need to be completed in III year and IV year only.

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 III year I semester.

b) Prior approval of mentor and Head of the Department for the enrolment into Minor programme, before commencement of III year I Semester (V 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) – GR24 Course Structure

I B. Tech I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext	Total Marks
					L	T	P	Total			
1	Maths	BS	GR24A1001	Linear Algebra and Function Approximation	3	1	0	4	40	60	100
2	Chemistry	BS	GR24A1004	Engineering Chemistry	3	1	0	4	40	60	100
3	CSE	ES	GR24A1006	Programming forProblem Solving	2	0	0	2	40	60	100
4	ME	ES	GR24A1012	Elements of Mechanical Engineering	1	1	0	1	50	--	50
5	ME	ES	GR24A1016	Graphics for Engineers	1	0	4	3	40	60	100
6	Chemistry	BS	GR24A1019	Engineering Chemistry Lab	0	0	3	1.5	40	60	100
7	CSE	ES	GR24A1021	Programming forProblem Solving Lab	0	0	3	1.5	40	60	100
8	ME	ES	GR24A1025	Engineering Workshop Lab	1	0	3	2.5	40	60	100
		TOTAL			**11**	**3**	**13**	**19.5**	**370**	**480**	**850**
9	Mgmt	MC	GR24A1028	Design Thinking	2	0	0	0	50	--	50

I B. Tech II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext	Total Marks
					L	T	P	Total			
1	Maths	BS	GR24A1002	Differential Equations and Vector Calculus	3	1	0	4	40	60	100
2	Physics	BS	GR24A1003	Applied Physics	3	1	0	4	40	60	100
3	ME	ES	GR24A1015	Engineering Mechanics	3	1	0	4	40	60	100
4	English	BS	GR24A1005	English	2	0	0	2	40	60	100
5	CSE	ES	GR24A1017	Data Structures	2	0	0	2	40	60	100
6	CSE	ES	GR24A1027	Python Programming	1	0	0	1	50	--	50
7	Physics	BS	GR24A1018	Applied Physics Lab	0	0	3	1.5	40	60	100
8	English	BS	GR24A1020	English Language and Communicatio nSkills Lab	0	0	2	1	40	60	100
9	CSE	ES	GR24A1024	Data Structures Lab	0	0	2	1	40	60	100
		TOTAL			**14**	**3**	**7**	**20.5**	**370**	**480**	**850**

II B.Tech I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext.	Total Marks
					L	T	P	Total			
1	ME	PC	GR24A2039	Kinematics of Machinery	3	0	0	3	40	60	100
2	ME	PC	GR24A2040	Metallurgy and Material Science	3	0	0	3	40	60	100
3	EEE	ES	GR24A2013	Basic Electrical and Electronics Engineering	3	0	0	3	40	60	100
4	ME	PC	GR24A2041	Strength of Materials	3	0	0	3	40	60	100
5	ME	PC	GR24A2042	Thermodynamics	3	0	0	3	40	60	100
6	ME	PC	GR24A2048	Manufacturing Engineering	2	0	0	2	40	60	100
7	ME	PC	GR24A2044	Metallurgy and Material Science Lab	0	0	2	1	40	60	100
8	ME	PC	GR24A2043	Strength of Materials Lab	0	0	2	1	40	60	100
9	ME	PC	GR24A2050	Manufacturing Engineering Lab	0	0	2	1	40	60	100
Total					**17**	**0**	**6**	**20**	**360**	**540**	**900**
10	ME	MC	GR24A2002	Value Ethics and Gender Culture	2	0	0	0	50	--	50

II B.Tech II Semester

S. No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext.	Total Marks
					L	T	P	Total			
1	ME	PC	GR24A2045	Thermal Engineering	3	0	0	3	40	60	100
2	ME	PC	GR24A2046	Fluid Mechanics and Fluid Machines	3	0	0	3	40	60	100
3	ME	PC	GR24A2047	Dynamics of Machinery	3	0	0	3	40	60	100
4	Maths	BS	GR24A2008	Computational Mathematics for Engineers	3	0	0	3	40	60	100
5	ME	PC	GR24A2052	Manufacturing Technology and Metrology	3	0	0	3	40	60	100
6	ME	PC	GR24A2049	Thermal Engineering Lab	0	0	2	1	40	60	100
7	ME	PC	GR24A2051	Fluid Mechanics and Fluid Machines Lab	0	0	2	1	40	60	100
8	ME	PC	GR24A2053	Manufacturing Technology and Metrology Lab	0	0	2	1	40	60	100
9	ME	PW	GR24A2106	Real-time Research Project/ Societal Related Project	0	0	4	2	50	--	50
Total					**15**	**0**	**10**	**20**	**370**	**480**	**850**
10	Mgmt	MC	GR24A2001	Environmental Science	2	0	0	0	50	--	50

III Year I Semester

S.No.	BOS	Group	Course Code	Course Name	Credits				Int.	Ext.	Total Marks
					L	T	P	Total			
1	ME	PC		Basic Machine Design	2	1	0	3	40	60	100
2	Mgmt	HS		Economics and Accounting for Engineers	3	0	0	3	40	60	100
3	ME	PC		CAD/CAM	2	0	0	2	40	60	100
4	ME	PC		Applied Thermodynamics	2	0	0	3	40	60	100
5		PE-I		Professional Elective-I	3	0	0	3	40	60	100
6		OE-I		Open Elective-I	3	0	0	3	40	60	100
7	ME	PC		IOT Lab	0	0	3	1	40	60	100
8	ME	PC		Computer Aided Modeling and Analysis Lab	0	0	3	1	40	60	100
9	ME	PC		Advanced manufacturing Processes Lab	0	0	3	1	40	60	100
				Total	**15**	**1**	**9**	**20**	**360**	**540**	**900**
10	Mgmt	MC		Constitution of India	2	0	0	0	50	--	50

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				Int.	Ext.	Total Marks
					L	T	P	Total			
1	ME	PC		Advanced Machine Design	3	0	0	3	40	60	100
2	ME	PC		Heat Transfer	2	1	0	3	40	60	100
3	ME	PC		Additive Manufacturing	3	0	0	3	40	60	100
4		PE-II		Professional Elective-II	3	0	0	3	40	60	100
5		OE-II		Open Elective-II	3	0	0	3	40	60	100
6	ME	PC		Computer Aided Manufacturing and 3D Printing Lab	0	0	2	1	40	60	100
7	ME	PC		Heat Transfer Lab	0	0	2	1	40	60	100
8	ME	PW		Mini Project with Seminar	0	0	4	2	40	60	100
9	English	BS		Effective Technical Communication	2	0	0	1	40	60	100
				Total	**16**	**1**	**8**	**20**	**360**	**540**	**900**

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				Int.	Ext.	Total Marks
					L	T	P	Total			
1	ME	PC		Applied Finite Element Methods and Computational Fluid Dynamics	3	0	0	3	40	60	100
2	ME	PC		Instrumentation and Control Systems	3	0	0	3	40	60	100
3		PE-III		Professional Elective-III	3	0	0	3	40	60	100
4		PE-IV		Professional Elective-IV	3	0	0	3	40	60	100
5		OE-III		Open Elective-III	3	0	0	3	40	60	100
6	ME	PC		Instrumentation and Control Systems Lab	0	0	2	1	40	60	100
7	ME	PC		CFD Lab	0	0	2	1	40	60	100
8	ME	PW		Project Work-Phase I	0	0	12	6	40	60	100
				Total	**15**	**0**	**16**	**23**	**320**	**480**	**800**

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

IV B.Tech II Semester

S.No.	BOS	Group	Course Code	Course Name	Credits				Int.	Ext.	Total Marks
					L	T	P	Total			
1	ME	PC		Industrial Engineering and Management	3	0	0	3	40	60	100
2	ME	PC		Operations Research and Management	2	0	0	2	40	60	100
3		PE-V		Professional Elective-V	3	0	0	3	40	60	100
4		PE-VI		Professional Elective-VI	3	0	0	3	40	60	100
5	ME	PW		Project Work-Phase II	0	0	12	6	40	60	100
				Total	**11**	**0**	**12**	**17**	**200**	**300**	**500**

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 GR24 REGULATIONS

THREAD 1	THREAD 2	OFFERED BY
Soft Skills and Interpersonal Skills Human Resource Development and Organizational Behavior Cyber Law and Ethics Economic Policies in India	Data Science for Engineers	**CSE**
	Data Analytics using Open-Source Tools	
	Augmented Reality and Virtual Reality	
	Basics of Java Programming	**CSE (AIML)**
	Introduction to DBMS	
	Introduction to Data Mining	
	Programming in Python	**CSE (DS)**
	Internet of Things	
	Scripting Languages	
	Services Science and Service Operational Management	**CSBS**
	IT Project Management	
	Marketing Research and Marketing Management	
	Introduction to Data Science	**IT**
	User Centric Human Computer Interaction	
	Design Patterns	
	Non Conventional Energy Sources	**EEE**
	Concepts of Control Systems	
	Artificial Neural Networks and Fuzzy Logic	
	Principles of Communications	**ECE**
	Sensor Technology	
	Communication Technologies	
	Industrial Automation and Control	**ME**
	Composite Materials	
	Operations Research	
	Engineering Materials for Sustainability	**CE**
	Geographic Information Systems and Science	
	Environmental Impact Assessment	
	Basics of Java Programming	**CSE (AI)**
	Introduction to DBMS	
	Introduction to Data Mining	
	Introduction to Data Science	**CSIT**
	User Centric Human Computer Interaction	
	Design Patterns	

I Year
I Semester

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

LINEAR ALGEBRA AND FUNCTION APROXIMATION

Course Code: GR24A1001 **L/T/P/C: 3/1/0/4**

I Year I Semester

Prerequisites: Elementary knowledge of vectors, matrices and pre-calculus.

Course Outcomes:

1. Work with the essential tools of vector and matrix algebra.
2. Compute eigenvalues and vectors for engineering applications.
3. Illustrate matrix decomposition techniques to determine the exact or approximate solutions of a linear algebraic system.
4. Illustrate the concepts of function approximation with measurement of error.
5. Develop the skill of finding multivariable function optima.

UNIT I

Fundamentals of Vector and Matrix algebra: Operations on vectors and matrices- Orthogonal projection of vectors- Exact and generalized inverse of a matrix- Rank of a matrix- Linear independence of vectors- Structured square matrices (Symmetric, Hermitian, skew-symmetric, skew-Hermitian, orthogonal and unitary matrices)- Vector and matrix norms Solution of a linear algebraic system of equations (homogeneous and non-homogeneous) using Gauss elimination.

UNIT II

Matrix eigenvalue problem and Quadratic forms: Determination of eigenvalues and eigenvectors of a matrix, properties of eigenvalues and eigenvectors (without proof)- Similarity of matrices- Diagonalization of a matrix- Orthogonal diagonalization of a symmetric matrix- Definiteness of a symmetric matrix.

Quadratic Forms- Definiteness and nature of a quadratic form- Reduction of a quadratic form to the canonical form using an orthogonal transformation.

UNIT III

Matrix decomposition and Least squares solution of algebraic systems : LU decomposition- Cholesky decomposition- Gram-Schmidt orthonormalization process- QR factorization- Eigen decomposition of a symmetric matrix- Singular value decomposition.

Least squares solution of an over determined system of equations using QR factorization and the generalized inverse- Estimation of the least squares error.

UNIT IV

Function approximation tools in engineering: Mean value theorems- Lagrange's mean value theorem, Taylor's theorem (without proof), Approximation off a function by Taylor's series.

The principle of least squares- Function approximation using polynomial, exponential and power curves using matrix notation- Estimating the Mean squared error.

UNIT V

Multivariable differential calculus and Function optimization: Partial Differentiation- Chain rule- Total differentiation- Jacobian- Functional dependence.

Multivariable function Optimization-Taylor's theorem for multivariable functions- Unconstrained optimization of functions using the Hessian matrix- Constrained optimization using the Lagrange multiplier method.

Text Books

1. Advanced Engineering Mathematics, 5th edition, R.K.Jain and S.R.K.Iyengar, Narosa publishing house.
2. Higher Engineering Mathematics- B.S.Grewal- Khanna publications.

References

1. Introduction to Linear Algebra, Gilbert Strang, 5th edition, Wellesley,2017.
2. Numerical methods for scientific and engineering computation, M.K.Jain, S.R.K.Iyengar, R.K.Jain- 3rd edition- New Age publishers
3. Applied Mathematics, Vol. I & II, P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, 2010

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING CHEMISTRY

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

I Year I Semester

Course Outcomes:

1. Assess the specification of water regarding its usage in domestic & Industrial scenarios.
2. Learn the working principles of various energy storage devices, and electrochemical reactions involved in corrosion.
3. Analyze the efficacy of polymers in diverse applications.
4. Distinguish various energy sources to prioritize eco-friendly fuels for environmentally sustainable development.
5. Interpret the role of engineering materials in various sectors.

UNIT I **(8 Lectures)**

Water and its Treatment: Introduction to the hardness of water – Estimation of hardness of water by complexometric method and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break-point chlorination. Boiler troubles: Sludges, Scales, and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning, External treatment methods - Softening of water by ion-exchange processes. Desalination of water – Reverse osmosis

UNIT II **(8 Lectures)**

Battery Chemistry and Corrosion: Introduction - Classification of **Batteries**- primary, and secondary batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of Zn-air and Lithium-ion battery, Applications of Li- ion battery to electric vehicles.

Fuel Cells - Definition, Construction, working principle and applications of Hydrogen- Oxygen fuel cell and Solid oxide fuel cell, Differences between battery and a fuel cell.

Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current methods.

UNIT III **(8 Lectures)**

Polymers: Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples – Nylon 6:6

Plastics: Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite, Compounding and fabrication of plastics - compression moulding and injection moulding. Fiber-reinforced plastics (FRP).

Conducting Polymers: Characteristics and Classification with examples-mechanism of

conduction in trans-polyacetylene and applications of conducting polymers.

Biodegradable Polymers: Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

UNIT IV (8 Lectures)

Energy Resources: Introduction, Calorific value of fuel – HCV, LCV- Dulong's formula. Classification- solid fuels: **Coal** – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – **Petroleum** and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages.

UNIT V (10 Lectures)

Engineering Materials: Smart materials and their engineering applications: Shape memory materials- Poly L- Lactic acid. Thermoresponse materials- Polyacryl amides, Poly vinyl amides.

Biosensors: Definition, characteristics, classification-, construction & working, applications and advantages of biosensors. Biochips -Definition, advantages, and applications.

Semiconductors: Si and Ge - Preparation, Ultra-purification and Crystal Growth by Zone Refining and Czochralski Crystal Pulling methods, Doping – Epitaxy, Diffusion and Ion-implantation.

Text Books

1. Engineering Chemistry by P.C. Jain and M. Jain; Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Engineering Chemistry, Rama Devi, Venkata Ramana Reddy and Rath, Cengage Learning, 2016.

Reference Books

1. A Textbook of Engineering Chemistry by Shashi Chawla, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Engineering Chemistry by O.G.Palanna, Tata McGraw Hills Private Ltd.
3. Engineering Chemistry, Shikha Agarwal, Cambridge University Press, 2015.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING

Course Code: GR24A1006 **L/T/P/C: 2/0/0/2**

I Year I Semester

Course Outcomes

1. Design algorithms and flowcharts for problem solving and illustrate the fundamentalsof C language.
2. Apply control structures and arrays to solve problems.
3. Discover the need for strings and functions in problem solving and apply it.
4. Analyze the need for pointers and structures in C and implement for solutions.
5. Demonstrate file handling mechanism, 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: Structure of C program, keywords, variables, constants, datatypes, operators, precedence and associativity, expression evaluation, implicit andexplicit type conversion, formatted and unformatted I/O.

UNIT II

Decision Making and Arrays:

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.

Arrays: One and two dimensional arrays, creating, accessing and manipulating elements of arrays.

Searching: Introduction to searching, Linear search and Binary search.

UNIT III

Strings and Functions:

Functions: Introduction to structured programming, 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, storage classes.

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: Idea of pointers, declaration and initialization of pointers, pointer to pointer, voidpointer, null pointer, pointers to arrays and structures, function pointer.

Structures and Unions: Defining structures, declaring and initializing structures, arrays withinstructures, array of structures, nested structures, passing structures to functions, unions, typedef.

UNIT V

File handling and Preprocessor in C:

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

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

Teaching methodologies:

- Power Point 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 Hallof 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, Mc Graw Hill, 4th Edition

G**OKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

ELEMENTS OF MECHANICAL ENGINEERING

Course Code: GR24A1012 **L/T/P/C: 1/1/0/1**

I Year I Semester

Course Outcomes

1. Identify different sources of energy and their conversion process.
2. Explain the working principle of hydraulic turbines, pumps, IC engines and refrigeration.
3. Recognize various metal joining processes and power transmission elements.
4. Understand the properties of common engineering materials and their applications in engineering industry.
5. Discuss the working of conventional machine tools, machining processes, tools and accessories.

UNIT I

Basic concepts of Thermodynamics: Introduction, states, concept of work, heat, temperature; Zeroth, 1st, 2nd and 3rd laws of thermodynamics. Concept of internal energy, enthalpy and entropy

UNIT II

Boilers: Introduction to boilers, classification, Lancashire boiler, Babcock and Wilcox boiler. Introduction to boiler mountings and accessories (no sketches).

Turbines: Hydraulic Turbines, Steam turbines, gas turbines, Compressors and Pumps - Classification, Principles and operations, Advantages and Disadvantages

UNIT III

Internal Combustion Engines

Classification, I.C. Engines parts, 2 and 4 stroke petrol and 4-stroke diesel engines. P-V diagrams of Otto and Diesel cycles. Simple problems on indicated power, brake power, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency and specific fuel consumption.

Refrigeration and Air conditioning

Refrigeration - Definitions - Refrigerating effect, Ton of Refrigeration, Ice making capacity, COP, relative COP, Unit of Refrigeration. Refrigerants, Properties of refrigerants, List of commonly used refrigerants. Principle and working of vapor compression refrigeration.

UNIT IV

Properties, Composition and Industrial Applications of engineering materials

Metals - Ferrous: cast iron, tool steels and stainless steels and nonferrous: aluminum, brass, bronze. Polymers Thermoplastics and thermosetting polymers. Ceramics - Glass, optical fiber glass, cermets. Composites - Fiber reinforced composites, Metal Matrix Composites Smart Materials Piezoelectric materials, shape memory alloys, semiconductors and insulators.

Joining Processes: Soldering, Brazing and Welding

Definitions. Classification and methods of soldering, brazing and welding. Brief description of arc welding, oxy-acetylene welding, TIG welding, and MIG welding.

Power Transmitting Devices: Belt Drives and Gear Drives Definitions advantages and disadvantages**.**

UNIT V

Lathe - Principle of working of a centre lathe. Parts of a lathe. Operations on lathe - Turning, Facing. Knurling. Thread Cutting. Drilling. Specification of Lathe

Milling Machine- Principle of milling, types of milling machines. Working of horizontal and vertical milling machines. Milling processes - plane milling, end milling.

Advanced Manufacturing Systems

Computer Numerical Control (CNC): Introduction, Computer Aided Product Life Cycle, components of CNC, 3D Printing, Applications

Robots: Robot anatomy, joints and links, common robot configurations. Applications of Robots in material handling, processing and assembly and inspection.

Textbooks:

1. Elements of Mechanical Engineering, K. R. Gopalakrishna, Subhas Publications, Bangalore, 2008.
2. Elements of Mechanical Engineering, Vol.-1 & 2, Hajra Choudhury, Media Promoters, New Delhi, 2001.

Reference Books:

1. Elements of Mechanical Engineering, R.K. Rajput, Firewall Media, 2005.
2. CAD/CAM/CIM, Dr. P Radhakrishnan, 3rd edition, New Age International Publishers, New Delhi 2016
3. Introduction to Robotics: Mechanics And Control, Craig, J. J., 2nd Ed.Addison-Wesley Publishing Company, Readong, MA, 1989.
4. Introduction to Engineering Materials", B.K. Agrawal,Tata McGraHill Publication, New Delhi. 2014
5. Thermal Science and Engineering", Dr. D.S. Kumar, S.K. Kataria & sons Publication, New Delhi. 2015

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

GRAPHICS FOR ENGINEERS

Course Code: GR24A1016 **L/T/P/C:**

1/0/4/3

I Year I Semester

Course Outcomes

1. Generate two dimensional drawings and apply AutoCAD commands.
2. Interpret projection methods and draw projections of line or point objects.
3. Imagine and generate multi-view projections of planes and solid objects in different positions
4. Construct and interpret sectional views and develop 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.

Construction of Engineering Curves- Ellipse, Parabola and Hyperbola -general method only.

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 -in all quadrants and **straight lines -**inclined to one reference plane only.

UNIT III

Projections of planes - definition and types of regular plane figures like triangle, square, pentagon, hexagon, and circle; projections of planes -inclined to one reference plane only.

Projections of solids - definition and types of right regular solids objects like prism, cylinder, pyramid, and cone; projections of solids -axis inclined to one reference plane only.

UNIT IV

Sections of solids- Section and sectional views of right regular solids like Prism, Cylinder, Pyramid and Cone – Auxiliary Views.

Development of surfaces- Development of surfaces of Right Regular Solids like Prism, Pyramid, Cylinder and Cone.

UNIT V

Isometric views– isomeric views of lines, planes (polygons) and solids (prism, cylinder, pyramid, and cone); generation of Isometric line diagrams. World Coordinate System, User Coordinate System.

Conversion of Isometric Views to Orthographic Views and Vice-versa, 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 LAB

Course Code: GR24A1019 **L/T/P/C: 0/0/3/1.5**

I Year I Semester

Course Outcomes:

1. Determination of parameters like hardness of water chloride content in water
2. Able to handle instruments like conductometer and potentiometer to find out the concentrations of acids and bases.
3. Estimate the amount of metal ion present in a given sample.
4. Prepare polymers like bakelite, nylon-6, and aspirin in the laboratory.
5. Find out the physical properties of fluids like adsorption, surface tension, and viscosity.

List of Experiments

1. Determination of Total Hardness of water by a complexometric method using EDTA.
2. Determination of Chloride content of water by Argentometry.
3. Redox titration: Estimation of Ferrous ion using standard $KMnO_4$ bY Permanganometry.
4. Estimation of HCl by Conductometric titrations.
5. Estimation of Ferrous ion by Potentiometry using dichromate.
6. Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.
7. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
8. Determination of Viscosity of liquid by using Ostwald's Viscometer.
9. Determination of Surface tension of liquid by using Stalagmometer.
10. Determination of Partition Coefficient of Acetic acid between n-butanol and water.
11. Preparation of phenol-formaldehyde resin (Bakelite).
12. Synthesis of Aspirin.

Reference Books

1. Vogel's textbook of Practical Organic Chemistry, 5^{th} Edition.
2. A Textbook on Experiments and Calculations in Engineering Chemistry-S. S. Dara, S Chand & Company; 9^{th} edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING LAB

Course Code: GR24A1021 **L/T/P/C: 0/0/3/1.5**

I Year I Semester

Course Outcomes:

1. Translate algorithms into a working program and analyze and debug the codes usingbasics of C language.
2. Develop programs by choosing appropriate control structures.
3. Select and apply the concept of arrays and strings for problem solving.
4. Demonstrate problem solving using modular programming and pointers.
5. Solve the problems using structures, files and pre-processor directives.

TASK 1

a. Write a C program to convert days into years, weeks and days.(Assume a year has 365 days).
b. Write a C program to find greatest and smallest among three numbers using conditional operator.
c. Write a C program to enter P, T, R and calculate Compound Interest.

TASK 2

a. Write a C program to swap two numbers using the following:
   (i) Using third variable
   (ii) Without using third variable
   (iii) Using bitwise operators
b. Write a C program to do the following using implicit and explicit type conversion
   (i) Convert Celsius temperature to Fahrenheit
   (ii) Convert Fahrenheit temperature to Celsius
   (iii) Find area of a triangle given sides a,b,c

TASK 3

a. Write a C program to add two numbers without using arithmetic operators in C.
b. Write a C program to determine whether a number is a power of 2 or not using bitwise operator and ternary operator.
c. Write a C program to check whether a number is even or odd using bitwise operator and ternary operator.

TASK 4

a. Write a C program to find the roots of a quadratic equation using if-else.
b. Write a C program to input electricity unit charges and calculate total electricity bill according to the given condition:
   For first 50 units Rs. 0.50/unit
   For next 100 units Rs. 0.75/unit

For next 100 units Rs. 1.20/unit

For unit above 250 Rs. 1.50/unit, an additional surcharge of 20% is added to the bill

c. Write a menu driven C program to implement a simple arithmetic calculator.
d. Write a C program to display number of days in month using switch case (The input is month number 1 -12).

TASK 5

a. Write a C program check whether a given number is Perfect number or not.
b. Write a C program check whether a given number is Palindrome number or not.
c. Write a C program check whether a given number is Armstrong number or not.
d. Write a C program check whether a given number is Strong number or not.

TASK 6

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

(i)

```
* * * *
*     *
*     *
* * * *
```

(ii)

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

(iii)

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

b. Write a C program to generate the prime numbers between x and y where x and y are starting and ending values to be supplied by the user.
c. Write a C program to calculate the sum of following series:
   (i) $S1=1+x/1!-x^2/2!+x^3/3!-x^4/4!+\ldots..xn/n!$
   (ii) $S2= x^1/1+x^3/3+x^5/5+\ldots.+x^n/n$

TASK 7

a. Write a C program to find sum, average and minimum and maximum in a list of numbers.
b. Write a C program to implement Linear search.
c. Write a C program to implement Binary search.

TASK 8

a. Write a C program to implement matrix addition.
b. Write a C program to implement matrix multiplication.

TASK 9

a. Write a C program to display binary equivalent of a given decimal number using functions.
b. Write a C program to implement transpose of a matrix using functions
c. Write a C program using functions that compares two strings to see whether they are identical or not. The function returns 1 if they are identical, 0 otherwise.

TASK 10

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

recursive functions.

b. Write a C programto find the GCD (greatest common divisor) of two given integers 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 11

a. Write a C program to implement the following with and without string functions:
   (i) Reverse a string (ii) Concatenate 2 strings.
b. Write a C program to read a string and determine whether it is palindrome or not.
c. Write a C program to sort the 'n' strings in the alphabetical order.

TASK 12

a. Write a C program to implement function pointer to find sum and product of two numbers.
b. Write a C program to sort list of numbers using pointers.

TASK 13

a. Define a structure Student, to store the following data about a student: rollno(int), name(string) and marks. Suppose that the class has 'n' students. Use array of type Student and create a function to read the students data into the array. Your program should be menu driven that contains the following options :
   (i) Print all student details
   (ii) Search student by rollno
   (iii) Print the names of the students having the highest test score
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.
b. Write a C program to count number of characters in a file and also convert all lower case characters to upper case and display it.
c. Write a C program to append a file and display it.

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, PrenticeHall of India.
2. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression).
3. Programming in C, Stephen G. Kochan, Fourth Edition, pearson Education.
4. Herbert Schildt, C: The Complete Reference, McGraw Hill, 4th Edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING WORKSHOP LAB

Course Code: GR24A1025 **L/T/P/C: 1/0/ 3/2.5**

I B.Tech I Semester

Course Outcomes

1. Identify workshop tools and their operational capabilities.
2. Practice on manufacturing of 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 Stair Case 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

8. Preparation of a prototype model of any trade under G-LOBE 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

Course Code: GR24A1028 **L/T/P/C: 2/0/0/0**

I Year I Semester

Course Outcomes:

1. Use design thinking and hypothesis-driven innovation processes to develop viable solutions to user challenges.
2. Use multiple brainstorming techniques to find innovative solutions.
3. Develop and test a business model or business case to support the viability of the solution.
4. Prototype a solution to a user challenge.
5. Investigate the cultural, emotional, technological, and business factors relevant to developing a new product or service design concept.

UNIT I

Revisiting Design Thinking :Creative thinking as basis of innovation; Empathy process for deep understanding of challenge with practical ingenuity; Making sense of observations and insights; Defining a point of view and context Design thinking skills for Problem Discovery, Definition, and Ideation – Identifying problems in daily lives and in the world at large, Understanding user and customer perspectives.

UNIT II

Ideation Process: Clear Articulation of problem statement with focus on latent needs; Brainstorming potential solutions; Ideation methods with case-study based approach to using Systematic Inventive Thinking (SIT) Methods such as Addition, Subtraction, Multiplication, Division and Task Unification Strategic Innovation for competition in future: Linear Innovation vs. non-linear innovation, Understanding and identifying weak signals, 3-box thinking, 3-Box framework and Box-3 ideation.

UNIT III

Designing Customer Experience: Understanding Innovation through Design Thinking; Enhancing Customer Experience; Service Design and Development Process and Case Studies; Service Experience Cycle and Case Studies.

UNIT IV

Sustainable Design Approaches: Concern for Environment and Sustainability in Design, Case Studies to understand good Design for Environment (DFE) Decisions; Design Considerations in the five stages of the Product Life Cycle.

UNIT V Integrative Engineering Design Solutions: Identifying and resolving issues with working in diverse teams, modularizing, prototype building by different engineering disciplines within the team, validated learning with accessible metrics, Capstone Project (Interdisciplinary) Applying Design Thinking Principles and Methods for Ideation and Prototyping, Testing Solution, Refining Solution, and Taking the Solution to the Users.

Text Books

1. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, Vijay Kumar, John Wiley & Sons, ISBN: 978-1118083468, 2012.
2. Living with Complexity, Donald A Norman, MIT Press, ISBN: 978-0262528948, 2016.
3. Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work, Beverly Rudkin Ingle, A Press, ISBN: 978-1430261810, 2013.

Reference Books

1. Emotionally Durable Design: Objects, Experiences and Empathy, Jonathan Chapman, 2nd Edition, Routledge, ISBN: 978-0415732161, 2015.
2. Innovation Design: How Any Organization Can Leverage Design Thinking to Produce Change, Drive New Ideas, and Deliver Meaningful Solutions, Thomas Lockwood, Edgar Papke, New Page Books, ISBN: 978-1632651167, 2017.
3. Design Thinking Business Analysis: Business Concept Mapping Applied, Thomas Frisendal, Springer, ISBN: 978-3642434822, 2012.
4. Chapter 1: A Simple Framework for Leading Innovation, The Three Box Solution, HBR Press, 2016.
5. Design a Better Business: New Tools, Skills and Mindset for Strategy and Innovation, Patrick Van Der Pijl, Justin Lokitz, Lisa Kay Solomon, Erik van der Pluijm, Maarten van Lieshout, Wiley, ISBN: 978-8126565085, 2016.

I Year
II Semester

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

Course Code: GR24A1002 **L/T/P/C: 3/1/0/4**

I Year II Semester

Course Outcomes:

1. Classify the differential equations of first order and solve them analytically by suggested methods.
2. Solve linear differential equations of higher order under various forcing functions.
3. Evaluate double and triple integrals and apply them to some problems in geometry and mechanics.
4. Apply vector differential operators on scalar and vector fields and apply them to solve some field related problems.
5. Apply classical vector integral theorems for fast evaluation of work done around closed curves and flux across closed surfaces.

UNIT I

ORDINARY DIFFERENTIAL EQUATIONS OF THE FIRST ORDER: LDE of the first order: Solution of Exact, Linear and Bernoulli equations, modeling Newton's law of cooling, growth and decay models.

UNIT II

ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER: LDE with constant coefficients: Complementary function, Particular integrals for *f(x)* of the form e^{ax}, x^n, $cosax$, $sinax$, $e^{ax}V(x)$ and $x\ V(x)$where $V(x)$=$cosax\ and\ sinax$, the method of variation of parameters, LDE with variable coefficients: Cauchy's homogeneous equation.

UNIT III

MULTIPLE INTEGRALS: Double integrals: Evaluation of Double Integrals, change of order of integration (only Cartesian form), change of variables (Cartesian and polar coordinates) Triple Integrals: Evaluation of triple integrals, change of variables (Cartesian to Spherical and Cylindrical polar coordinates) Applications: Area using the double integral –Volume of a solid using the double and triple integral.

UNIT IV

VECTOR DIFFERENTIATION AND LINE INTEGRATION: Vector differentiation: Scalar and vector point functions, Concepts of gradient, 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. R.K.Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa publishing house, Fourth edition 2014.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

Reference Books

1. GRIET reference manual.
2. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

APPLIED PHYSICS

Course Code: GR24A1003 **L/T/P/C: 3/1/0/4**

I Year II Semester

Course Outcomes:

1. Solve engineering problems involving quantum nature of radiation and matter waves.
2. Understand the characteristics of semiconductor devices and operation of optoelectronic devices.
3. Identify magnetic and superconducting materials based on their properties for various applications.
4. Analyze the properties of Laser and its propagation in different types of optical fibers.
5. Explore the features of nanomaterials.

UNIT I

Quantum Physics and Solids

Quantum Mechanics: Introduction, Black body radiation, Planck's law, Photoelectric effect-Einstein's Photoelectric equation(quantitative), Wave-Particle duality: de Broglie hypothesis, Davisson and Germer experiment, Heisenberg's uncertainty principle, Born's interpretation of the wave function, Schrodinger's time independent wave equation, Particle in one dimensional infinite potential box.

Solids: Classification of solids into metals, semiconductors, and insulators.

UNIT II

Semiconductors and devices: Intrinsic and extrinsic semiconductors(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.

Radiative transition: Absorption, Spontaneous and Stimulated emissions, Principle, Construction, Working, Characteristics and Applications: LED and Solar cell.

UNIT III

Magnetic materials and Superconductivity

Magnetic Materials: Introduction, permeability, field intensity, magnetic field induction, magnetisation, magnetic susceptibility, origin of magnetic moment: Bohr magneton, classification of magnetic materials: Ferro, Para, Dia, Antiferro and Ferri, Hysteresis curve based on domain theory of ferromagnetism, Soft and hard magnetic materials, Applications of magnetic materials.

Superconductivity: Superconductivity phenomenon, Meissner effect, Type I and Type II superconductors, applications of superconductors.

UNIT IV

Lasers and Fiber Optics

Lasers: Introduction, Characteristics of lasers, Lasing action, Essential components of laser, Construction and working: Ruby laser, He-Ne laser and Semiconductor laser, Applications of

lasers.

Fiber Optics: Introduction, Principle and Structure of an optical fiber, Basic components in optical fiber communication system, Advantages of optical fibers over conventional cables, Types of optical fibers, Acceptance angle-Numerical aperture, Losses associated with optical fibers, Applications of optical fibers.

UNIT V

Nanotechnology: Introduction, Quantum confinement, Surface to volume ratio, Classification of Nanomaterials, Synthesis methods: Top-Down Technique: Ball milling method, Bottom-Up technique: Sol-Gel method, Characterization techniques: SEM, TEM and EDAX.

Text books

1. Engineering Physics, B.K. Pandey, S. Chaturvedi – Cengage Learing.
2. Applied Physics, T. Bhīma Sankaram, BSP Publishers.
3. Engineering Physics, P.K Palanisamy, Scitech Publishers.
4. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand.

Reference Books

1. Fundamentals of Semiconductor Devices, Second Edition, Anderson and Anderson, McGraw Hill.
2. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw- Hill Inc. (1995)
3. Semiconductor Physics and Devices, 4e, Neamen and Biswas, McGraw Hill.
4. Online Course: “Optoelectronic Materials and Devices” by Monica Katiyar and Deepak Guptha on NPTEL.
5. Halliday and Resnick, Physics – Wiley.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING MECHANICS

Course Code: GR24A1015 **L/T/P/C: 3/1/0/4**

I Year II Semester

Course Outcomes:

1. Determine resultant of forces acting on a body and analyze equilibrium of a body subjectedto a system of forces.
2. Solve problem of bodies subjected to friction, Determine the forces in the members of the trusses
3. Find the location of centroid and calculate moment of inertia of a given section and bodies
4. Solve Kinematic Problems of uniform motion and uniform accelerated motion
5. Solve Dynamic problems using Newton's Second Law, work energy and Impulse Momentum Equations.

UNIT I

Introduction to Engineering Mechanics - Force Systems: Basic concepts, Particle equilibrium in 2-D ; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, – Resultant-Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems ; Static Indeterminacy.

UNIT II

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction.

Analysis of Trusses: Introduction, Classification of trusses, Assumptions made in the analysis of perfect truss, Methods of Analysis of Trusses- Method of Joints and Method of Sections.

UNIT III

Centroid and Center of gravity- Centroid of Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications.

Area Moment Of Inertia: Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Parallel Axis Theorem, Perpendicular Axis Theorem.

Mass Moment of Inertia , Inertia of Masses - Transfer Formula for Mass Moments of Inertia – Mass moment of inertia of Rectangular box, Cylinder, Cone and Sphere.

UNIT IV

Kinematics of Particles: Rectilinear motion (Uniform motion and uniform accelerated motion), Plane curvilinear motion (rectangular, path, and polar coordinates), Projectile motion, Relative and constrained motion.

UNIT V

Dynamics of Particles ; Newton's 2nd law of motion to solve particle kinetics (rectangular, path, and polar coordinates). energy, power Work-energy method, potential energy, kinetic energy. Impulse-momentum method (linear, angular), Impact (Direct and oblique).

Text Books

1. Singer's Engineering Mechanics: Statics and Dynamics, 2011 Edition by K. Vijay Kumar Reddy, J. Suresh Kumar , B.S. Publications.
2. A. Nelson, "Engineering Mechanics: Statics & Dynamics", Tata McGraw-Hill Education, 2009.

Reference Books

1. Timoshenko S.P and Young D.H., "Engineering Mechanics", McGraw Hill International Edition, 1983.
2. Andrew Pytel, JaanKiusalaas, "Engineering Mechanics", Cengage Learning, 2014.
3. Beer F.P & Johnston E.R Jr. "Vector Mechanics for Engineers", TMH, 2004.
4. Hibbeler R.C & Ashok Gupta, "Engineering Mechanics", Pearson Education, 2010.
5. Tayal A.K., "Engineering Mechanics – Statics & Dynamics", Umesh Publications, 2011.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGLISH

Course Code: GR24A1005 **L/T/P/C: 2/0/0/2**

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

UNIT I

Chapter entitled '***Toasted English*' by R.K.Narayan** from ***"English: Language, Context and Culture"*** published by Orient BlackSwan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT II

Chapter entitled **'Appro JRD' by Sudha Murthy** from ***"English: Language, Context and Culture"published*** by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs

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

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing: and Style of Writing- Defining /Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence.

UNIT III

Chapter entitled **'Lessons from Online Learning' by F.Haider Alvi, Deborah Hurst et al** from ***"English: Language, Context and Culture"*** published by Orient BlackSwan, Hyderabad.

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

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

Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for

Practice.

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

UNIT IV

Chapter entitled **'Art and Literature' by Abdul Kalam** from ***"English: Language, Context and Culture"*** published by Orient BlackSwan, Hyderabad.
Vocabulary: Standard Abbreviations in English
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice
Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing.

UNIT V

Chapter entitled **'Go, Kiss the World' by Subroto Bagchi** from ***"English: Language, Context andCulture"*** published by Orient BlackSwan, Hyderabad.
Vocabulary: Technical Vocabulary and their Usage
Grammar: Common Errors in English (*Covering all the other aspects of grammar which were notcovered in the previous units*)
Reading: Reading Comprehension-Exercises for Practice
Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

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

- **Note: 1**. 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.
- **Note**: **2**.Based on the recommendations of NEP2020, teachers are requested to be flexible to adopt Blended Learning in dealing with the course contents .They are advised to teach 40 percent of each topic from the syllabus in blended mode.

Text Books

1. "English: Language, Context and Culture" by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.

Reference Books

1. Effective Academic Writing by Liss and Davis (OUP)
2. Richards, Jack C. (2022) Interchange Series. Introduction, 1,2,3. Cambridge University Press
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
4. Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary. (2nd ed.,). Sage Publications India Pvt. Ltd.
5. (2019). Technical Communication. Wiley India Pvt. Ltd.
6. Vishwamohan, Aysha. (2013). English for Technical Communication for Engineering Students.Mc Graw-Hill Education India Pvt. Ltd.

7. Swan, Michael. (2016). Practical English Usage. Oxford University Press. Fourth Edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES

Course Code: GR24A1017 **L/T/P/C: 2/0/0/2**

I Year II Semester

Course Outcomes:

1. Implement various sorting techniques and analyze the computational complexity of algorithms.
2. Analyze the basics of data structures and its types and translate to programs the operationson stack and queue and their applications.
3. Develop algorithms for various operations on linked lists and convert them to programs.
4. Interpret operations on non-linear data structure binary tree and BST.
5. Summarize the operations on graphs and apply graph traversals techniques and outline hashing techniques.

UNIT I

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

Sorting: Bubble sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Radix Sort, Counting sort.

UNIT II

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 III

LIST: Introduction, dynamic memory allocation, self-referential structures, single linked list, advantages and disadvantages of single linked list, single linked list v/s arrays, representation ofa linked list in memory, operations-insertion, deletion, display, search.

Types and applications: Circular linked list, double linked list, implementation of stack, queue using linked list.

UNIT IV

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 V

Graphs: Definition, basic terminology, representation of graphs, graph traversal techniques –

Breadth First Traversal, Depth First Traversal.

Hashing - Introduction to hashing, hash function and types, hash table, implementation, collision resolution techniques–separate chaining, linear probing, quadratic probing, double hashing (only examples – no implementation).

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

Text Books

1. Data Structures, 2/e, Richard F, Gilberg, Forouzan, Cengage.
2. Data Structures and Algorithms, 2008, G.A.V.Pai, TMH.

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.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PYTHON PROGRAMMING

Course Code: GR24A1027 **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 Tkint.

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. Think Python, how to think like a computer scientist, Allen B. Downey,SPD, O'Reilly.
4. Core Python Programming, Wesley J.Chun, second edition, pearson.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

APPLIED PHYSICS LAB

Course Code: GR24A1018 **L/T/P/C: 0/0/3/1.5**

I Year II Semester

Course Outcomes:

1. Compare the behavior of Solar cells and LED.
2. Analyze the behavior of magnetic fields and their applications.
3. Infer the work function of a material through photoelectric effect.
4. Discuss the characteristics of Lasers and infer the losses in optical fibers.
5. Estimate the frequency of tuning fork through the phenomena of resonance.

List of Experiments:

1. Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode.
2. Solar Cell: To study the V-I Characteristics of solar cell.
3. Light emitting diode: To study V-I characteristics of light emitting diode.
4. Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.
5. Hall effect: To determine Hall co-efficient of a given semiconductor.
6. Photoelectric effect: To determine work function of a given material and Planck's constant.
7. LASER: To study the V-I characteristics of LASER sources.
8. Optical fiber: To determine the bending losses of Optical fibers.
9. Optical fiber: To determine the Numerical Aperture of Optical fibers.
10. Melde's experiment: To determine the 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: GR24A1020 **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

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

a. Computer Assisted Language Learning (CALL) Lab
b. Interactive Communication Skills (ICS) Lab

Exercise I

CALL Lab:

Understand: Introduction to Phonetics – Speech Sounds – Consonant and Vowel Sounds.

Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants.

ICS Lab:

Understand: Ice Breaking and JAM.

Practice: Ice-Breaking Activity and JAM Session. Introducing oneself and others

Exercise II

CALL Lab:

Understand: Structure of Syllables– Weak Forms and Strong Forms in Context– Word Stress and Rhythm.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.

ICS Lab:

Understand: Features of Good Conversation – Non-verbal Communication.

Practice: Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions- Telephone Etiquette, Rapid Round –Memory Games.

Exercise III

CALL Lab:

Understand: Intonation--Errors in Pronunciation-the Influence of Mother Tongue (MTI).

Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronounciation.

ICS Lab:
Understand: Public Speaking – Exposure to Structured Talks.
Practice: Making a Short Speech – Extempore.

Exercise IV
CALL Lab:
Understand: Presentation Skills – Elements of Presentation – Organizing Content – Use of Power Point – Slides Preparation
Practice: Presentation Skills
ICS Lab:
Understand: How to make informal and Formal Presentations
Practice: Collages / Poster Presentations-Power point presentations

Exercise V
CALL Lab:
Understand: Listening Skills and its importance-– Purpose- Process- Types- Barriers of Listening - Listening for General/Specific Details.
Practice: Listening Comprehension Tests.
ICS Lab:
Understand: Mind map - Story Telling - Narrating a story using mind maps
Practice: Weaving Stories

Minimum Requirement of infrastructural facilities for ELCS Lab:
1. Computer Assisted Language Learning (CALL) Lab
2. Interactive Communication Skills (ICS) Lab

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES LAB

Course Code: GR24A1024 **L/T/P/C: 1/0/4/3**

I Year II Semester

Course Outcomes:

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

TASK 1

a. Implement Bubble sort using a C program.
b. Implement Selection sort using a C program.
c. Implement Insertion sort using a C program.

TASK 2

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 3

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 4

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

TASK 5

a. Write a C program to check for balanced parenthesis.
b. Write a C program to implement priority queue using arrays.

TASK 6

a. Implement the following operations on Single Linked List using a C program.
    i. create
    ii. insert
    iii. delete
    iv. search
    v. display

TASK 7

a. Write a C program to implement Circular Linked List operations – create, insert, delete and display.

TASK 8

a. Write a C program to implement Double Linked List operations – create, insert, deleteand display.

TASK 9

a. Implement a C program for Stack using Linked list.
b. Implement a C program for Queue using Linked list.

TASK 10

a. Implement the following operations on Binary Search Tree
   i. create
   ii. insert
   iii. search
   iv. delete

TASK 11

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

TASK 12

a. Develop a C code for preorder, inorder and postorder traversals of a Binary Search Tree using recursion.
b. Design a C program for level order traversal of a Binary Search Tree.

TASK 13

a. Write a C program to implement Adjacency Matrix of a given graph.
b. Write a C program to implement Adjacency List of a given graph.

TASK 14

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

TASK 15

a. Implement a C program for the following operations on Hashing:
   i. insert
   ii. delete
   iii. search
   iv. display

Text Books

1. Data Structures, 2/e, Richard F, Gilberg, Forouzan, Cengage.
2. Data Structures and Algorithms, 2008, G.A.V.Pai, TMH.

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.

II Year
I Semester

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

KINEMATICS OF MACHINERY

Course Code: GR24A2039 **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: GR24A2040 **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

ASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code: GR24A2013 **L/T/P/C: 3/0/0/3**

II Year I Semester

Course Outcomes:

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

UNIT I

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

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

UNIT II

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

UNIT III

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

UNIT IV

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

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

UNIT V

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

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

Text Books

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRENGTH OF MATERIALS

Course Code: GR24A2041 **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 and Impact 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 respective centroidal & 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

THERMODYNAMICS

Course Code: GR24A2042 **L/T/P/C: 3/0/0/3**

II Year I 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 of Continuum, 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

MANUFACTURING ENGINEERING

Course Code: GR24A2048 L/T/P/C: 2/0/0/2

II B.Tech 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 of tools, 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", Media Promotors 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.

Teaching Methodology:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

METALLURGY AND MATERIAL SCIENCE LAB

Course Code: GR24A2044 **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

CourseCode: GR24A2043 **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 using Cantilever Beam set-up

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

Task-9: To determine the Young's modulus of given structural material by Maxwell's Reciprocal 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 testing equipment (Izod and Charpy).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MANUFACTURING ENGINEERING LAB

Course Code: GR24A2050 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 progressive press 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

VALUE ETHICS AND GENDER CULTURE

Course Code: GR24A2002 **L/T/P/C: 2/0/0/0**

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

II YEAR II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

THERMAL ENGINEERIG

Course Code: 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 absorbing machines, 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 FLUID MACHINES

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

II Year II Semester

Course Outcomes

1. Apply concept of mathematics, science and engineering in fluid flows.
2. Use the governing equations of fluid flow and apply the same to simple flow problems.
3. Explain the mathematical formulation of various flow problems.
4. Analyze the boundary layer concept to the fluid flow problems.
5. Execute the concept of fluid and models of fluids for flow problems.

UNIT I

Definition of fluid, Newton's law of viscosity, Units and dimensions- Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, incompressible flow, Bernoulli's equation and its applications.

UNIT II

Exact flow solutions in channels and ducts, Couette and Poiseuille flow, laminar flow through circular conduits and circular annuli-concept of boundary layer– measurement of boundary layer thickness–Darcy Weisbach equation, friction factor, Moody's diagram.

UNIT III

Need for dimensional analysis–methods of dimension analysis - Rayleigh and buckingham π theorem–Similitude–types of similitude -Dimensionless parameters– application of dimensionless parameters–Model analysis.

UNIT IV

Centrifugal pumps, working principle, work done by the impeller, multi stage pumps-performance curves. Euler's equation–theory of roto-dynamic machines–various efficiencies–velocity components at entry and exit of the rotor, velocity triangles— Cavitation in pumps-Reciprocating pump–working principle, slip, percentage of slip, power required to drive the pump.

UNIT V

Basics of hydroelectric power plant - Classification of water turbines, heads and efficiencies, velocity triangles-Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles– draft tube-Specific speed, unit quantities, performance curves for turbines–governing of turbines.

Text Books

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH, 4th edition,2014
2. Fluid Mechanics and Hydraulic Machines by R K Rajput.Laxmi Publications(P)Ltd., 2019, 10th edition

Reference Books

1. A Textbook of Fluid Mechanics and Hydraulic Machines by Dr R.K. Bansal, Laxmi Publications(P) Ltd.,2019, 9th edition.
2. Introduction to Fluid Mechanics and Fluid Machines By S K Som, Gautam Biswas,Mc Graw Hill , 2012, 5th edition
3. Fluid Mechanics by F M White, Tata Mcgraw Hill Publications, 6th edition , 2016
4. Fluid Mechanics & Hydraulic Machines: Problems & Solutions byK.Subrmanya/TMH private limited, 16th edition, 2011,
5. Hydraulic Machines by Banga & Sharma, Khanna Publishers, 3rd edition , 2008.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DYNAMICS OF MACHINERY

Course Code: 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

COMPUTATIONAL MATHEMATICS FOR ENGINEERS

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

II Year II Semester

Course outcomes

1. Apply well known techniques to find real roots of an equation and linear algebraic systems by iterative methods
2. Apply interpolation techniques for univariate and bivariate data using Gaussian and cubic spline methods
3. Apply numerical techniques to find eigen values and corresponding eigenvectors of a matrix
4. Apply numerical techniques in differentiation and integration.
5. Apply finite difference method to solve IVP in ODE and PDE.

UNIT 1

Root finding and Numerical solution of linear algebraic systems: Finding the real root of algebraic and transcendental equations by Regula-Falsi and Newton Raphson methods - Gauss Jacobi and Gauss Seidel iterative methods to solve a linear algebraic system.

UNIT II

Interpolation and Cubic spline: Interpolation with non-uniform data: Newton divided differences formula, Hermite interpolation, Interpolation with uniform data- Newton and Gauss formulas-Newton's bivariate interpolation for uniform data, Fitting natural cubic spline to data.

UNIT III

E**igenvalues and Eigenvectors:** Jacobi iteration method for finding eigenvalues and eigen vectors of a symmetric matrix- Power method and inverse power method for finding the largest and smallest eigenvalues and eigenvectors of a matrix.

UNIT IV

Numerical differentiation and Numerical integration: Numerical differentiation using the Newton's forward, backward and central difference formulas. Numerical integration by Trapezoidal rule, Simpson's 1/3rd and $3/8^{th}$ rules, Gauss-Legendre one point, two point and three point rules.

UNIT V

Numerical solution of initial and boundary value problems in ODE and PDE: Euler, Modified Euler method and R-K fourth order methods to solve initial value problems in ODE- Finite differences method to solve boundary value problems in ODE- Solution of Laplace's equation by Jacobi and Successive over relaxation (SOR) methods

Text Books

1. M.K.Jain,S.R.K. Iyengar, R.K.Jain-.Numerical methods for scientific and engineering computation-New Age International publishers-Fourth edition-2—3

2. Robert J.Schilling and Sandra L.Harries- Applied numerical methods for engineers using MATLAB and C-Thomson Brooks/Cole-2002

Reference Books

1. GRIET reference manual
2. S.S.Sastry- Introductory methods of numerical analysis- Prentice Hall (India)- Fourth edition-2010

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MANUFACTURING TECHNOLOGY AND METROLOGY

Course Code: **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: **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, Viscosity using 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: Performance 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: GR22A2051 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: **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

REAL-TIME REASEARCH PROJECT/ SOCIETAL RELATED PROJECT

Course Code: GR22A2109 **L/T/P/C: 0/0/4/2**

II Year II Semester

Course Outcomes

1. Predict the Field domain in the specialized area under Engineering discipline.
2. Evaluate and Obtained the category of the solution with help of Real time studies
3. Analyze and discuss the field problems using Analysis tools /Modes/simulations and experimental investigations.
4. Implementing the solution of problem statement.
5. Prioritize the reports and deliver the final work with presentation.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)

ENVIRONMENTAL SCIENCE

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

II Year, I/II Semester

Course Pre-Requisites: Basic knowledge of environmental issues

Course Outcomes:

1. Gain a variety of experiences & acquire a basic knowledge about the environment & its allied problems
2. Interpret the key components in safeguarding the environment
3. Evolve an individual vision of harmonious interaction with the natural world.
4. Appraise the quality of the environment to create a healthy atmosphere
5. Familiarize with the individual responsibilities towards the green revolution

UNIT I
INTRODUCTION AND AWARENESS ACTIVITIES
Environmental Science: Introduction, Definition, scope and importance.
AWARENESS ACTIVITIES

- Small group meetings about:
- Water management
- Waste water treatment
- Projects Vs Environment
- Zero waste management
- Impact of Science & Technology on Environment
- E-waste management
- Biodiversity loss
- Renewable Energy

UNIT II
SLOGAN AND POSTER MAKING EVENT

- Food waste management
- Rain water harvesting
- Climate change
- Green Power
- Water conservation
- Green at work
- Role of IT in environment and human health
- Sustainable development

UNIT III
EXPERT LECTURES ON ENVIRONMENTAL SCIENCE

- Environmental Impact Assessment
- Industrial waste treatment
- Regenerative farming/Organic farming/Vertical gardens/Hydroponics
- Circular Economy

UNIT IV

CLEANLINESS DRIVE

- Indoor air pollution
- Vehicular pollution
- Visual pollution
- Waste management at home
- Composting
- Plastic recycling

UNIT V

CASE STUDIES

- HPCL and LG Polymers disasters in Vizag
- Oleum gas leak in Delhi
- Mathura Refinery & Taj Mahal
- Conservation of Hussain Sagar lake
- The Cleanliest city of India-Surat
- Green Buildings in India
- KBR park in Hyderabad (Environmental protection Vs Development)
- Fluorosis and remediation
- Evaluation of STP or ETP operation in Hyderabad
- Ecotourism & its impacts
- Positive Impact on Environment due to Lockdown Forced by Corona Pandemic

TEXT BOOKS:

1. Environmental Studies for UG Courses, Erach Bharucha, UGC Publications, Delhi, 2004.
2. Textbook of Environmental Studies, Deeksha Dave, S. S. Katewa, Cengage Delmar Learning India Pvt., 2012.

REFERENCES:

1. Introduction to Environmental Science, Y. Anjaneyulu, BS Publications, 2004.
2. Environmental Studies, Anubha Kaushik & C. P. Kaushik, 4th Edition, New Age International Publishers.