Academic Regulations
Programme Structure
and
Detailed Syllabus

Bachelor of Technology (B.Tech)
in
Civil 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	Component of 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 is for 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 is for 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	Regular course of study of First year firstsemester.

	second semester	
2	First year second semester to Second year first semester	**(i)** Regular course of study of First year 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 firstsemester.
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 firstsemester.

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

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

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

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

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

iii) The 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.

	Class Awarded	**CGPA Secured**
	First Class with Distinction	CGPA >= 8.00 with no F or below grade/detention anytime during the programme
	First Class	CGPA >= 8.00 with rest of the clauses of S.No 1 not satisfied
	First Class	CGPA ≥ 6.50 and CGPA < 8.00
	Second Class	CGPA ≥ 5.50 and CGPA < 6.50
	Pass Class	CGPA ≥ 5.00 and CGPA < 5.50

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 to Third 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 semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester toThird year second semester.	Regular course of study of Third year first semester.
4	Third year second semester to Fourth 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 ≥ 6.50 and CGPA < 8.00
4	Second Class	CGPA ≥ 5.50 and CGPA < 6.50
5	Pass Class	CGPA ≥ 5.00 and CGPA < 5.50

Academic Regulations for B.Tech with Minors Programme under 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

	Minor Programme	**Eligible programme of students**	**@Offering Department**	**Award of Degree**
	Artificial Intelligence & Machine Learning	All programmes, except B.Tech in CSE (AI&ML) /B.Tech (AI&ML)/ B.Tech (AI)/ B.Tech CSE(AI)	CSE	"B.Tech in programme name with Minor in Artificial Intelligence & Machine Learning"

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

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

B. Tech Civil Engineering GR24 Course Structure

I B. Tech (CE)-I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
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 for Problem Solving	2	0	0	2	40	60	100
4	CE	ES	GR24A1008	Elements of Civil Engineering Lab	0	0	2	1	50	-	50
5	Chemistry	BS	GR24A1019	Engineering Chemistry lab	0	0	3	1.5	40	60	100
6	CSE	ES	GR24A1021	Programming for Problem Solving Lab	0	0	3	1.5	40	60	100
7	ME	ES	GR24A1025	Engineering Workshop	1	0	3	2.5	40	60	100
8	ME	ES	GR24A1016	Graphics for Engineers	1	0	4	3	40	60	100
Total					**10**	**2**	**15**	**19.5**	**330**	**420**	**750**
9	Mgmt	MC	GR24A1028	Design Thinking	2	0	0	0	50	--	50

I B. Tech (CE)- II Semester

S. No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
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	English	HS	GR24A1005	English	2	0	0	2	40	60	100
4	CSE	ES	GR24A1017	Data Structures	2	0	0	2	40	60	100
5	ME	ES	GR24A1015	Engineering Mechanics	3	1	0	4	40	60	100
6	CSE	ES	GR24A1024	Data Structures Lab	0	0	2	1	40	60	100
7	English	HS	GR24A1020	English Language and Communication Skills Lab	0	0	2	1	40	60	100
8	Physics	BS	GR24A1018	Applied Physics Lab	0	0	3	1.5	40	60	100
9	CSE	ES	GR24A1027	Python Programming	0	0	2	1	50	--	50
TOTAL					**13**	**3**	**9**	**20.5**	**370**	**480**	**850**

II B. Tech (CE)- I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
1	CE	PC	GR24A2009	Building Materials and Construction Planning	2	0	0	2	40	60	100
2	CE	PC	GR24A2017	Surveying and Geomatics	2	0	0	2	40	60	100
3	CE	PC	GR24A2011	Solid Mechanics –I	2	1	0	3	40	60	100
4	Maths	BS	GR24A2008	Computational Mathematics for Engineers	3	0	0	3	40	60	100
5	CE	PC	GR24A2012	Introduction to Fluid Mechanics	3	0	0	3	40	60	100
6	EEE	PC	GR24A2013	Basic Electrical and Electronics Engineering	3	0	0	3	40	60	100
7	CE	PC	GR24A2020	Surveying Lab	0	0	4	2	40	60	100
8	CE	PC	GR24A2015	Solid Mechanics Lab	0	0	4	2	40	60	100
TOTAL					**15**	**1**	**8**	**20**	**320**	**480**	**800**
9	Mgmt	MC	GR24A2002	Value Ethics and Gender Culture	2	0	0	0	50	--	50

II B. Tech (CE)- II Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
1	CE	PC	GR24A2016	Solid Mechanics– II	2	0	0	2	40	60	100
2	CE	PC	GR24A2010	Engineering Geology	2	0	0	2	40	60	100
3	CE	PC	GR24A2018	Structural Analysis – I	3	0	0	3	40	60	100
4	Mgmt	HS	GR24A2004	Economics and Accounting for Engineers	3	0	0	3	40	60	100
5	CE	PC	GR24A2019	Hydraulic Engineering	2	0	0	2	40	60	100
6	CE	PC	GR24A2014	Engineering Geology Lab	0	0	4	2	40	60	100
7	CE	PC	GR24A2021	Computer Aided Design Lab	0	0	4	2	40	60	100
8	CE	PC	GR24A2022	Fluid Mechanics and Hydraulic Machinery Lab	0	0	4	2	40	60	100
9	CE	PW	GR24A2106	Real-time Research Project/ Societal Related Project	0	0	4	2	50	--	50
TOTAL					**12**	**0**	**16**	**20**	**370**	**480**	**850**
10	Chemistry	MC	GR24A2001	Environmental Science	2	0	0	0	50	--	50

III B. Tech (CE) - I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int	Ext	Total Mark
1	CE	PC		Geotechnical Engineering	2	0	0	2	40	60	100
2	CE	PC		Concrete Technology	2	0	0	2	40	60	100
3	CE	PC		Hydrology and Water Resources Engineering	2	0	0	2	40	60	100
4	CE	PC		Design of Reinforced Concrete Structures	2	1	0	3	40	60	100
5	CE	PE		Professional Elective-I	3	0	0	3	40	60	100
6	CE	OE		Open Elective-I	3	0	0	3	40	60	100
7	CE	PC		Geotechnical Engineering Lab	0	0	4	2	40	60	100
8	CE	PC		Concrete Technology Lab	0	0	4	2	40	60	100
9	English	HS		Effective Technical Communication	1	0	0	1	40	60	100
TOTAL					**15**	**1**	**8**	**20**	**360**	**540**	**900**
10	Mgmt	MC		Constitution of India	2	0	0	0	50	--	50

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

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

III B. Tech (CE) - II Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int	Ext	Total Marks
1	CE	PC		Design of Steel Structures	2	1	0	3	40	60	100
2	CE	PC		Foundation Engineering	3	0	0	3	40	60	100
3	CE	PC		Environmental Engineering	2	0	0	2	40	60	100
4	CE	PE		Professional Elective-II	3	0	0	3	40	60	100
5	CE	OE		Open Elective-II	3	0	0	3	40	60	100
6	CE	PC		Environmental Engineering Lab	0	0	4	2	40	60	100
7	CE	PC		GIS Lab	0	0	4	2	40	60	100
8	CE	PW		Mini Project with Seminar	0	0	4	2	40	60	100
TOTAL					**13**	**1**	**12**	**20**	**320**	**480**	**800**

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

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

IV B. Tech (CE) - I Semester

S. No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int	Ext	Total Marks
1	CE	PC		Estimation and Costing	2	1	0	3	40	60	100
2	CE	PC		Transportation Engineering	3	0	0	3	40	60	100
3	CE	PE		Professional Elective-III	3	0	0	3	40	60	100
4	CE	PE		Professional Elective-IV	3	0	0	3	40	60	100
5	CE	OE		Open Elective-III	3	0	0	3	40	60	100
6	CE	PC		Transportation Engineering Lab	0	0	4	2	40	60	100
7	CE	PC		Computer Applications in Structural Engineering Lab	0	0	4	2	40	60	100
8	CE	PW		Project Work-Phase I	0	0	12	6	40	60	100
TOTAL					**14**	**1**	**20**	**25**	**320**	**480**	**800**

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

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

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

IV B. Tech (CE) - II Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int	Ext	Total Marks
1	CE	PE		Professional Elective-V	3	0	0	3	40	60	100
2	CE	PE		Professional Elective-VI	3	0	0	3	40	60	100
3	CE	HS		Entrepreneurship and Project Management	2	1	0	3	40	60	100
4	CE	PW		Project Work-Phase II	0	0	12	6	40	60	100
		TOTAL			**8**	**1**	**12**	**15**	**160**	**240**	**400**

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

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

PROFESSIONAL ELECTIVES - 4THREADS

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

OPEN ELECTIVES FOR GR22 REGULATIONS:

THREAD 1	THREAD 2	OFFERED BY
1. Soft Skills and Interpersonal Communication 2. Human Resource Development and Organizational Behavior 3. Cyber Lawand Ethics 4. Economic Policies inIndia	1. Principles of E-Commerce	**CSE**
	2. Business Analytics	
	3. Augmented Reality and Virtual Reality	
	1. Internet of Things	**CSE (AIML)**
	2. Augmented Reality and Virtual Reality	
	3. Human Computer Interaction	
	1. Augmented Reality and Virtual Reality	**CSE (DS)**
	2. Internet of Things	
	3. Human Computer Interaction	
	1. Services Science and Service Operational Management 2. IT Project Management 3. Marketing Research and Marketing Management	**CSBS**
	1. Artificial Intelligence	**IT**
	2. Introduction to Data Science	
	3. Human Computer Interaction	
	1. Non-Conventional Energy Sources	**EEE**
	2. Machine Learning	
	3. Artificial Intelligence Techniques	
	1. Principles of Communication	**ECE**
	2. Sensor Technology	
	3. Cellular and Mobile Communications	
	1. Robotics	**ME**
	2. Composite Materials	
	3. Operations Research	
	1. Engineering Materials for Sustainability	**CE**
	2. Geographic Information Systems and Science	
	3. Plumbing (Water and Sanitation)	

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

Reference Books

1. Introduction to Linear Algebra, Gilbert Strang, 5^{th} edition, Wellesley,2017.
2. Numerical methods for scientific and engineering computation, M.K.Jain, S.R.K. Iyengar, R.K.Jain- 3^{rd} 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: GR24A1004 **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. Analyse 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

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

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

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

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

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 and explicit 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 ofarrays.
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, void pointer, null pointer, pointers to arrays and structures, function pointer.
Structures and Unions: Defining structures, declaring and initializing structures, arrays within structures, 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

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

Course Code: GR24A1008 **L/T/P/C: 0/0/2/1**
I Year I Semester

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

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING CHEMISTRY LABORATORY

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, 5th Edition.
2. A Textbook on Experiments and Calculations in Engineering Chemistry-S. S. Dara, S Chand & Company; 9th 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 365days).
b. Write a C program to find greatest and smallest among three numbers using conditionaloperator.
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 bitwiseoperator and ternary operator.
c. Write a C program to check whether a number is even or odd using bitwise operator andternary 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/unitFor next 100 units Rs. 1.20/unitFor 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.

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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 arestarting 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 usingfunctions.
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 areidentical or not. The function returns 1 if they are identical, 0 otherwise.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING WORKSHOP

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

I Year I Semester

Course Outcomes

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

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
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, Modularising, 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
ENGLISH

Course Code:GR24A1005 **L/T/P/C: 3/1/0/4**

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: Nature 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 Modifiers 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 and Culture"*** 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 theneeds 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 Book

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 ofalgorithms.
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 outlinehashing 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 ofqueue 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 vs arrays, representation ofa linked list in memory, operations-insertion, deletion, display, search.

Types and applications: Circular linked list, double linked list, implementation of stack, queueusing 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
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 subjected to 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
DATA STRUCTURES LAB

Course Code: GR24A1024 **L/T/P/C: 0/0/2/1**
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, deleteand 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 Treeusing 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

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 Pronunciation.
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
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

PYTHON PROGRAMMING

Course Code: GR24A1027 **L/T/P/C: 0/0/2/1**

I Year II Semester

Course Outcomes:

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

UNIT I

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

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

UNIT II

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

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

UNIT III

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

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

UNIT IV

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

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

UNIT V

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

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

Text Books

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

Reference Books

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

II YEAR
I SEMSTER

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

Course Code: GR24A2009 **L/T/P/C: 2/0/0/2**
II Year I Semester

Course Outcomes:

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

UNIT I

Building Stones, Bricks and Tiles

Stone- Ancient Building stones, classification of building stones, quarrying procedures, characteristics ofgood building stone, dressing and tools for dressing of stones.
Bricks -Composition of brick earth, manufacturing of brick, characteristics of good brick, field and labtest.
Tiles - Types of tiles, manufacturing of tiles, structural requirements of tiles.

UNIT II

Cement, Lime, Admixtures

Ingredients of cement, manufacturing of cement.
Lime -Various ingredients of lime, constituents of limestone, classification of lime, manufacturing oflime.
Admixtures - physical admixtures, chemical admixtures.

UNIT III

Wood, Glass, Paints

Wood- structure, types of wood, properties of wood, seasoning, defects, alternative material for wood.
Glass-types of glasses, manufacturing of glass. Paints -Constituents of paints, types of paints. Introduction to Building Components -Lintel, arches, staircase, floors, roofs, foundation, Doors, windows.

UNIT IV

Masonry and Finishing, Form Works

Brick Masonry- Types and bonds. Stone Masonry- Types.
Finishing- plastering, pointing and cladding- Types of ACP (Aluminium composite panel).
FormWorks - requirements, standards, Scaffolding, shoring, under pinning.

UNIT V

Building Services and Building Planning

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

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

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SURVEYING AND GEOMATICS

Course Code: GR24A2017 **L/T/P/C: 2/0/0/2**
II Year I Semester

Course Outcomes:

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

UNIT I

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

Measurement of Distances and Directions

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

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

UNIT II

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

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

UNIT - III

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

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

UNIT - IV

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

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

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

Text Books:

1. Surveying (Vol – 1, 2 & 3), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) ltd., New Delhi 2016
2. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi, 2004.
3. Duggal S K, "Surveying (Vol – 1 & 2), Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2004.
4. Hoffman. B, H. Lichtenegga and J. Collins, Global Positioning System - Theory and Practice, Springer -Verlag Publishers, 2001

Reference Books:

1. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi.2012
2. Chandra A M, "Plane Surveying", New Age International Pvt. Ltd., New Delhi, 2002.
3. Chandra A M, "Higher Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
4. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill – 2000.
5. Surveying and leveling by R. Agor Khanna Publishers 2015.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SOLID MECHANICS – I

Course Code: GR24A2011 **L/T/P/C: 2/1/0/3**

II Year I Semester

Prerequisite: Mathematics, Engineering Mechanics.

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

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

Shear Stresses - Derivation of formula - Shear stress distribution across various beam sections like rectangular, circular, triangular and angle sections**.**

UNIT IV

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

Principal Stresses and Strains

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

UNIT V

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

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INTRODUCTION TO FLUID MECHANICS

Course Code:GR24A2012 **L/T/P/C: 3/0/0/3**
II Year I Semester

Prerequisite: Mathematics, Physics.

Course Outcomes:

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

UNIT I

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

UNIT II

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

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

UNIT III

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

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

UNIT IV

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

UNIT V

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

Text Books

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

References Books

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

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

Course Code: 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
SURVEYING LAB

Course Code: GR24A2020 **L/T/P/C:0/0/4/2**
II Year I Semester

Prerequisite: Surveying

Course Outcomes:

1. Define the characteristics and applications of basic survey instruments.
2. Apply knowledge of mathematics, science and engineering in land measurementTechniques.
3. Calculate distances, inclinations, elevations, areas and volumes.
4. Generate maps of earth surfaces.
5. Analyzing the data and transfer relevant points onto ground.

List of Experiments

TASK-1: (i) Measurement of an area by Chain Survey (Open and Closed Traverse).
(ii) Study of Topo sheets

TASK-2: Chaining across obstacles

TASK-3: Simple, fly, Differential Levelling.

TASK-4: Study of Theodolite- Measurement of horizontal and vertical angles- (Repetition and Reiteration method).

TASK-5: Trigonometric Levelling- Heights and distances problems.

TASK-6: Calculation of R.L and distance using tachometric survey.

TASK-7: Setting out of simple Curve**.**

TASK-8: Determine the area of the field by using Total Station.

TASK-9: Column and foundation marking using Total Station.

TASK-10: (i) Distance, gradient, differential height between two inaccessible points using Total Station.
(ii) Measurement of Area using hand held GPS

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SOLID MECHANICS LAB

Course Code: GR24A2015 **L/T/P/C:0/0/4/2**
II Year I Semester

Prerequisites: Engineering Mechanics, Mathematics and Physics.

Course Outcomes:

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

TASK- 1: Tension test on metals

TASK- 2: Torsion test on metals

TASK- 3: Hardness test on metals

TASK- 4: Spring test on metals

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

TASK-6: Impact test on metals.

TASK-7: Deflection test on cantilever beam.

TASK-8: Deflection test on simply supported beam.

TASK-9: Deflection test on continuous beam.

TASK-10: Verification of Maxwell's Reciprocal theorem

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

VALUE ETHICS AND GENDER CULTURE

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

II Year I Semester

Course Outcomes:

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

UNIT I

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

A Case study on values and self-development

UNIT II

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

A Case study on Personality

UNIT III

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

A Case study on professional ethics

UNIT IV

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

A Case study/ video discussion on attitudes towards gender

UNIT V

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

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

Text Books

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

Reference Books

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

II YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SOLID MECHANICS- II

Course Code:GR24A2016 **L/T/P/C: 2/0/0/2**
II Year II Semester

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

Course Outcomes:

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

UNIT I

Thin Cylinders

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

Thick Cylinders

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

UNIT II

Torsion of Circular Shafts

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

Springs

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

UNIT III

Columns and Struts

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

Beam Columns:

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

UNIT IV

Direct and Bending Stresses of Dams, Retaining walls and Chimneys

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

UNIT V

Unsymmetrical Bending of Beams

Introduction–Centroid principal axes of section–Graphical Stresses in beams subjected to unsymmetrical bending. Principal axes- Resolution of bending moment into two rectangular axes through the centroid - Location of neutral axis. Deflection of beams under unsymmetrical bending. **Curved Beams:** Introduction – circular beams loaded uniformly and supported on symmetrically placed columns and Semi-circular beams simply supported on three equally spaced supports.

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING GEOLOGY

Course Code: GR24A2010 **L/T/P/C: 2/0/0/2**
II Year II Semester

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
STRUCTURAL ANALYSIS - I

Course Code: GR24A2018 **L/T/P/C: 3/0/0/3**
II Year II Semester

Prerequisites: Engineering Mechanics, Solid mechanics.

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

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

UNIT V

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

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

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ECONOMICS AND ACCOUNTING FOR ENGINEERS

Course Code:GR24A2004 **L/T/P/C: 3/0/0/3**

II Year II Semester

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

HYDRAULIC ENGINEERING

Course Code: GR24A2019 **L/T/P/C: 2/0/0/2**

II Year II Semester

Prerequisite: Introduction to Fluid Mechanics

Course Outcomes:

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

UNIT I

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

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

UNIT II

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

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

UNIT III

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity, Rayleigh method, Buckingham's π Method. Application of dimensional analysis and model studies to fluid flow problems, Dimensionless groups, Similitude-Three types of similarities: Geometric similarity, Kinematic similarity and Dynamic similarity – Force Ratios – Dimensionless Numbers – Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number – Model laws -Undistorted and Distorted models.

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined

and curved vanes, jet striking centrally and at tip of the vane, Velocity triangles at inlet and outlet, expressions for work done and efficiency.

UNIT IV

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

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

UNIT V

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

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

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING GEOLOGY LAB

Course Code:GR24A2014 **L/T/P/C: 0/0/4/2**
II Year II Semester

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Course Outcomes:

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

Exercises:

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

Lab Examination Pattern:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTER AIDED DESIGN LAB

Course Code: GR24A2021 **L/T/P/C:0/0/4/2**

II Year II Semester

Prerequisite: Engineering Graphics

Course Outcomes:

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

LIST OF EXPERIMENTS

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

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

Course Code: GR24A2022 **L/T/P/C:0/0/4/2**
II Year II Semester

Prerequisite: Fluid Mechanics and Hydraulic Engineering

Course Outcomes:

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

List of Experiments

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

Text Books

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENVIRONMENTAL SCIENCE

Course Code:GR24A2001 **L/T/P/C: 2/0/0/0**

II Year II Semester

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.

Reference Books:

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