Academic Regulations Programme Structure and Detailed Syllabus

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

(Four Year Regular Programme)

(Applicable for Batches admitted from 2022-23)

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 GR22

(Applicable for Batches Admitted from 2022-23)

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	Information Technology	12	B.Tech. Information Technology
7	Computer Science and Business System	32	B.Tech. Computer Science & Business System
8	Computer Science and Engineering (AIML)	66	B.Tech. Computer Science and Engineering (AIML)
9	Computer Science and Engineering (Data Science)	67	B.Tech. Computer Science and Engineering (Data Science)

GR22 Regulations shall govern the above programmes offered by the Departments with effect from the students admitted to the programmes in 2022-23 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) **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. 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.

6. 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.

g) The evaluation of courses having ONLY internal marks in I-Year I Semester and II Semester is as follows:

- I Year courses: The internal evaluation is for 50 marks and it 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. The student is deemed to have failed, if he/she (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.
- II Year II Semester *Real-Time/Field-based Research Project/Societal Related Project* course: The internal evaluation is for 50 marks and it 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. The student is deemed to have failed, if he/she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (ii) secures less than 40% marks in this course.

7. **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.

8. **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.

9. **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.

10. **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.

11. **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.

12. 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 to First year second semester	Regular course of study of First year first 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 secondsemester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Second year first semester to Second year second semester	Regular course of study of Second year 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.

c) Provision of opting 2 OE courses through online mode.

d) Choice of placement-oriented value-added courses in every semester from II year till IV year

e) Students can take a year break after second or third year to work on R&D

f) Under Mandatory Courses

i) Co-Curricular activities -- 0.5 credit for publishing paper, publishing patent, attend seminar, technical competition and taking part in hackathon

ii) Extra-Curricular activities -- 0.5 credit for sports represent University or part or college winning team a medal or cup in outside recognized inter collegiate or above tournaments or NSS activities or donated blood two times or 2 green campus events

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

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

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

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

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

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

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

S. No	Class Awarded	CGPA Secured
1	First Class with Distinction	CGPA >= 8.00 with no F or below grade/detention anytime during the programme
2	First Class	CGPA >= 8.00 with rest of the clauses of S.No 1 not satisfied
3	First Class	CGPA ≥ 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

Equivalence of grade to marks

Marks % = (CGPA -0.5)*10

15. 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).

16. **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.

17. **Transitory Regulations**

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of GR20 Regulations due to lack of attendance, shall be permitted to join I year I Semester of GR22 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 GR20 regulations for want of attendance, shall be permitted to join the corresponding semester of GR22 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 GR22 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 GR20 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of GR22 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 GR20 & GR22 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 GR22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in GR22 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 GR22 Regulations. **There is NO exemption of credits in any case**.
6. If a student is readmitted to GR22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in GR22 Regulations

will be substituted by another subject to be suggested by the college academic administration.

Note:

If a student readmitted to GR22 Regulations and has not studied any courses/topics in his/her earlier regulations of study which is prerequisite for further subjects in GR22 Regulations, then the college shall conduct remedial classes to cover those courses/topics for the benefit of the students.

18. 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.

19. 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 and the 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 GR22
(Applicable for Batches Admitted from 2023-24)

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 semesterfrom all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to Third year second semester.	Regular course of study of Third year first semester.
4	Third year second semester to Fourth year first semester.	(i) Regular course of study of Thirdyear 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 $\geq$ 6.50 and CGPA < 8.00
4	Second Class	CGPA $\geq$ 5.50 and CGPA < 6.50
5	Pass Class	CGPA $\geq$ 5.00 and CGPA < 5.50

Academic Regulations for B.Tech. with Minors Programme under GR22

(Applicable for Batches Admitted from 2022-23)

1. Objectives

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

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

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

a) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4 -Years B.Tech. programme.

b) For B.Tech. with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B.Tech. degree). All these 18 credits need to be completed in III year and IV year only.

c) After registering for the Minor programme, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), he/she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of B.Tech., he/she will be awarded only B.Tech. degree in the concerned programme.

d) There is no transfer of credits from Minor programme courses to regular B.Tech. degree course and vice versa.

e) These 18 credits are to be earned from the additional Courses offered by the host department in the college as well as from the MOOCS platform.

f) For the course selected under MOOCS platform following guidelines may be followed:

- **i)** Prior to registration of MOOCS courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.
- **ii)** Minimum credits for MOOCS course must be equal to or more than the credits specified in the Minor course structure provided by the University.
- **iii)** Only Pass-grade/marks or above shall be considered for inclusion of grades in minor grade memo.
- **iv)** Any expenses incurred for the MOOCS courses are to be met by the students only.

g) The option to take a Minor programme is purely the choice of the student.

h) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor programme at any time; and in that case the student will be awarded only B.Tech. degree in the concerned programme on earning the required credits of 160.

i) The student can choose only one Minor programme along with his/her basic engineering degree. A student who chooses an Honors programme is not eligible to choose a Minor programme and vice-versa.

j) A student can graduate with a Minor if he/she fulfils the requirements for his/her regular B.Tech. programme as well as fulfils the requirements for Minor programme.

k) The institute shall maintain a record of students registered and pursuing their Minor programmes, minor programme-wise and parent programme -wise. The same report needs to be sent to the University once the enrolment process is complete.

l) The institute / department shall prepare the time-tables for each Minor course offered at their respective institutes without any overlap/clash with other courses of study in the respective semesters.

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

a) A student can opt for B.Tech. programme with Minor programme if she/he has no active backlogs till II Year I Semester (III semester) at the time of entering into III year I semester.

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

c) If more than 50% of the students in a programme fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

4. Registration for the courses in Minor Programme

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied/registered for regular B.Tech. programme. No course should be identical to that of the regular B.Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum No. of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

5. Minor courses and the offering departments

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

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

B.Tech Civil Engineering GR22 Course Structure

I B. Tech (CE)-I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	BS	GR22A1001	Linear Algebra and Function Approximation	3	1	0	4	3	1	0	4	40	60	100
2	Chemistry	BS	GR22A1005	Engineering Chemistry	3	1	0	4	3	1	0	4	40	60	100
3	English	HS	GR22A1006	English	2	0	0	2	2	0	0	2	40	60	100
4	CSE	ES	GR22A1007	Programming for Problem Solving	2	1	0	3	2	1	0	3	40	60	100
5	ME	ES	GR22A1011	Graphics for Engineers	1	0	2	3	1	0	4	5	40	60	100
6	Chemistry	BS	GR22A1015	Engineering Chemistry lab	0	0	1.5	1.5	0	0	3	3	40	60	100
7	CSE	ES	GR22A1017	Programming for Problem Solving Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
8	English	HS	GR22A1016	English Language and Communication Skills Lab	0	0	1	1	0	0	2	2	40	60	100
Total					**11**	**3**	**6**	**20**	**11**	**3**	**12**	**26**	**320**	**480**	**800**
9	Mgmt	MC	GR22A1022	Design Thinking	0	0	0	0	2	0	0	2	40	60	100

I B. Tech(CE)- II Semester

S. No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	BS	GR22A1002	Differential Equations and Vector Calculus	3	1	0	4	3	1	0	4	40	60	100
2	Physics	BS	GR22A1004	Engineering Physics	3	1	0	4	3	1	0	4	40	60	100
3	ME	ES	GR22A1010	Engineering Mechanics	3	1	0	4	3	1	0	4	40	60	100
4	CSE	ES	GR22A1012	Data Structures	2	1	0	3	2	1	0	3	40	60	100
5	Physics	BS	GR22A1014	Engineering Physics Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
6	CSE	ES	GR22A1020	Data Structures Lab	0	0	1	1	0	0	2	2	40	60	100
7	ME	ES	GR22A1021	Engineering Workshop	1	0	1.5	2.5	1	0	3	4	40	60	100
TOTAL					**12**	**4**	**4**	**20**	**12**	**4**	**8**	**24**	**280**	**420**	**700**

II B. Tech (CE)- I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext.	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CE	PC	GR22A2010	Building Materials and Construction Planning	2	0	0	2	2	0	0	2	40	60	100
2	CE	PC	GR22A2011	Engineering Geology	2	0	0	2	2	0	0	2	40	60	100
3	CE	PC	GR22A2012	Solid Mechanics –I	2	1	0	3	2	1	0	3	40	60	100
4	Maths	BS	GR22A2009	Computational Mathematics for Engineers	3	0	0	3	3	0	0	3	40	60	100
5	CE	PC	GR22A2013	Introduction to Fluid Mechanics	3	0	0	3	3	0	0	3	40	60	100
6	EEE	PC	GR22A2014	Basic Electrical and Electronics Engineering	3	0	0	3	3	0	0	3	40	60	100
7	CE	PC	GR22A2015	Engineering Geology lab	0	0	2	2	0	0	4	4	40	60	100
8	CE	PC	GR22A2016	Solid Mechanics Lab	0	0	2	2	0	0	4	4	40	60	100
TOTAL					**15**	**1**	**4**	**20**	**15**	**1**	**8**	**24**	**320**	**480**	**800**
9	Mgmt	MC	GR22A2002	Value Ethics and Gender Culture	0	0	0	0	2	0	0	2	40	60	100

II B. Tech (CE)- II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext.	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CE	PC	GR22A2017	Solid Mechanics – II	2	1	0	3	2	1	0	3	40	60	100
2	CE	PC	GR22A2018	Surveying and Geomatics	3	0	0	3	3	0	0	3	40	60	100
3	CE	PC	GR22A2019	Structural Analysis – I	3	0	0	3	3	0	0	3	40	60	100
4	Mgmt	HS	GR22A2004	Economics and Accounting for Engineers	3	0	0	3	3	0	0	3	40	60	100
5	CE	PC	GR22A2020	Hydraulic Engineering	2	0	0	2	2	0	0	2	40	60	100
6	CE	PC	GR22A2021	Surveying Lab	0	0	2	2	0	0	4	4	40	60	100
7	CE	PC	GR22A2022	Computer AidedDesign Lab	0	0	2	2	0	0	4	4	40	60	100
8	CE	PC	GR22A2023	Fluid Mechanics and Hydraulic MachineryLab	0	0	2	2	0	0	4	4	40	60	100
TOTAL					**13**	**1**	**6**	**20**	**13**	**1**	**12**	**26**	**320**	**480**	**800**
9	Chemistry	MC	GR22A2001	Environmental Science	0	0	0	0	2	0	0	2	40	60	100

III B. Tech(CE) - I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int	Ext	Total Mark
					L	T	P	Total	L	T	P	Total			
1	CE	PC		Geotechnical Engineering	2	0	0	2	2	0	0	2	40	60	100
2	CE	PC		Concrete Technology	2	0	0	2	2	0	0	2	40	60	100
3	CE	PC		Hydrology and Water Resources Engineering	3	0	0	3	3	0	0	3	40	60	100
4	CE	PC		Design of Reinforced Concrete Structures	2	1	0	3	2	1	0	3	40	60	100
5	CE	PE		Professional Elective-I	3	0	0	3	3	0	0	3	40	60	100
6	CE	OE		Open Elective-I	3	0	0	3	3	0	0	3	40	60	100
7	CE	PC		Geotechnical Engineering Lab	0	0	2	2	0	0	4	4	40	60	100
8	CE	PC		Concrete Technology Lab	0	0	2	2	0	0	4	4	40	60	100
TOTAL					**15**	**1**	**4**	**20**	**15**	**1**	**8**	**24**	**320**	**480**	**800**
9	Mgmt	MC		Constitution of India	0	0	0	0	2	0	0	2	40	60	100

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

OpenElective-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	Credits				Hours				Int	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CE	PC		Designof Steel Structures	2	1	0	3	2	1	0	3	40	60	100
2	CE	PC		Foundation Engineering	3	0	0	3	3	0	0	3	40	60	100
3	CE	PC		Environmental Engineering	2	0	0	2	2	0	0	2	40	60	100
4	CE	PE		Professional Elective-II	3	0	0	3	3	0	0	3	40	60	100
5	CE	OE		Open Elective-II	3	0	0	3	3	0	0	3	40	60	100
6	CE	PC		Environmental Engineering Lab	0	0	2	2	0	0	4	4	40	60	100
7	CE	PC		GIS Lab	0	0	2	2	0	0	4	4	40	60	100
8	CE	PW		Mini Project with Seminar	0	0	2	2	0	0	4	4	40	60	100
TOTAL					**13**	**1**	**6**	**20**	**13**	**1**	**12**	**26**	**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 BuildingTechnology

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	Credits				Hours				Int	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CE	PC		Estimation and Costing	2	1	0	3	2	1	0	3	40	60	100
2	CE	PC		Transportation Engineering	3	0	0	3	3	0	0	3	40	60	100
3	CE	PE		Professional Elective-III	3	0	0	3	3	0	0	3	40	60	100
4	CE	PE		Professional Elective-IV	3	0	0	3	3	0	0	3	40	60	100
5	CE	OE		Open Elective-III	3	0	0	3	3	0	0	3	40	60	100
6	CE	PC		Transportation Engineering Lab	0	0	2	2	0	0	4	4	40	60	100
7	CE	PC		Computer Applications in Structural Engineering Lab	0	0	2	2	0	0	4	4	40	60	100
8	CE	PW		Project Work-Phase I	0	0	6	6	0	0	12	12	40	60	100
TOTAL					**14**	**1**	**10**	**25**	**14**	**1**	**20**	**35**	**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 Waterand Wastewater Treatment
4	CE		Rehabilitation and Retrofitting of Structures

Open Elective III			
S.No.	**BOS**	**Course Code**	**COURSE**
1	CE		Environmental Impact Assessment

IV B. Tech (CE) - II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	CE	PE		Professional Elective-V	3	0	0	3	3	0	0	3	40	60	100
2	CE	PE		Professional Elective-VI	3	0	0	3	3	0	0	3	40	60	100
3	Mgmt	HS		Entrepreneurship and Project Management	2	1	0	3	2	1	0	3	40	60	100
4	CE	PW		Project Work-Phase II	0	0	6	6	0	0	12	12	40	60	100
		TOTAL			**8**	**1**	**6**	**15**	**8**	**1**	**12**	**21**	**160**	**240**	**400**

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

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

PROFESSIONAL ELECTIVES - 4THREADS

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

I YEAR
I SEMSTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

LINEAR ALGEBRA AND FUNCTION APPROXIMATION

Course Code: GR22A1001 **L/T/P/C: 3/1/0/4**
I Year I Semester

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

Course Objectives:

1. Comprehend the concepts of linearity and linear systems, which form the core for many engineering concepts
2. Interpret the matrix eigenvalue problem and relate the theory to pattern recognition problems
3. Distinguish between various techniques of matrix factorization and the significance of unit rank decomposition principle
4. Discuss the differential calculus of multi variable functions which leads to function optimization.
5. Apply tools for function approximation problems that arising in engineering

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. Develop the skill of finding multivariable function optima
5. Illustrate the concepts of function approximation with measurement of error

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

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

UNIT V

Function approximation tools in Engineering: Function approximation using Taylor's polynomials- Properties of Chebyshev polynomials- Uniform approximation using Chebyshev polynomials

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

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, 5th edition, Wellesley,2017.
2. Numerical methods for scientific and engineering computation, M.K.Jain, S.R.K.Iyengar,
3. R.K.Jain- 3rd edition- New Age publishers
4. 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: GR22A1005 **L/T/P/C: 3/1/0/4**

I Year I Semester

Course Objectives:

1. To relate how the basic concepts and principles of chemistry can be applied to practical utility in a broader perspective of the society.
2. To distinguish the ranges of electromagnetic spectrum and its interaction with matter and to develop knowledge of various spectroscopic techniques at atomic and molecular levels.
3. To identify and apply various principles of electrochemistry, corrosion and water treatment which are essential for an engineer in industry
4. To acquire knowledge of existence of different organic molecules in different stereo chemical orientations useful for understanding reaction pathways.
5. To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.

Course Outcomes:

1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Relate electromagnetic spectra used for exciting different molecular energy levels in various spectroscopic techniques and their application in medicine and other fields.
3. Recognize various problems related to electrochemistry and corrosion in industry and is able to explain different prevention techniques and apply concepts of chemistry in engineering.
4. Know the origin of different types of engineering materials used in modern technology and interpret different problems involved in industrial utilization of water.
5. Understand the processing of fossil fuels for the effective utilization of chemical energy.

UNIT I

Atomic and Molecular Structure: Atomic and Molecular orbitals - Definition, examples and comparison, Molecular orbital theory- postulates and MO energy diagrams of N_2 and O_2.

Theories of Metallic bonding – Free electron theory, Resonance theory, Molecular orbital theory, Valence Bond Theory – Postulates and Limitations, Bonding in $[Ni(CO)_4]$, $[Ni(Cl)_4]^{2-}$, $[Ni(CN)_4]^{2-}$, $[Co(NH_3)_6]^{3+}$, and $[CoF_6]^{3-}$. Crystal Field Theory, Crystal Field Splitting of transition metal ion d-orbitals in octahedral, tetrahedral and square planar geometries.

UNIT II

Spectroscopic Techniques and Applications:

Regions of Electromagnetic spectrum. Molecular spectroscopy: Rotational Spectroscopy: Rotation of molecules, Rotational spectra of rigid diatomic molecules, Selection rules.

Vibrational Spectroscopy: The vibrating diatomic molecule, Simple and anharmonic oscillators of a diatomic molecule, Selection rules, Applications of IR spectroscopy.

NMR Spectroscopy: Criteria for NMR activity (Magnetic and non-magnetic nuclei), Basic concepts and Principle of ^1H NMR spectroscopy, Chemical shift- Shielding and Deshielding. Magnetic Resonance Imaging.

UNIT III

Batteries and Corrosion:

Batteries: Primary and Secondary types, Lithium ion and Lead acid batteries. Fuel cells: Definition, Hydrogen-Oxygen fuel cell and Microbial Fuel cell – working principle and applications.

Corrosion: Definition, causes and effects of corrosion, Theories of chemical and electro chemical corrosion with mechanism, Differential metal corrosion - Galvanic corrosion, Differential aeration corrosion - pitting corrosion, Factors affecting corrosion – Nature of metal (Position of metal, Relative areas, Purity and Passivity), Nature of Environment (pH, Temperature and Humidity), Corrosion control methods: Cathodic protection (sacrificial anodic and impressed current cathodic protection), Metallic coatings: Hot dipping- galvanization and tinning.

UNIT IV

Engineering Materials and Water Technology

Semiconductors: Si and Ge - preparation, purification and crystal growth by zone refining and Czochralski pulling methods, Doping – Epitaxy, Diffusion and Ion implantation.

Plastics: Comparison between thermoplastics and thermosets, Fabrication of plastics - compression moulding and injection moulding. Conducting polymers – Definition, classification and applications.

Water: Hardness - Causes, types and units. Boiler troubles-scales and sludges, caustic embrittlement. Water purification: Demineralization by Ion-exchange process, Desalination by reverse osmosis method.

UNIT V

Stereochemistry and Energy Resources

Stereochemistry: Elements of symmetry-plane of symmetry, centre of symmetry, alternating axis of symmetry. Chirality, Enantiomers – tartaric acid, Diastereomers- 2,3-dichloropentane, Conformational analysis of n-butane. Structure, synthesis and pharmaceutical applications of aspirin and ibuprofen.

Energy sources: Fossil Fuels: Coal –types, analysis of coal- proximate and ultimate analysis and their significance, Petroleum-its composition, Cracking – Definition, Fluid bed catalytic cracking, Knocking and its mechanism in Internal Combustion engine, Octane rating, Hydrogen gas generation by Electrolysis process.

Text Books:

1. Engineering chemistry by P.C. Jain and M. Jain; Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Textbook of Engineering Chemistry by A. Jayashree, Wiley Publications

Reference Books:

1. Organic Chemistry by Morrison, Boyd & Bhattacharjee (Pearson Pubs)
2. Engineering Chemistry by O.G.Palanna, Tata McGraw Hills Private Ltd.
3. Fundamentals of Molecular Spectroscopy, by C.N. Banwell. McGraw Hill Publication
4. A Textbook of Engineering Chemistry by Shashi Chawla, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGLISH

Course Code: GR22A1006 **L/T/P/C : 2/0/0/2**
I Year I Semester

Course Objectives:

1. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Equip students to study academic subjects more effectively and critically using the theoretical and practical components of English syllabus.
3. Develop study skills and communication skills in formal and informal situations.
4. Understand the importance of defining, classifying and practice the unique qualities of professional writing style.
5. Employ the acquired knowledge in classroom with reference to various social and professional spheres thus leading to a life-long learning process

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. Listen and respond appropriately.

UNIT I

Where the Mind is without Fear poem by Rabindranath Tagore

Vocabulary: The Concept of Word Formation -- The Use of Prefixes and Suffixes.
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 - Do's and Don'ts of Paragraph Writing - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT II

The Last Leaf by O. Henry

Vocabulary: Synonyms and Antonyms.
Grammar: Modal Auxiliaries - Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
Reading: Sub-skills of Reading- Skimming and Scanning
Writing: Précis Writing, Describing Objects, Places and Events – Classifying - Providing Examples or Evidence

UNIT III

'Blue Jeans' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.

Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages in English to

form Derivatives-Words from Foreign Languages and their Use in English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading: Improving Comprehension Skills – Techniques for Good Comprehension
Writing: Format of a Formal Letter-Writing Formal Letters E.g. Letter of Complaint, Letter of Requisition and Letter of permission, Use of phrases for formal and informal letter writing and Email etiquette

UNIT IV
'What Should You Be Eating' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Standard Abbreviations in English and Phrasal Verbs
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Comprehension- Intensive Reading and Extensive Reading
Writing: Writing Introduction and Conclusion -Essay Writing- Argumentative and Discursive essay – Picture Composition

UNIT V
'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: One Word Substitutes, Technical vocabulary and their usage
Grammar: Common Errors in English
Reading: Reading Comprehension-Exercises for Practice
Writing: What is Report Writing - Technical Reports vs General Reports – Importance of Report Writing – Structure and characteristics of Report Writing - Relevance of Reports to Engineers

Text Books:

1. Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge University Press.

Reference Books:

1. Swan, M. (2016). Practical English Usage. Oxford University Press.
2. Kumar, S and Lata, P. (2018). Communication Skills. Oxford University Press.
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
4. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
5. Hamp-Lyons, L. (2006). Study Writing. Cambridge University Press.
6. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING

Course Code: GR22A1007 **L/T/P/C:2/1/0/3**
I Year I Semester

Course Objectives:

1. To interpret the various steps in problem solving and program development.
2. To recall and reuse the fundamentals, syntax and semantics of C programming language.
3. To illustrate problem solving using arrays, strings, structures and pointers.
4. To demonstrate structured and modular programming approach in solving problems.
5. To interpret code and debug the given problems using files.

Course Outcomes:

1. To design algorithms and flowcharts for problem solving and illustrate the fundamentals of C language.
2. To identify and apply control structures and arrays to solve problems.
3. To discover the need for strings and functions in problem solving and apply it.
4. To analyze the need for pointers and structures in C and implement for solutions.
5. To interpret working with files, 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 of arrays. **Searching:** Introduction to searching, Linear search and Binary search.

UNIT III

Strings and Functions:

Functions: Introduction to structured programming, function declaration, signature of a function, parameters and return type of a function, categories of functions, parameter passing techniques, passing arrays and strings to functions, recursion, merits and demerits of recursive functions, storage classes.

Strings: Introduction to strings, operations on characters, basic string functions available in C - strlen, strcat, strcpy, strrev, strcmp, String operations without string handling functions, arrays of strings.

UNIT IV

Pointers and Structures:

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

Structures and Unions: Defining structures, declaring and initializing structures, arrays 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.

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

GRAPHICS FOR ENGINEERS

Course Code: GR22A1011 **L/T/P/C: 1/0/4/3**
I Year I Semester

Course Objectives:

1. Provide basic conventions and standards used in Graphics for Engineers.
2. Impart knowledge on different projection methods.
3. Draw multi views of a plane object located in different orientations.
4. Identify and draw 2d views of a solid objects in different positions.
5. Apply solid modelling features and concepts to draw and develop industrial components like springs, gears etc.

Course Outcomes:

1. Interpret industrial drawings and read working drawings.
2. Draw engineering objects like springs using AutoCAD.
3. Imagine and create multi-views of 2-d plane figures.
4. Construct and interpret multi-views of 3-d solid objects with proper dimensioning, scaling etc.
5. Draw and create pictorial views and model the industrial objects like gears and bearings with solid modelling commands available in AutoCAD tool.

UNIT I

Engineering Graphics with CAD - Introduction engineering graphics and significance of computer aided design CAD software, advanced commands, dimensioning and tolerancing, fundamentals of 2-D construction.

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 plane figures (triangle, square, pentagon, hexagon, and circle); projections of plane (inclined to one reference plane only).

UNIT IV

Projections of solids - definition and types of solid objects (prism, cylinder, pyramid, and cone); projections of solid (axis inclined to one reference plane only); creation of threads, washers, keys, and springs.

UNIT V

Isometric views - construction of isomeric views of planes (polygons) and solids (prism, cylinder, pyramid, and cone); fundamentals of 3-d drawings, world coordinate system, solid modelling and commands, creation of gears and bearings; conversion of 3-d to 2-d views and construction of 3-d view from 2-d views (simple objects)

Text Books:

1. Engineering Graphics and Design by Kaushik Kumar / Apurbakumar Roy / Chikesh
2. Engineering Drawing by N.D.BHATT/CHAROTAR PUBLISHING HOUSE PVT LTD

Reference Books:

1. Engineering Graphics Essentials with AutoCAD 2018 Instruction by Kirstie Platenberg/SDC publications.
2. Engineering Drawing by Basanth Agrawal/ C M Agrawal/ McGraw Hill Education
3. Engineering Drawing by K.Venu Gopal/New Age Publications.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING CHEMISTRY LAB

Course Code: GR22A1015 **L/T/P/C: 0/0/3/1.5**

I Year I Semester

Course Objectives:

1. Introduce practical applications of chemistry concepts to solve engineering problems.
2. To determine the rate constant of reactions from concentrations as a function of time.
3. Measure the molecular or ionic properties such as conductance, redox potentials.
4. Synthesize a drug molecule to learn how organic compounds are prepared in industry.
5. Know the laboratory practices implemented in a research and industrial chemistry laboratory setting.

Course Outcomes:

1. Ability to perform experiments illustrating the principles of chemistry relevant to the study of science and engineering.
2. Determination of parameters like hardness and chloride content in water, measurement of redox potentials and conductance.
3. Understand the kinetics of a reactions from a change in concentrations of reactants or products as a function of time.
4. Synthesize a drug molecule as an example of organic synthesis methods widely used in industry.
5. Determination of physical properties like adsorption and viscosity.

List of Experiments:

1. Determination of Total Hardness of water by 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 constant of acid catalyzed reaction of methyl acetate
7. Adsorption of Acetic acid by charcoal
8. Determination of Surface tension of liquid by using Stalagmometer
9. Determination of Viscosity of liquid by using Ostwald's Viscometer
10. Determination of Partition Coefficient of Acetic acid between n-butanol and water
11. Synthesis of Aspirin
12. Synthesis of Paracetamol

Reference Books:

1. Vogel's text book of Practical organic chemistry, 5th Edition.
2. Senior Practical Physical Chemistry, B.D. Khosala, A. Gulati and V. Garg (R. Chand & Co., Delhi)
3. Text book on experiments and Calculations in Engineering Chemistry-S.S.Dara.
4. An introduction to practical chemistry, K.K. Sharma and D.S. Sharma (Vikas Publications, New Delhi)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING LAB

Course Code: GR22A1017 **L/T/P/C: 0/0/3/1.5**
I Year I Semester

Course Objectives:

1. To analyse various IDE's to create, edit, compile, run and debug programs.
2. To develop programs to solve basic problems by choosing fundamental concepts in C like operators.
3. Build C programs using suitable control structures.
4. To develop modular, reusable and readable C programs using the concepts like functions, arrays and strings.
5. To design programs using structures, pointers and files.

Course Outcomes:

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

TASK 1

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

TASK 2

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

TASK 3

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

TASK 4

a. Write a C program to find the roots of a quadratic equation using if-else.
b. Write a C program to input electricity unit charges and calculate total electricity bill according to the given condition:
   For first 50 units Rs. .50/unit
   For next 100 units Rs. 0.75/unit
   For next 100 units Rs. 1.20/unit
   For unit above 250 Rs. 1.50/unit
   An additional surcharge of 20% is added to the bill
c. Write a menu driven C program to implement a simple arithmetic calculator.
d. Write a C program to display number of days in month using switch case (The input is month number 1 -12).

TASK 5

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

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TASK 6

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

```
(i)            (ii)                  (iii)
* * * *                 1                  1
*     *              2    3                2  2
*     *           4    5    6             3  3  3
* * * *        7    8    9    10          4  4  4  4
```

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

TASK 7

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

TASK 8

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

TASK 9

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

TASK 10

a. Write a C program to implement factorial of a given integer using recursive and non-recursive functions.
b. Write a C program to find the GCD (greatest common divisor) of two given integers using recursive andnon-recursive functions.
c. Write a C program to print first 'n' terms of Fibonacci series using recursive and non-recursive functions.

TASK 11

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

TASK 12

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

TASK 13

a.Define a structure Student, to store the following data about a student: rollno(int), name(string) and marks. Suppose that the class has 'n' students. Use array of type Student and create a function to read the students data into the array. Your program should be menu driven that contains the following options :

(i) Print all student details
(ii) Search student by rollno
(iii) Print the names of the students having the highest test score

b. Write a C program that uses structures and functions to perform addition and product of two complexnumbers? (use structures and functions)

TASK 14

a.Write a C program to merge two files into a third file.
b. Write a C program to count number of characters in a file and also convert all lower case characters toupper case and display it
c.Write a C program to append a file and display it

TASK 15

a.Write a C program to find sum of 'n' numbers using command line arguments.b.Write a C program to implement following pre-processor directives:

i. define ii. undef iii. ifdef iv. ifndef.

c.Write a C program to create a user defined header file to find sum, product and greatest of two numbers.

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

Course Code: GR22A1016 **L/T/P/C : 0/0/2/1**
I Year I Semester

Course Objectives:

1. Facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
2. Sensitize students to the nuances of English speech sounds, word accent, intonation rhythm and Neutralization of accent for intelligibility
3. Bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
4. Improve the fluency of students in spoken English and neutralize their mother tongue influence
5. train students to use language appropriately for public speaking and interviews

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 – Word Stress and Rhythm– Weak Forms and Strong Forms in Context.
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: Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions- Telephone Etiquette

Exercise III
CALL Lab: Errors in Pronunciation-the Influence of Mother Tongue (MTI).
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: Debates- argumentative vs persuasive - Public Speaking – Exposure to Structured Talks.
Practice: Debates- 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

DESIGN THINKING

Course Code: GR22A1022 **L/T/P/C: 2/0/0/0**

I Year I Semester

Course Objectives:

1. To Define Design Thinking and understand its mindsets
2. To explain Design Thinking Methodology
3. Apply Ideation Tools
4. To Discover the concept of Empathy
5. Explain how to design products

Course Outcomes:

1. To find various DT mindsets
2. Students will be able to extend DT methodology towards defining the problem
3. Students will be able to Identify Tools for Innovation
4. Students will be able to develop Empathy Maps
5. Students will be able to build Prototypes

UNIT I

Introduction to Design Thinking: LRI Assessment, Introduction to Design Thinking, Understanding the Mindsets-Empathy, Optimism, Embrace Ambiguity, Make it, Learn from Failure, Iterate, Create Confidence, Creativity Convergent & Divergent Thinking

UNIT II

Design Thinking Methodology: The 5 Stages of the Design Thinking Process- Empathise, Define (the problem), Ideate, Prototype, and Test,

UNIT III

Ideation tools & exercises: Sample Design Challenge, Design Challenge Themes, Story telling and Tools for Innovation and creativity.

UNIT IV

Empathize-Understand customers, Empathy Maps, Empathise-Step into customers shoes- Customer Journey Maps, Define- Analysis & Drawing Inferences from Research

UNIT V

The Design Challenge: Define the Design Challenge, Prototyping & Iteration- Feasibility Study, Testing-Documentation and the Pitching

Text Books:

1.Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School - Idris Mootee.

Reference Books:

1. Zero to One: Note on Start-Ups, or How to Build the Future
2. The Lean Startup: How Constant Innovation Creates Radically Successful Businesses
3. Start With Why: How Great Leaders Inspire Everyone To Take Action

I YEAR
II SEMSTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

Course Code: GR22A1002 **L/T/P/C: 3/1/0/4**
I Year II Semester

Course Objectives:

1. Solve engineering problems governed by linear differential equations
2. Learn the skill of evaluating multiple integrals needed for applications arising in science and engineering
3. Interpret the principles of vector differential calculus for some field theory concepts
4. Make use of line integrals for evaluating work done by a field
5. Develop the skill of utilizing special vector integral theorems for fast determination of work done and flux

Course Outcomes:

1. Classify the differential equations of first order and solve them analytically
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
4. Apply principles of vector differentiation and line integration for 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
Linear Differential Equations of the first order: Solution of Exact, Linear and Bernoulli equations, modelling Newton's law of cooling, growth and decay models, modelling of R-L circuit

UNIT II
Ordinary Differential Equations of Higher Order
Solution of homogeneous and non-homogeneous linear differential equations with constant coefficients, complimentary functions, particular integrals and the method of variation of parameters
Solution of Linear Differential Equations with variable coefficients: Cauchy's and Legendre's homogeneous equations

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)
Application of double integral to find the area of a lamina and volume of a solid, application of the triple integral to find the volume of a solid

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.
4. Calculus Early Transcendental 9E by James Steward, Daniel Clegg, Saleem Watson, CENGAGE Publications

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING PHYSICS

Course Code: GR22A1004 **L/T/P/C: 3/1/0/4**
I Year II Semesters

Course Objectives:

1. Explain the interaction of light with matter through interference and diffraction phenomena.
2. Discuss the use of lasers as light sources in optical fiber applications.
3. Outline the behavior of free electrons in materials.
4. Describe the properties and fabrication methods of nanomaterials.
5. Recognize the basic concepts of acoustics and ultrasonic.

Course Outcomes:

1. Apply the principles of interference and diffraction of light in engineering applications.
2. Analyze the properties of Laser and its propagation in different types of optical fibers.
3. Classify materials based on the theory of Kronig Penny model.
4. Enumerate the nature and characterization of nanomaterials and its applications.
5. Use the concepts of acoustics and non-destructive testing in solving engineering problems.

UNIT I

Wave Optics: Superposition of waves, Interference of light by wave front splitting: Young's double slit experiment, Interference in thin films by reflection, Interference of light by amplitude splitting: Newton's rings, Difference between interference and diffraction, Fraunhofer diffraction from a single slit, Diffraction grating, Grating spectrum, Determination of wavelength of light using diffraction grating.

UNIT II

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, Comparison of optical fibers over conventional cables, Types of optical fibers, Acceptance angle-Numerical aperture, Losses associated with optical fibers, Applications of optical fibers.

UNIT III

Introduction to solids: Bloch's theorem, Kronig – Penny model and its conclusions, E-K diagram, Brillion Zones, Effective mass of electron, Classification of solids on the basis of energy bands, Intrinsic and extrinsic semiconductors, Direct and Indirect band gap semiconductors.

UNIT IV

Nanomaterials: 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.

UNIT V

Acoustics: Basic requirements of acoustically good hall, Reverberation and Reverberation time, Sabine's formula for Reverberation time, Measurement of absorption coefficient of a material, Factors affecting the architectural acoustics and their remedies.

Ultrasonics: Introduction, Classification of ultrasonic waves: Longitudinal waves, Transverse waves, Surface waves and Plate waves, Production of ultrasonic waves: Piezoelectric method and Magnetostriction method, Properties of ultrasonic waves, Applications of ultrasonics: SONAR and NDT - Pulse echo method.

Teaching methodologies:

- White board and marker
- Power Point Presentations
- Video lectures

Text Books:

1. Engineering Mechanics, 2nd edition- MK Harbola, Cengage Learning
2. Mechanics, D S Mathur and P S Hemne, S Chand
3. Engineering Physics, P.K Palanisamy, Scitech Publishers.
4. Ajoy Ghatak, "Optics", McGraw Hill Education, 2012

Reference Books:

1. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006
2. O. Svelto, "Principles of Lasers"
3. "Introduction to Mechanics", M.K.Verma, Universities Press
4. I. G. Main, "Vibrations and waves in physics', 3rd Edition, Cambridge University Press, 2018
5. Applied Physics, T. Bhīma Sankaram, BSP Publishers.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING MECHANICS

Course Code: GR22A1010 **L/T/P/C: 3/1/0/4**
I Year II Semester

Course Objectives

1. Explain the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium.
2. Perform analysis of bodies lying on rough surfaces.
3. Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections.
4. Determine the forces in the members of the trusses.
5. Explain the concepts of work-energy method, impulse-momentum and its applications to translation, rotation and plane motion.

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.
3. Find the location of centroid and calculate moment of inertia of a given section.
4. Determine the forces in the members of the trusses
5. Solve problems using work energy equations for translation, fixed axis rotation and plane motion of rigid bodies.

UNIT I

Introduction to Engineering Mechanics - Force Systems

Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – 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, screw Centroid and Centre of Gravity-Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications.

UNIT III

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; Product of Inertia, 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 composite bodies.

UNIT IV

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. Principle of Virtual Work: Equilibrium of ideal systems, efficiency of simple machines, stable and unstable equilibriums.

UNIT V

Review of Particle Dynamics: Rectilinear motion, Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion, Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work- kinetic energy, power, potential energy. Impulse-momentum (linear, angular), Impact (Direct and oblique).

Text Books:

1. Reddy Vijay Kumar K. and J. Suresh Kumar (2010), Singer's Engineering Mechanics– Statics & Dynamics
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.
6. Basudeb Bhattacharyya, "Engineering Mechanics", Oxford University Press, 2008.
7. Meriam. J. L., "Engineering Mechanics", Volume-II Dynamics, John Wiley & Sons, 2008.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES

Course Code: GR22A1012 **L/T/P/C:2/1/0/3**
I Year II Semester

Course Objectives:

1. To illustrate various sorting techniques and analyze the order of complexities of algorithms.
2. To demonstrate operations of linear data structures like stacks and queues and their applications.
3. To develop algorithms to implement various linked lists operations and distinguish static and dynamic allocations.
4. To demonstrate operations of non-linear data structures, trees and graphs.
5. To realize the merits and demerits and applications of various data structures.

Course Outcomes:

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

UNIT I

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

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

UNIT II

Stacks: Introduction to Data Structures and types, Stack – Operations: pop, push, display, peek, Representation and implementation of stack operations using arrays, stack applications, recursion, infix to postfix transformation, evaluating postfix expressions.

Queues: Queue – Operations: enqueue, dequeue, display, representation and implementation of queue operations using array, applications of queues, circular queues - representation and implementation.

UNIT III

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

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

using linked list.

UNIT IV

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

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

UNIT V

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

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

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 PHYSICS LAB

Course Code: GR22A1014 **L/T/P/C: 0/0/3/1.5**

I Year II Semester

Course Objectives:

1. Experiment with resonance phenomena using mechanical and electrical sources.
2. Analyze the mechanical properties of solid materials.
3. Recall the basic properties of light through hands on experience.
4. Apply the theoretical concepts of Lasers and optical fibers in practical applications.
5. Outline the characteristics of various semiconducting materials.

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Course Outcomes:

1. Estimate the frequency of tuning fork, spring constant through coupled oscillation and analyze the resonance phenomena in LCR circuit.
2. Compare the rigidity modulus of wires of different materials using Torsional pendulum.
3. Interpret the properties of light like interference and diffraction through experimentation.
4. Asses the characteristics of Lasers and infer the losses in optical fibers.
5. Identify the type of semiconductor by measuring energy gap.

List of Experiments:

1. Melde's experiment: To determine the frequency of a turning fork using Melde's arrangement.
2. Torsional pendulum: To determine the rigidity modulus of the given wire using Torsional pendulum.
3. Newton's rings: To determine the wave length of the light source by forming Newton's rings.
4. Diffraction grating: To determine the wavelength of the light source by using diffraction grating.
5. Dispersive power: To determine the dispersive power of prism by using spectrometer.
6. Determination of wavelength of light by Laser diffraction method.
7. LCR Circuit: To determine the resonant frequency and quality factor of LCR circuit in series and parallel.
8. LASER: To study the V-I characteristics of LASER source.
9. Optical fiber: To determine the bending losses of Optical fibers.
10. Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode.

Note: Any 8 experiments are to be performed.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES LAB

Course Code: GR22A1020 **L/T/P/C: 0/0/2/1**
I Year II Semester

Course Objectives:

1. To interpret sorting techniques.
2. To design programs on stack and queue operations and their applications.
3. To construct programs for linked lists operations using dynamic memory allocation.
4. To develop modular, reusable and readable C programs for tree operations.
5. To implement graph representations and graph traversal techniques

Course Outcomes:

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

TASK 1

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

TASK 2

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

TASK 3

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

TASK 4

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

TASK 5

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

TASK 6

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

TASK 7

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

TASK 8

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

TASK 9

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

TASK 10

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

TASK 11

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

TASK 12

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

TASK 13

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

TASK 14

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

TASK 15

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

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 WORKSHOP

Course Code: GR22A1021 **L/T/P/C: 1/0/ 3/2.5**
I Year II Semester

Course Objectives:

1. Prepare and practice of scientific principles underlying the art of manufacturing in workshop/manufacturing practices.
2. Demonstrate basic knowledge of various tools and their use in different sections.
3. Make students to execute applications of various tools in carpentry.
4. Make students recognize applications of manufacturing methods casting, forming machining, joining and advanced manufacturing methods.
5. Develop generate safety rules, safe practices and workshop dress code.

Course Outcomes:

1. Develop various trades applicable to industries / Manufacturing practices.
2. Create Hands on experience for common trades.
3. Improve to fabricate components with their own hands.
4. Develop practical knowledge on the dimensional accuracies and dimensional tolerances possible with various manufacturing processes.
5. To build the requirement of quality of work life on safety and organizational needs.

TRADES FOR EXERCISES: At least two exercises from each trade:

1. Carpentry
2. Fitting Shop
3. Tin-Smithy
4. Casting
5. Welding Practice
6. House-wiring
7. Black Smithy
8. **VIDEO LECTURES**: Carpentry, Fitting operations, Tin-Smithy, Casting, Welding, Electrical and Electronics, Black Smithy, Plumbing, Power tools in construction and Wood Working, Manufacturing Methods,

Text Books:

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal /Anuradha.

Reference Books:

1. Work shop Manual - P. Kannaiah/ K. L. Narayana/SciTech
2. Workshop Manual / Venkat Reddy/BSP
3. Workshop Manual/K. Venugopal/Dr.V. Prabhu Raja/G.Sreekanjan

II YEAR
I SEMSTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BUILDING MATERIALS AND CONSTRUCTION PLANNING

Course Code: GR22A2010 **L/T/P/C: 2/0/0/2**
II Year I Semester

Course Objectives:

1. Identify various building materials and their structural requirements.
2. Explain the significance of cement and lime, Admixtures in construction.
3. Identify the suitable material for building components.
4. Review different types of masonry construction.
5. Discuss about various building services and planning.

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 woks.
5. Assess various building services and principles of building planning.

UNIT I

Building Stones, Bricks and Tiles

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

UNIT II

Cement, Lime, Admixtures

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

UNIT III

Wood, Glass, Paints

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

UNIT IV

Masonry and Finishing, Form Works

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

Finishing- plastering, pointing and cladding- Types of ACP (Aluminium composite panel). Form Works - requirements, standards, Scaffolding, shoring, under pinning.

UNIT V

Building Services and Building Planning

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

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

Text Books:

1. SK Duggal, Building Materials, New Age Publications 5th Edition, April, 2019.
2. B C Punmia, Ashok Kumar Jain and Arun Kumar Jain, Building Construction, Laxmi Publications (P) Ltd., New Delhi, 11th Edition, 2019.
3. P C Varghese, Building Construction, Prentice Hall of India Private Ltd., New Delhi, 2nd Edition, 2017.

Reference Books:

1. Roy Chudley "Construction Technology" Vol. – 1 & 2,2nd Edition, Longman, UK, 2014.
2. Rangwala, Building Construction, Charotar Publishing House Pvt. Ltd.; 33rd Edition, 2016.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING GEOLOGY

Course Code: GR22A2011 **L/T/P/C: 2/0/0/2**

II Year I Semester

Course Objectives:

1. Recognize the importance of weathering.
2. Identify the physical properties of minerals and their importance in Civil Engineering
3. Express knowledge on various types of rocks and their study.
4. Analyse various geological structures like faults, folds, joints and unconformity.
5. Identify various consequences of water table, landslides and earthquakes.

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, sedimentaryand metamorphic rocks.
4. Recognize various geological structures and the failures of dams, reservoirs and tunnelsdue 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: Feldsper, 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. Specific gravity of rocks. Field Classification chart. 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. Important distinguishing features of rocks as Lineation and Foliation. Detailed study of Gneiss, Schist, Slate.

UNIT IV

Structural Geology: Outcrop and width of outcrop. Fold - Types and nomenclature, Criteria for their recognition in field Faults: Classification, recognition in field. 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. Chennkesavulu, Mc-Millan, Text book of Engineering Geology, India Ltd., 2nd edition, 2013
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, NewDelhi, 2016.
2. Krynine & Judd, Principles of Engineering Geology & Geotechnics, McGraw Hill New York, CBS publications,2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SOLID MECHANICS – I

Course Code: GR22A2012 **L/T/P/C: 2/1/0/3**

II Year I Semester

Prerequisite: Mathematics, Engineering Mechanics.

Course Objectives:

1. Knowledge of engineering materials based on first energy principles, deformation and strain, concept of strain energy, momentum balance, stress and stress states, elasticity and elasticity bounds, plasticity and yield design.
2. Understanding the shear force and bending moment for different types of beams which allows them to understand, modeling and design of a large range of engineering materials.
3. Utility to evaluate the flexural and shear stress concepts for the different materials and shapes of the structure.
4. Skill to determine the principal stresses and strains under different loading using analytical and Mohr's Circle method.
5. Knowledge on deflection of beam for different materials under various loading conditions using moment area, double integration & Macaulay's method.

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 and fixed beams with different loading.
3. Evaluate 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. Evaluate 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 concentrated load, uniformly distributed load over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads,

uniformly varying loads, application of moments. Relationship between SF, BM and rate of loading at a section of beam.

UNT III

Flexural Stresses: Theory of simple bending - assumptions - derivation of bending equation: M/I = f/y = E/R - neutralaxis - 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 determinate 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, 18^{th}Edition,2014.
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
COMPUTATIONAL MATHEMATICS FOR ENGINEERS

Course code:GR22A2009 **L/T/P/C: 3/0/0/3**
II Year I Semester

Course Objectives

1. Distinguish between analytical and numerical solutions arising in mathematics
2. Learn methods that provide solutions to problems not possessing an analytical solution
3. Acquire skills to estimate derivatives and integrals numerically
4. Understand the usefulness of the principle of least squares
5. Understand the principles of numerical techniques require to solve ODE and PDE

Course Outcomes

1. Apply well known techniques to find real roots of an equation and linear algebraic systems by iterative methods
2. Apply interpolation and numerical differentiation techniques for univariate data
3. Solve problems related to numerical integration and least squares approximations of a function
4. Choose appropriate numerical techniques to solve IVP and BVP in ODE
5. Distinguish between various numerical methods to solve PDE arising in the context of heat conduction

UNIT I

Root finding and Numerical solution of linear algebraic systems

Finding the real root of algebraic and transcendental equations by Regula-Falsi and Newton Raphson methods -Gauss Jacobi and Gauss Seidel iterative methods to solve a linear algebraic system with error analysis

UNIT II

Interpolation - Cubic spline- Differentiation

Interpolation with non-uniform data: Newton divided differences formula, operational calculus, Interpolation with uniform data- Newton and Gauss formulas, Fitting natural cubic spline to data Numerical differentiation for uniform and non-uniform data

UNIT III

Numerical integration and Curve approximations

Numerical integration by Trapezoidal rule, Simpson's 1/3rd and $3/8^{th}$ rules – The Principle of least squares, Fitting a straight line, parabola, exponential and power curve, Simple and Multiple linear regression with 2 independent variables

UNIT IV

Numerical solution of initial and boundary value problems in ODE

Taylor's series method, Picard's method, Euler method, Modified Euler method and R-K fourth order methods to solve initial value problems in ODE - Finite differences method to solve boundary value problems in ODE

UNIT-V

Numerical solution initial and boundary value problems in PDE

Solution of Laplace's equation by Jacobi, Gauss-Seidel method and Successive over relaxation (SOR) methods, Solution of Heat equation by the finite difference method.

TEXT BOOKS

1. M.K.Jain, S.R.K. Iyengar, R.K.Jain-.Numerical methods for scientific and engineering computation-New Age International publishers-Fourth edition-2—3
2. Robert J.Schilling and Sandra L.Harries- Applied numerical methods for engineers using MATLAB and C-Thomson Brooks/Cole-2002

REFERENCE BOOKS

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTRODUCTION TO FLUID MECHANICS

Course Code: GR22A2013 **L/T/P/C: 3/0/0/3**
II Year I Semester

Prerequisite: Mathematics, Physics.

Course Objectives:

1. To introduce the concepts of fluid mechanics useful in Civil Engineering application
2. Measurement of pressure, computations of hydrostatic forces and the concepts of Buoyancyall final useful applications in many engineering problems.
3. Identifying the nature and behavior of fluid flows and distinguish fluid dynamics and kinematics
4. Describe the boundary layer flows and predict the drag and lift forces
5. Classify the head losses in pipe flows and skill seeing of measurement of flows.

Course Outcomes:

1. Comprehend the various fluid properties and fluid statics.
2. Understand 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; vapour 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 explanatory to Buoyancy and meta centre

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. Venture meter, 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.

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- Laminar flow through straight circular pipes- Haigen- Poisuelle equation derivation.

Text Books

1. Modi and Seth, Fluid Mechanics, Standard book house, 23rd edition, 2019.
2. Dr. R.K. Bansal, A text of Fluid mechanics and hydraulic machines, LaxmiPublications (P) ltd., New Delhi, 10th Edition, 2019
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: GR22A2014 **L/T/P/C: 3/0/0/3**
II Year I Semester

Course Objectives:

1. Understand and apply fundamental electrical theory and laws in basic series and Parallel dc circuits including ohm's law and Kirchhoff's laws.
2. Know the principle, working operations of various DC and AC machines.
3. Measure the fundamental electrical quantities using digital and analog multi-meters and an oscilloscope.
4. How the rectification (AC to DC) has been done by diodes.
5. Learn the basic semiconductor switching devices and its characteristics.

Course Outcomes:

1. Apply the application of ohms law & Kirchhoff's laws.
2. Discuss about fundamental principles of electrical machines.
3. Measure the fundamental electrical quantities using oscilloscope.
4. Illustrate the basic principles of semi conducting devices.
5. Analyze the different applications of a transistor and SCR.

UNIT I

Electrical Circuits: Basic definitions, Types of elements, Ohm's Law, , Kirchhoff's Laws, Faraday's Law, Resistive networks, Inductive networks, capacitive networks, Series, Parallel circuits and Star- delta and delta-star transformations.

UNIT II

DC Machines and AC Machines Principle of operation of DC Generator - emf equation - types– DC motor principle – types- torque equation– applications – three point starter– Principle of operation of induction motor – slip – torque characteristics – applications- Principle of operation of an alternator.

UNIT III

Transformers and Instruments Principle of operation of single phase transformers – EMF equation – losses – efficiency and regulation. Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments. Cathode Ray Oscilloscope Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Electrostatic and Magnetic deflection, Applications of CRO - Voltage, Current and frequency measurements.

UNIT IV

Diode and its Characteristics P-N junction diode, symbol, V-I Characteristics, Diode Applications, and Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems).

UNIT V

Transistors P-N-P and N-P-N Junction transistors, Transistor as an amplifier, SCR, Symbol, V-I characteristics and applications.

Text/Reference Books:

1. V.K.Mehta, S.Chand& Co, Principles of Electrical and Electronics Engineering.
2. M.S Naidu and S. Kamakshaiah, Introduction to Electrical Engineering, TMH Publications.
3. Kothari and Nagarath, Basic Electrical Engineering, TMH Publications, 2nd Edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING GEOLOGY LAB

Course Code: GR22A2015 **L/T/P/C: 0/0/4/2**
II Year I Semester

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Course Objectives:

1. Identify various Rocks and Minerals, their physical properties and use in industry.
2. Study the macroscopic description of few Rocks and Minerals.
3. Based on topic, usage of different rocks and minerals in commercial aspect.
4. Interpret various Geological maps showing structures like faults, folds, beds and unconformities etc.
5. Solve structural geology problems

Course Outcomes:

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

Exercises:

1. Studyof 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, faults, Unconformities etc.
5. Study of Seismic zones of India.
6. 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
SOLID MECHANICS LAB

Course Code: GR22A2016 **L/T/P/C:0/0/4/2**
II Year I Semester

Prerequisites: Engineering Mechanics, Mathematics and Physics.

Course Objectives:

1. Understanding the effect of tension in mild steel bars under tensile loading.
2. Skill to examine the resistance of various materials using hardness test and impact test
3. Find the modulus of rigidity in springs using spring test.
4. An idea on the compressive stress of concrete, wood etc.
5. Knowledge of pure bending theory and evaluate the Young's modulus of materials and Maxwell's reciprocal Theorem on beams.

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

VALUE ETHICS AND GENDER CULTURE

Code: GR22A2002 **L/T/P/C: 2/0/0/0**
II Year I Semester

Course objectives:

1. To understand about the importance of ethical values
2. To understand the significance of human conduct and self-development
3. To enable students to imbibe and internalize the value and Ethical behaviour in personal and professional lives.
4. To provide a critical perspective on the socialization of men and women.
5. To create an awareness on gender violence and condemn it.

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 Sreenivasand 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 SEMSTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SOLID MECHANICS- II

Course Code: GR22A2017 **L/T/P/C: 2/1/0/3**
II Year II Semester

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

Course Objectives:

1. Knowledge of various stresses in thin and thick cylinders under pressures and show stress distribution diagrams.
2. Introduce concept of torsion and bending in circular shafts and springs.
3. Evaluate the bulking or failure load for axially loaded and eccentrically loaded columns and struts.
4. Knowledge of direct and bending stresses in concrete structures like retaining wall, chimney, dams, and stability in dams.
5. Describe unsymmetrical bending in simply supported beams and to memorise beams incurved plan.

Course Outcomes:

1. Compute various stresses in thin and thick cylinders under pressure, show stress distribution diagrams and define Lame's theorems.
2. Analyse 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 dams, retaining walls and chimneys, and to check the stability of dams.
5. Evaluate the behaviour of members under unsymmetrical bending and find stresses in circular and semi-circular beams.

UNIT I

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

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

UNIT II

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

Springs: Introduction, types of spring, analysis of close coiled helical spring, elliptical and open coiled helicalspring.

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 andstress 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. R.K. Rajput, Strength of materials, S. Chand & Co, New Delhi, 6th Edition,2015.
3. S.S. Bhavikatti, Strength of materials, Vikas Publications, 4th Edition,2021.

Reference Books:

1. Ferdinand Beer and others, Mechanics of solid, Tata Mc. Graw Hill Publications, 7thEdition,2014.
2. A.R.Basu, Strength of materials, Dhanpat Rai& Co, NaiSarah, NewDelhi, 2nd edition,2012.
3. L.S.Srinath, Strength of materials, Macmillian Publishers India Ltd, 2000.
4. B.S. Basavrajaiah and P. Mahadevappa, Strength of materials, University Press, Hyderabad, 3rd Edition,2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SURVEYING AND GEOMATICS

Course Code: GR22A2018 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Objectives:

1. Describe the function of surveying in civil engineering construction and work with survey observations, and perform calculations.
2. To introduce basics and concepts of curves which will enable to setup and map the curves on ground with precision.
3. To understand the working of Total Station equipment and solve the surveying problems.
4. To introduce basics and concepts of aerial photography, acquisition and mapping from aerialphotographs using different types of stereo plotters.
5. The objective of this course is to familiarize about the principles of remote sensing, dataacquisition and analyze of satellite data.

Course Outcomes:

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to Engineering and surveying activities.
2. To be able to apply the knowledge on levelling and area, volume calculations.
3. Acquire the knowledge on theodolite and traversing methods in surveying.
4. To be able to calculate, design and layout of horizontal and vertical curves and acquire theknowledge on modern surveying methods
5. Acquire knowledge about photogrammetry principles, methods and. product generationstrategies in both Analytical and digital Photogrammetry system

UNIT I

Introduction to Surveying: 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

Leveling

Simple Leveling: Basic definitions; Types of levels and levelling staffs - classification of methods of leveling; Sources of errors in leveling - 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- Simpson's rule - Boundaries with offsets at irregular intervals - coordinate method - planimeter; level section - two level section - trapezoidal and prismoidal rule -volume from contour plan - 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, Trigonometric levelingwhen 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, compound, reverse, transition andvertical curves.

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

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

Reference Books:

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, first edition 2006.
2. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International publications, 2013.
3. Chandra, A.M., Higher Surveying, 2nd Edition, New Age International Publishers, 2006.
4. Anji Reddy, M., Remote sensing and Geographical information system, B.S.Publications, 4th edition, 2012.
5. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 17th edition,2019.
6. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRUCTURAL ANALYSIS - I

Course Code: GR22A2019 **L/T/P/C: 3/0/0/3**
II Year II Semester

Prerequisites: Engineering Mechanics, Solid mechanics.

Course Objectives:

1. Skill to Estimate the deflections of simple beams and pin-jointed trusses using energy theorems.
2. Ability to analyze three and two hinged, circular and parabolic arches
3. Knowledge to Analyze statically in-determinate structures using force and displacement methods.
4. To understand the effect of moving loads and analyse statically determinate beams and simple trusses.
5. To understand the effect using influence diagrams in analysis of statically determinate beams and simple trusses.

Course Outcomes:

1. Determine deflections of beams and trusses using energy methods.
2. Analyse three and two hinged of circular and parabolic arches.
3. Analyse indeterminate beams using force method for propped cantilever, fixed and Continuous beams (Clapeyorns's three moment theorem).
4. Apply Slope deflection, Moment distribution and Kani's methods to analyse statically indeterminate structures.
5. Analyse 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 andpin 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

Indeterminate Beams (Force Method)

a. Propped cantilevers
b. Fixed beams
c. Continuous Beams (By Clapeyron's theorem of three moments).

UNIT IV

Analysis of Simple and Continuous Beams (Indeterminate Structures)

(up to 2nd degree of Static indeterminacy)

a. Slope Deflection method
b. Moment Distribution method
c. Kani's Method.

UNIT V

Moving Loads and Influence Line Diagrams: Introduction, maximum SF and BM at a given section and absolute maximum S.F and B.M dueto single concentrated load, U.D load longer than the span, U.D load shorter than the span, two point loads with fixed distance between them and several point loads – Equivalent uniformly distributed Sload – focal length.
Definition of influence line for SF, Influence line for B.M- load position for maximum SF at a section –Load positions for maximum BM at a section – Point loads, UDL longer than the span, UDL shorter than the span- Influence lines for forces in members of Pratt and Warren trusses.

Text Books:

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

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, Theoryof 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: GR22A2004 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Objectives:

1. To provide the student with a clear understanding of demand analysis, elasticity of demand and demand forecasting.
2. To provide the insight on theory of production and cost analysis.
3. To describe different types of markets and competition and to elaborate the different forms of organisation and different methods of pricing.
4. To make the students understand various capital budgeting techniques
5. To Provide an insight of fundamental of accounting and emphasis on describe final accounts preparation

Course Outcomes:

1. The student will be able to understand the concepts of economics and Demand concepts, elasticity, and techniques for forecast demand of products
2. The student will be able to plan the production levels in tune with maximum utilization of organizational resources and with maximum profitability.
3. To understand the types of markets, types of competition and to estimate the cost of products and decide the price of the products and services produced
4. The student will be able to analyze the profitability of various projects using capital budgeting techniques and
5. The student is able will be able prepare the financial statements 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 ***Demand Analysis***: 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.

UNIT II

Production & Cost Analysis: ***Production Function*** – 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 and Policies of Pricing. Methods of Pricing. *Business:* Features and evaluation of different forms of Business

Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises, and their types.

UNIT IV

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)

UNIT V

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).

Text Books:

1. Managerial Economics – International Edition, 2019, by Christopher Thomas (Author), S. Charles Maurice (Author), McGraw-Hill Education
2. Managerial Economics Aryasri: Managerial Economics and Financial Analysis, TMH, 2009.
3. Managerial Economics: Analysis, Problems and Cases - P. L. Mehta, Edition, 13. Publisher, Sultan Chand, 2007.
4. Financial Accounting Paperback – 2016 by K.L.Narang S.P.Jain, Kalyani Publishers,2005.

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: GR22A2020 **L/T/P/C: 2/0/0/2**
II Year II Semester

Prerequisite: Fluid Mechanics
Course Objectives:

1. Describe the type of channel flow and application of chezys and manning equation
2. Predict the non-uniform flow in open channel flows.
3. Analyze the dimensions of model with prototype.
4. Identify the hydraulic jump losses, surface profiles and channel bed slopes.
5. Compute hydropower and work done bythe centrifugal pumps.

Course Outcomes:

1. Describe and predict the most economical Rectangular, Trapezoidal and circular channel sections and critical flow in rectangular channel.
2. Apply dynamic equation in non-Uniform flows and visualize surface properties of channel flow.
3. Analyse model and proto type simulation.
4. Analyse the hydraulic jump in rectangular channel.
5. Evaluate the efficiency of turbines, pumps and hydropower.

UNIT I

Introduction to Open Channel 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 formula. Factors affecting Manning's Roughness Coefficient 'n'. Most economical Rectangular, Trapezoidal and Circular Channel sections.

Specific energy, Specific energy curve, critical flow in rectangular channel, discharge curve Specific force Specific depth, and Critical depth.

UNIT II

Non-Uniform 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.

UNIT III

Hydraulic Jump: Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, types, applications and location of hydraulic jump. Energy dissipation and other uses, surges a moving hydraulic jump.

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity, Rayleigh method, Buckingham's Pi method. Buckingham's πTheorem application of dimensional analysis and

model studies to fluid flow problem Dimensionless groups. Similitude, Model studies, Types of models. Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number.

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, draft tube theory and function efficiency. Angular momentum principle, Applications to radial flow turbines. Governing of turbines, characteristic curves.

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally, jet striking at tip of the vane.

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- characteristic curves- NPSH-Cavitations - Reciprocating pumps basics and definition.

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. Modi & Seth, Hydraulic and Fluid mechanics, Standard Book House, 22nd edition, 2018.
3. K. Subramanya,Flow in Open Channel,Tata McGraw Hill, 5th edition, 2019.
4. Dr. R.K. Bansal, A text of Fluid mechanics and hydraulic machines, LaxmiPublications (P) ltd., New Delhi, 10th Edition, 2019.

Reference Books:

1. J.F.Douglas, J.M. Gaserek and J.A.Swaffirld, Fluid Mechanics,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

SURVEYING LAB

Course Code: GR22A2021 **L/T/P/C:0/0/4/2**
II Year II Semester

Prerequisite: Surveying
Course Objectives:

1. Introduction to the applicability of basic survey instruments.
2. Skill of determining relative positions in land surveying.
3. Visualization of elevations, areas and volumes.
4. Skill of plotting existing geographical surface information.
5. Knowledge to judge the compatibility of instruments.

Course Outcomes:

1. Define the characteristics and applications of basic survey instruments.
2. Apply knowledge of mathematics, science and engineering in land measurement Techniques.
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 Curve**.**

TASK-8: Determine the area of the field byusing 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) GPS Hand Application

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

COMPUTER AIDED DESIGN LAB

Course Code: GR22A2022 **L/T/P/C:0/0/4/2**
II Year II Semester

Prerequisite: Engineering Graphics

Course Objectives:

1. Introduction of computer aided drafting software and define its use in construction work.
2. Understand the basic building drawing fundamentals for creating and manipulate geometric models by CAD System.
3. Apply the knowledge of innovative competencies of CAD to increase the creativity to design projects.
4. Visualize and draw the building components like truss, windows and doors.
5. Understand the concepts of various truss members and its applications.

Course Outcomes:

1. Comprehend the fundamentals of building drawings and understand CAD software for drafting.
2. Draw Material, Sanitary, Electrical Symbols and various brick bonds by using drawing commands in CAD.
3. Develop Geometric Plan, Sections and Elevations for single and multi- storeyed building with suitable scale and dimensions.
4. Draft the building components and sectional view of doors, windows and trusses.
5. Create the drawings of various trusses like King post truss, Queen post truss and North light truss.

LIST OF EXPERIMENTS

1. Introduction to Computer Aided Drafting
2. Software and Basic drawing commands for CAD
3. Conventional Symbols used in Building Construction
    a. Building materials symbols
    b. Plumbing fixtures and
    c. Electric fixtures
4. Bonds in brick masonry
5. 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
    f. Workshop building with north light rooftruss
6. Drawing Plan, Section and Elevation of Multi-storeyed Building

7. Detailing of Building Components
    a. Doors
    b. Windows
    c. Ventilator
    d. Stairs
    e. Lintel Cum Shade
8. Drawing of King post truss, Queen post truss and North light Truss.

Reference Books:

1. M.N. Shesha Prakash, G.S. Suresh , Reference Book on Computer Aided Design Laboratory, Laxmi Publications; First edition (2016)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

Course Code: GR22A2023 **L/T/P/C:0/0/4/2**
II Year II Semester

Prerequisite: Fluid Mechanics and Hydraulic Engineering

Course Objectives:

1. Demonstration of the discharge through venture meter and orifice meter
2. Verify the Energy head in the pipe flows and able to compute impact coefficients of jet.
3. Describe the laminar and turbulent flows and velocity distribution in pipe lines
4. Evaluate the major and minor losses in pipe flow
5. Compute the efficiency of Pelton wheel turbine and multistage centrifugal pump

Course Outcomes:

1. Predict the discharge through venture meter and orifice meter.
2. Estimate the energy heads. Compute the laminar flow, length of flow.
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 Venturimeter /Orificemeter
2. Calibration of Rectangular notch/ Triangular Notch
3. Major losses
4. Minor losses in pipe (Hydraulic losses due to sudden enlargement of pipe and sudden contraction of pipe)
5. Verification of Bernoulli's Theorem
6. Reynold's experiment Laminar Flow and Turbulent flow through pipes
7. Impacts of jets on vanes
8. Pelton wheel turbine
9. Multi stage centrifugal pump
10. 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

References Books

1. J.F.Douglas, J.M.Gaserek and J A Swaffirld, Fluid Mechanics,5th longman 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 of India Pvt. Ltd., New Delhi, 2nd Edition,1994.

4. Dr. R.K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications
5. (P) ltd., New Delhi, 10th Edition, 2019.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING & TECHNOLOGY

ENVIRONMENTAL SCIENCE

Course Code:GR22A2001 **L/T/P/C:2/0/0/0**
II Year II Semester

Prerequisites: Basic knowledge of environmental issues

Course Objectives:

1. To recognize the impacts of human interventions towards environment
2. To understand how science and scientific method work to address environmental problems
3. To list out the benefits in creating a sustainable environment
4. To sketch out various activities in achieving a cleaner environment
5. To emphasize the role of an individual for a better planet to live

Course Outcomes:

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