ACADEMIC REGULATIONS PROGRAMME STRUCTURE AND DETAILED SYLLABUS

GR22

Bachelor of Technology
(Civil Engineering)
(Effective for the students admitted from the Academic Year 2022-23)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

GOKARAJU RANGARAJU

INSTITUTE OF ENGINEERING AND TECHNOLOGY

Bachupally, Kukatpally, Hyderabad-500090,Telangana
Tel: +91 7207344440
URL: www.griet.ac.in, E-Mail: info@griet.ac.in

ACADEMIC REGULATIONS PROGRAMME STRUCTURE & DETAILED SYLLABUS

Bachelor of Technology Civil Engineering

(Four Year Regular Programme)
(Applicable for Batches Admitted from 2022-23)

GOKARAJU RANGARAJU

INSTITUTE OF ENGINEERING AND TECHNOLOGY

Bachupally, Kukatpally, Hyderabad, Telangana, India- 500090

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)
10	Computer Science and Engineering (Artificial Intelligence)	61	B.Tech Computer Science and Engineering (Artificial Intelligence
11	Computer Science and Information Technology	33	B.Tech Computer Science and Information Technology

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 themerit rank obtained bythe 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 samemeaning.
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 $\geq$ 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 becondoned.

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'sperformance 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 durationof 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 theconcerned 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 durationof 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 - 3marks • 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 shallbe 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, 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 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 finalfor 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 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 Firstyear 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 second semester From all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Second year first semester to Second year second semester	Regular course of study of Second year first semester.
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 to Fourth year second semester	Regular course of study of Fourth year first semester.

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, technicalcompetition 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 tableare earned.

Computation of SGPA and CGPA:

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

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

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

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

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

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

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 credit

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

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

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 oramendments 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 2022-23)

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 academicyears.

   b) A student should register for all 120 credits and secure all credits. The marks obtained in all 120 creditsshall 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 sixacademic years from the year of their admission, shall forfeit their seat in B.Tech programme.

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

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

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

S. No.	Promotion	Conditions to be fulfilled
1	Second year first semester to Second year second semester.	Regular course of study of Second year first semester.
2	Second year second semester toThird year first semester.	(i) Regular course of study of Second year second semester. (ii) Must have secured at least 50% credits up to Second year second semesterfrom all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to Third year second semester.	Regular course of study of Third year first semester.
4	Third year second semester 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 ≥ 6.50 and CGPA < 8.00
4	Second Class	CGPA ≥ 5.50 and CGPA < 6.50
5	Pass Class	CGPA ≥ 5.00 and CGPA < 5.50

Academic Regulations for B.Tech with Minors Programme under 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.

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 Algebraand Function Approximation	3	1	0	4	3	1	0	4	40	60	100
2	Chemistry	BS	GR22A1005	EngineeringChemistry	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	Programmingfor Problem Solving	2	1	0	3	2	1	0	3	40	60	100
5	ME	ES	GR22A1011	Graphics forEngineers	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 Languageand CommunicationSkills 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	EngineeringPhysics	3	1	0	4	3	1	0	4	40	60	100
3	ME	ES	GR22A1010	EngineeringMechanics	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	EngineeringPhysics Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
6	CSE	ES	GR22A1020	Data StructuresLab	0	0	1	1	0	0	2	2	40	60	100
7	ME	ES	GR22A1021	EngineeringWorkshop	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 Materialsand 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 Aided Design Lab	0	0	2	2	0	0	4	4	40	60	100
8	CE	PC	GR22A2023	Fluid Mechanics and Hydraulic Machinery Lab	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
10	English	MC	GR22A2108	Effective Technical Communication	0	0	0	0	2	0	0	2	40	60	100
11	CE	MC	GR22A2109	Real-time Research Project/ Societal Related Project	0	0	2	2	0	0	4	4	50	--	50

III 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	GR22A3001	Geotechnical Engineering	2	0	0	2	2	0	0	2	40	60	100
2	CE	PC	GR22A3002	Concrete Technology	2	0	0	2	2	0	0	2	40	60	100
3	CE	PC	GR22A3003	Hydrology and Water Resources Engineering	3	0	0	3	3	0	0	3	40	60	100
4	CE	PC	GR22A3004	Design of Reinforced Concrete Structures	2	1	0	3	2	1	0	3	40	60	100
5		PE		Professional Elective-I	3	0	0	3	3	0	0	3	40	60	100
6		OE		Open Elective-I	3	0	0	3	3	0	0	3	40	60	100
7	CE	PC	GR22A3010	Geotechnical Engineering Lab	0	0	2	2	0	0	4	4	40	60	100
8	CE	PC	GR22A3011	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	GR22A2003	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	GR22A3005	Structural Analysis - II
2	CE	GR22A3006	Traffic Engineering and Management
3	CE	GR22A3007	Surface Hydrology
4	CE	GR22A3008	Pavement Materials

OPEN ELECTIVE-I			
S. No.	BOS	Course Code	Course
1	CE	GR22A3009	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	GR22A3079	Design of Steel Structures	2	1	0	3	2	1	0	3	40	60	100
2	CE	PC	GR22A3080	Foundation Engineering	3	0	0	3	3	0	0	3	40	60	100
3	CE	PC	GR22A3081	Environmental Engineering	2	0	0	2	2	0	0	2	40	60	100
4		PE		Professional Elective-II	3	0	0	3	3	0	0	3	40	60	100
5		OE		Open Elective-II	3	0	0	3	3	0	0	3	40	60	100
6	CE	PC	GR22A3087	Environmental Engineering Lab	0	0	2	2	0	0	4	4	40	60	100
7	CE	PC	GR22A3088	GIS Lab	0	0	2	2	0	0	4	4	40	60	100
8	CE	PW	GR22A3089	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	GR22A3082	Masonry Structures
2	CE	GR22A3083	Rock Mechanics
3	CE	GR22A3084	Open Channel Flow
4	CE	GR22A3085	Green Building Technology

OPEN ELECTIVE-II			
S. No.	BOS	Course Code	Course
1	CE	GR22A3086	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	GR22A4001	Estimation and Costing	2	1	0	3	2	1	0	3	40	60	100
2	CE	PC	GR22A4002	Transportation Engineering	3	0	0	3	3	0	0	3	40	60	100
3		PE		Professional Elective-III	3	0	0	3	3	0	0	3	40	60	100
4		PE		Professional Elective- IV	3	0	0	3	3	0	0	3	40	60	100
5		OE		Open Elective-III	3	0	0	3	3	0	0	3	40	60	100
6	CE	PC	GR22A4012	Transportation Engineering Lab	0	0	2	2	0	0	4	4	40	60	100
7	CE	PC	GR22A4013	Computer Applications in Structural Engineering Lab	0	0	2	2	0	0	4	4	40	60	100
8	CE	PW	GR22A4082	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	GR22A4003	Bridge Engineering
2	CE	GR22A4004	Ground Improvement Techniques
3	CE	GR22A4005	Groundwater
4	CE	GR22A4006	Tall Buildings

PROFESSIONAL ELECTIVE-IV			
S. No.	BOS	Course Code	Course
1	CE	GR22A4007	Finite Element Methods
2	CE	GR22A4008	Port and Harbor Engineering
3	CE	GR22A4009	Physico-Chemical Processes for Water and Wastewater Treatment
4	CE	GR22A4010	Rehabilitation and Retrofitting of Structures

OPEN ELECTIVE-III			
S. No.	BOS	Course Code	Course
1	CE	GR22A4011	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		PE		Professional Elective-V	3	0	0	3	3	0	0	3	40	60	100
2		PE		Professional Elective-VI	3	0	0	3	3	0	0	3	40	60	100
3	Mgmt	HS	GR22A4095	Entrepreneurship and Project Management	2	1	0	3	2	1	0	3	40	60	100
4	CE	PW	GR22A4145	Project Work- Phase II	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-V			
S. No.	BOS	Course Code	Course
1	CE	GR22A4087	Prestressed Concrete
2	CE	GR22A4088	Urban Transportation and Planning
3	CE	GR22A4089	Design of Hydraulic Structures
4	CE	GR22A4090	Construction Project Planning and Systems

PROFESSIONAL ELECTIVE-VI			
S. No.	BOS	Course Code	Course
1	CE	GR22A4091	Earthquake Engineering
2	CE	GR22A4092	Pavement Design
3	CE	GR22A4093	Irrigation Management
4	CE	GR22A4094	Construction Equipment and Automation

PROFESSIONAL ELECTIVES - 4THREADS

Structural Engineering	Geotechnical and Transportation Engineering	Environmental and Hydrology Engineering	Construction Technology & Management
Structural Analysis-II	Traffic Engineering and Management	Surface Hydrology	Pavement Materials
Masonry Structures	Rock Mechanics	Open Channel flow	Green Building Technology
Bridge Engineering	Ground Improvement Techniques	Ground water	Tall Buildings
Finite Element Methods	Port and Harbour Engineering	Physico-Chemical Processes for Water and Wastewater Treatment	Rehabilitation and Retrofitting of Structures
Prestressed Concrete	Urban Transportation and Planning	Design of Hydraulic Structures	Construction Project Planning and Systems
Earthquake Engineering	Pavement Design	Irrigation Management	Construction Equipment and Automation

OPEN ELECTIVES FOR GR22 REGULATIONS

THREAD 1	THREAD 2	OFFERED BY
Soft Skills and Interpersonal Skills (GR22A3145) Human Resource Development and Organizational Behavior (GR22A4049) Cyber Law and Ethics (GR22A4077) Economic Policies in India (GR22A4147)	Data Science for Engineers (GR22A3049)	CSE
	Data Analytics using Open-Source Tools (GR22A3120)	
	Augmented Reality and Virtual Reality (GR22A4054)	
	Basics of Java Programming (GR22A3072)	CSE (AIML)
	Introduction to DBMS (GR22A3141)	
	Introduction to Data Mining (GR22A4080)	
	Programming in Python (GR22A3077)	CSE (DS)
	Internet of Things (GR22A3147)	
	Scripting Languages (GR22A4085)	
	Services Science and Service Operational Management (GR22A4134)	CSBS
	IT Project Management (GR22A4135)	
	Marketing Research and Marketing Management (GR22A4136)	
	Introduction to Data Science (GR22A3056)	IT
	User Centric Human Computer Interaction (GR22A3127)	
	Design Patterns (GR22A4063)	
	Non-Conventional Energy Sources (GR22A3019)	EEE
	Concepts of Control Systems (GR22A3095)	
	Artificial Neural Networks and Fuzzy Logic (GR22A4022)	
	Principles of Communications (GR22A3040)	ECE
	Sensor Technology (GR22A3113)	
	Communication Technologies (GR22A4045)	
	Industrial Automation and Control (GR22A3030)	ME
	Composite Materials (GR22A3105)	
	Operations Research (GR22A3018)	
	Engineering Materials for Sustainability (GR22A3009)	CE
	Geographic Information Systems and Science (GR22A3086)	
	Environmental Impact Assessment (GR22A4011)	
	Basics of Java Programming (GR22A3072)	CSE (AI)
	Introduction to DBMS (GR22A3141)	
	Introduction to Data Mining (GR22A4080)	
	Introduction to Data Science (GR22A3056)	CSIT
	User Centric Human Computer Interaction (GR22A3127)	
	Design Patterns (GR22A4063)	

I YEAR
I SEMESTER

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 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 approximatesolutions 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 powercurves using matrix notation- Estimating the Mean squared error

Text Books

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

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 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 $[Ni(CO)4]$, $[Ni(Cl)4]^{2-}$, $[Ni(CN)4]^{2-}$, $[Co(NH3)6]^{3+}$, and $[CoF6]^{3-}$. 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 ^{1}H 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 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 UniversityPress.

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

CourseCode:GR22A1007   L/T/P/C:2/1/0/3
I Year I Semester

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 inC.

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 ifladder, 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 ofstrings.

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, 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, 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 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 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

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

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 and ternary operator.
c. Write a C program to check whether a number is even or odd using bitwise operator and ternary operator.

TASK 4
a. Write a C program to find the roots of a quadratic equation using if-else.
b. Write a C program to input electricity unit charges and calculate total electricity bill according to the given condition:
   For first 50 units Rs. .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 and ending values to be supplied by the user.
c. Write a C program to calculate the sum of following series:
   (i) $S1=1+x/1!-x^2/2!+x^3/3!-x^4/4!+.....xn/n!$ (ii)$S2= x^1/1+x^3/3+x^5/5+....+x^n/n$

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 roll no
   iii. Print the names of the students having the highest test score.
b. Write a C program that uses structures and functions to perform addition and product of two complex numbers? (use structures and functions)

TASK 14
a. Write a C program to merge two files into a third file.
b. Write a C program to count number of characters in a file and also convert all lower-case characters to upper case and display it
c. Write a C program to append a file and display it.

TASK 15
a. Write a C program to find sum of 'n' numbers using command line arguments.
b. Write a C program to implement following pre-processor directives:
   a. Define   c . ifdef
   b. Undef   d. 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
   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 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 knowledgecollaboratively 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 Requestsand 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 ofListening - 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

CourseCode:GR22A1022   **L/T/P/C: 2/0/0/0**
I Year I Semester

Course Outcomes:
1. Students To find various DT mindsets.
2. Students will be able to extend DT methodology towards defining the problem.
3. 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- Empathize, Define (the problem), Ideate, Prototype, and Test,

UNIT III
Ideation tools & exercises: Sample Design Challenge, Design Challenge Themes, Storytelling and Tools for Innovation and creativity.

UNIT IV
Empathize-Understand customers, Empathy Maps, Empathize-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 DesignSchool - 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 SEMESTER

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 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 theorem: 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 Semester

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 diffractiongrating.

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, Factorsaffecting 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 Outcomes:
1. Determine resultant of forces acting on a body and analyze equilibrium of a body subjected to a system of forces.
2. Solve problems of bodies subjected to friction.
3. Find the location of centroid and calculate the 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 ofperfect 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 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 onstack 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 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. Assess 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 Torsionalpendulum.
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 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 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 SEMESTER

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

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

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

UNIT IV
Masonry and Finishing, Form Works
Brick Masonry- Types and bonds. Stone Masonry- Types.
Finishing- plastering, pointing and cladding- Types of ACP (Aluminum 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 Outcomes:
1. Identify the weathering effects and various deposits.
2. Recognize minerals and its importance from civil engineering point of view.
3. Distinguish features of igneous, sedimentary, and metamorphic rocks.
4. Recognize various geological structures and the failures of dams, reservoirs, and tunnels due to geological reasons.
5. Relate water table and the failures of earthquake and landslides.

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

UNIT II
Mineralogy: Mineral, Origin and composition. Physical properties of minerals, Role of study of physical properties of following common rock forming minerals: 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 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: $M/I= f/y = E/R$ – neutral axis - determination of bending stresses -section modulus of rectangular and circular sections (Solid and Hollow), I, T, angle and channel sections - design of simple beam sections.
Shear Stresses - Derivation of formula - Shear stress distribution across various beam sections like rectangular, circular, triangular and angle sections**.**

UNIT IV
Compound Stresses and Strains: Two- dimensional system, stress at a point on an inclined plane under axial loading-Normal and Tangential stresses on an inclined plane for biaxial stresses-two perpendicular normal stresses accompanied by a state of simple shear.
Principal Stresses and Strains
Analytical and graphical solutions- Mohr's circle of stresses - various theories of failures- maximum principal stress theory-maximum shear stress theory- maximum strain energy theory- maximum shear strain energy theory.

UNIT V

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

Text Books

1. Dr. R.K. Bansal, Strength of material, Laxmi Publications, New Delhi, 6th edition, 2018.
2. S. Ramamrutham, Strength of material- Dhanpat Rai Publishing Company, New Delhi, 18th Edition,2014.
3. R K Rajput, Strength of materials, S Chand Publications, 6th edition, 2015.

Reference Books

1. Dr. B.C. Punmia, Mechanics of Materials, Laxmi publications, 11th edition, 2017.
2. B. S. Basavarajaiah, Strength of Materials, University Press, Hyderabad, 3rd Edition, 2010.
4. Ferdinand Beer and others, Mechanics of Solid, Tata Mc. Graw Hill publications, 7th Edition,2014.
3. A.R.Basu, Strength of materials, Dhanpat Rai &Co, Nai Sarah, New Delhi, 2nd dition,2012.
4. S S Bhavikatti, Strength of materials, New Age Publications, 4th edition, 2021.
5. R. Subramanian, Strength of materials, Oxford University Press, New Delhi, 3rd edition,2016.
   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 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 3/8th 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 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; vapor pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility. Fluid Statics - Fluid Pressure: Pressure at a point, Pascal law, pressure variation with temperature, density and altitude. Piezometer, U- Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro manometer. pressure gauges.

UNIT II
Hydrostatic Law, Hydrostatic pressure, and force: horizontal, vertical, and inclined curved surfaces. Introduction explanatory to Buoyancy and meta center
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: venturi meter, 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-Wies batch 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, Laxmi Publications (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.

Reference 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 Outcomes:
1. Apply the application of ohms law & Kirchhoff's laws.
2. Discuss 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,TMHPublications.
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 Outcomes:
1. Identify various minerals and their properties.
2. Identify various rocks and their properties.
3. Understand various rocks and minerals used in 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. Study of physical properties and identification of minerals referred under theory.
2. Megascopic description and identification of rocks referred under theory.
3. Study of Geological map of India.
4. Interpretation and drawing of sections for geological maps showing tilted beds, 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 Outcomes:
1. Determine the important mechanical properties of materials.
2. Identify the stiffness of an elastic isotropic material.
3. Evaluate the Reciprocal theorem.
4. Measure any substance's resistance to uniform compression.
5. Resistance of various materials against abrasion and impact.

TASK- 1: Tension test on metals

TASK- 2: Torsion test on metals

TASK- 3: Hardness test on metals

TASK- 4: Spring test on metals

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

TASK-6: Impact test on metals.

TASK-7: Deflection test on cantilever beam.

TASK-8: Deflection test on simply supported beam.

TASK-9: Deflection test on continuous beam.

TASK-10: Verification of Maxwell's Reciprocal theorem

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

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

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

Course Outcomes

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

UNIT I

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

❖   A Case study on values and self-development

UNIT II

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

❖   A Case study on Personality

UNIT III

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

❖   A Case study on professional ethics

UNIT IV

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

❖   A Case study/ video discussion on attitudes towards gender

UNIT V

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

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

Text Books

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

Reference Books

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

II YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SOLID MECHANICS- II

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

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

Course Outcomes:
1. Compute various stresses in thin and thick cylinders under pressure, show stress distribution diagrams and define Lame's theorems.
2. Analyze the torsional strength of structural members and differentiate between closed and opencoiled 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 circularand 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 helical spring.

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

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

UNIT IV
Direct and Bending Stresses of Dams, Retaining walls and Chimneys: Stresses under the action of direct loading and bending moment, core of a section. Determination of stresses in the case of chimneys, retaining walls and dams. Conditions for stability of dams. Stresses due to direct loading and bending moment about its axis.

UNIT V
Unsymmetrical Bending of Beams: Introduction–Centroid principal axes of section–Graphical Stresses in beams subjected to unsymmetrical bending. Principal axes- Resolution of bending moment into two rectangular axes through the centroid - Location of neutral axis. Deflection of beams under unsymmetrical bending. Curved Beams: Introduction – circular beams loaded uniformlyand 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, 7th Edition,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

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

Course Outcomes:
1. Apply the knowledge, techniques, skills, and applicable tools of the discipline toEngineering 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 acquirethe knowledge on modern surveying methods
5. Acquire knowledge about photogrammetry principles, methods and productgeneration strategies 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 leveling when base is accessible and inaccessible.

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

UNIT IV
Curves: Types of curves and their necessity, elements of simple, compound, reverse, transition, and vertical 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- advantages and Applications. Field Procedure for total station survey, Errors in Total Station Survey, Global Positioning System- Principle and Applications.

UNIT V

Photogrammetry Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping-mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes. Digital Photogrammetry – Introduction- List of software 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 andRemote 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 Outcomes:
1. Determine deflections of beams and trusses using energy methods.
2. Analyze three and two hinged circular and parabolic arches.
3. Analyze indeterminate beams using force method for propped cantilever, 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. Analyze statically determinate structures using rolling load and influence line methods.

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

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

UNIT III
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 due to single concentrated load, U.D load longer than the span, U.D load shorter than the span, two- p o i n t 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, Theory of structures, S. Chand Publishers, 12th edition, 2020.
6. Dr. B.C. Punmia, Mechanics of Materials, Laxmi publications, 11th edition, 2017.
7. B.D. Nautical, Introduction to structural analysis, new age international publishers, New Delhi,2001

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

Course Code: GR22A2004   **L/T/P/C: 3/0/0/3**
II Year II Semester

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 Organization: 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 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. Analyze model and proto type simulation.
4. Analyze 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, Laxmi Publications (P) ltd., New Delhi, 10th Edition, 2019.

Reference Books

1. J.F.Douglas, J.M.Gaserek and   J.A.Swaffirld Fluid Mechanics, Prentice Hall,5thedition,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 Editon 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 Outcomes:
1. Define the characteristics and applications of basic survey instruments.
2. Apply knowledge of mathematics, science and engineering in land measurementTechniques.
3. Calculate distances, inclinations, elevations, areas and volumes.
4. Generate maps of earth surfaces.
5. Analyzing the data and transfer relevant points onto ground.

LIST OF EXPERIMENTS

TASK-1: (i) Measurement of an area by Chain Survey (Open and Closed Traverse).
     (ii) Study of Topo sheets
TASK-2: Chaining across obstacles
TASK-3: Simple, fly, Differential Levelling.
TASK-4: Study of Theodolite- Measurement of horizontal and vertical angles- (Repetition and Reiteration method).
TASK-5: Trigonometric Levelling- Heights and distances problems.
TASK-6: Calculation of R.L and distance using tachometric survey.
TASK-7: Setting out Curve**.**
TASK-8: Determine the area of the field by using Total Station.
TASK-9: Column and foundation marking using Total Station.
TASK-10: (i) Distance, gradient, differential height between two inaccessible points using Total Station.
     (ii) 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 Outcomes:
1. Comprehend the fundamentals of building drawings and understand CAD software fordrafting.
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 buildingwith 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 lighttruss.

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 roof truss.
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 DesignLaboratory, 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 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 Venturi meter /Orifice meter
2. Calibration of Rectangular notch/ Triangular Notch
3. Major losses
4. Minor losses in pipe (Hydraulic losses due to sudden enlargement of pipe and suddencontraction 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

Reference 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 (P) ltd., New Delhi, 10th Edition, 2019.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND 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 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 the natural world.
4. Appraise the quality of the environment 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 LearningIndia 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,

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
EFFECTIVE TECHNICAL COMMUNICATION

Course Code: GR22A2108   **L/T/P/C:2/0/0/0**
II Year II Semester

Course Outcomes:
1. Demonstrate to proficiency in producing well-structured technical documents adhering to standard writing conventions and industry-specific guidelines.
2. Develop critical analysis skills to assess and evaluate technical documents.
3. Develop a habit of lifelong learning in technical communication, recognizing its importance in their personal and professional growth.
4. Exhibit effective oral communication skills by delivering technical presentations with clarity, coherence, and appropriate use of visual aids.
5. Exemplify intercultural competence in technical communication.

UNIT I
Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, Factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media, Artificial Intelligence - Voice of the future, Everyday life, Communicating with Machines.

UNIT II
Technical Writing, Grammar, and Editing- Abstract Writing, Technical writing process, forms of discourse, Collaborative writing, creating indexes, technical writing style and language, Basics of grammar, and study of advanced grammar, Introduction to Digital Humanities, Managing technical communication projects, Time estimation, Single sourcing, Localization.

UNIT III
Self-Development and Assessment- SWOT, Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, Career planning, Self-esteem, Managing Time, Personal memory, Taking notes, Complex problem-solving, Stress Management, Working with Rhythm and Balance, Emotional Intelligence, Six Hats of Thinking.

UNIT IV
Communication and Technical Writing- Group discussion, Oral presentation, Resume writing, Interview skills, Graphic presentation, Personality Development, Technical articles, Official notes, Memos, and Minutes of meetings.

UNIT V
Ethics- Business ethics- Corporate Social Responsibility-importance, need, stories, Engineering Ethics, Role and responsibility of engineer, Work culture in jobs.

Text Books
1. M Ashraf Rizvi, Effective Technical Communication, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.

Reference Books
1. Raman Sharma, Technical Communication, Oxford Publication, London, 2013.
2. Meenakshi Raman, Shalini Upadhyay, SOFT SKILLS Key to Success in Workplace and Life, Cengage Learning India Pvt. Ltd., Delhi, 2018.

3. Ron Cowan, The teacher's Grammar of English, CAMBRIDGE UNIVERSITY PRESS, New Delhi,2008.
4. Shiv Khera, You Can Win, Macmillian Books, New York, 2003.
5. Arthur D. Rosenberg, David Hizer, The Resume Handbook, Adams Media, an F+W Publications Company, 57 Little field Street, Avon, MA02322, USA.
6. M. Kay DuPont, Business Etiquette & Professionalism, Viva Books private Limited, Hyd.,2005
7. David F. Beer and David McMurrey, Guide to Writing as an Engineer, John Willey, New York, 2004.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
REAL-TIME RESEARCH PROJECT/ SOCIETAL RELATED PROJECT

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

Course Outcomes:

1. Predict the Field domain in the specialized area under Engineering discipline.

2. Evaluate and Obtained the category of the solution with help of Real time studies.

3. Analyze and discuss the field problems using software tools /Modes/simulations and experimental investigations.

4. Implementing the solution of problem statement.

5. Prioritize the reports and deliver the final work with presentation.

III YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GEOTECHNICAL ENGINEERING

Course Code:GR22A3001   **L/T/P/C:2/0/0/2**
III Year I Semester

Prerequisites: Engineering Geology

Course Outcomes:
1. Identify basic Engineering properties of soil and classify the soil.
2. Evaluate coefficient of permeability and effective stresses of soil.
3. Assess the mechanism of stress distribution and compaction in soils.
4. Analyze the behaviour of soil during consolidation process.
5. Evaluate the performance of shear strength of soil mass.

UNIT I
Introduction - Types of soils and their formation, Scope of soil mechanics, Basic definitions and relationships, Soil mass as two and three-phase system, Relative Density, Consistency limits, Consistency indices, Grain size analysis, Indian standard soil classification system and Plasticity chart.

UNIT II
Permeability of Soil – Capillary rise, Darcy's law, determination of coefficient of permeability by constant-head method and falling-head method. Field methods by pumping-out test. Permeability of stratified soils and factors affecting permeability of soil.
Seepage Analysis - characteristics of flow nets, total stress, neutral stress and effective stress. Principle of effective stress, effect of water table and fluctuations in effective stress, quicksand condition.

UNIT III
Stresses in soils – Introduction, Pressure bulb and Isobars, Boussinesq's equation for the vertical stress due to point load, line load, strip load, uniformly loaded circular area. Representation of stress along the vertical plane and horizontal plane. Westergaard's equation, Theory of Newmark's Influence Chart. Appropriate stress distribution methods - equivalent point load method and two to one method.
Compaction of Soil – Mechanism of compaction, laboratory tests, factors affecting compaction, effects of compaction on soil properties, Field compaction and quality control.

UNIT IV
Consolidation of Soil – stress history of clay, primary consolidation, and secondary consolidation settlement, Terzaghi's theory of consolidation, interpretation of consolidation test results, determination of pre-consolidation pressure.

UNIT V
Shear Strength - Mohr circle and its characteristics, Mohr-Coulomb theory. Types of laboratory shear tests – direct shear test, tri-axial compression test, unconfined compression test and vane shear test. Shear strength of clays and sands.

Text Books

1. Gopal Ranjan and ASR Rao, Basic and Applied Soil Mechanics, New Age International Pvt. Ltd,New Delhi, 3rd edition (2016).
2. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, Delhi,5th edition (2000), Reprint (2020).
3. C. Venkataramiah, Geotechnical Engineering, New age International publishers (2002),5th edition(2017).

Reference Books

1. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundations, Laxmipublications Pvt. Ltd., New Delhi, 16th edition, Reprint (2017).
2. Dr. P. Purushotham Raj, Soil Mechanics and Foundation Engineering, Pearson Education India(2008).
3. S. K.Gulhati & Manoj Datta, Geotechnical Engineering, Mc.Graw Hill Education Pvt Ltd., NewDelhi(2005), Reprint (2017).
4. Braja M. Das, Advanced Soil Mechanics, Taylor and Francis, 4 th edition (2013).
5. Soil Mechanics by Craig R.F., Chapman & Hall, 8th edition 2012, CRC Press.
6. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri-Wiley Inter science, 3rd edition- 1996.
7. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S.Murthy, Publishers: Marcel Dekker, 2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONCRETE TECHNOLOGY

Course Code:GR22A3002   **L/T/P/C:2/0/0/2**
III Year I Semester

Prerequisites: Building Materials and Construction Planning
Course Outcomes:
1. Explain the physical and chemical properties of concrete ingredients and able to conduct tests on cement.
2. Explain the physical and chemical properties of aggregates and able to conduct tests on aggregates.
3. Comprehend the behaviour of fresh & hardened concrete.
4. Demonstrate different tests on hardened concrete and estimate the creep and shrinkage of concrete.
5. Design the mix proportions for the specific work for required strength and workability with available materials at workplace and discuss the applications of the special concretes.

UNIT – I
Cements & Admixtures: Portland cement – Chemical composition – Hydration, setting of cement – Structure of hydrated cement – Tests on physical properties – Different grades of cement – Admixtures – Mineral and chemical admixtures.

UNIT – II
Aggregates: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum size of aggregate.

UNIT - III
Fresh Concrete: Manufacturing of concrete, mixing, compaction curing, Properties of fresh concrete. Workability – Factors affecting workability – Measurement of workability–Setting times of concrete – Effect of time and temperature on workability – Segregation & bleeding.
Hardened Concrete: Water / Cement ratio – Abram's Law – Gel Space ratio – Nature of strength of concrete – Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength -Durability of Concrete.

UNIT - IV
Testing of Hardened Concrete: Compression tests – Tension tests – Factors affecting strength – Flexure tests – Splitting tests – Non-destructive testing methods – Codal provisions for NDT – Quality control of Concrete.
Elasticity, Creep & Shrinkage: Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – Types of shrinkage.

UNIT - V
Concrete Mix Design: Factors in the choice of mix proportions – Acceptance criteria – Proportioning of concrete mixes by BIS method of mix design.
Special concretes: Lightweight aggregate concrete – Cellular concrete– No-fines concrete – High density concrete – Fibre Reinforced concrete – Different types of fibres– Factors affecting properties & Applications of F.R.C – Polymer concrete – Types of Polymer concrete – Properties of polymer concrete & Applications – High performance concrete – Self-consolidating concrete – SIFCON – Geopolymer Concrete.

Text Books:

1. Concrete Technology: Theory and Practice, M. S. Shetty and A. K. Jain, S Chand Co., Publishers 2018.
2. Concrete Technology by M.L. Gambhir – Tata Mc. Graw Hill Publishers, 5th edition 2017 New Delhi.
3. Concrete: Microstructure, Properties, and Materials, P. Kumar Mehta, Paulo J. M. Monteiro, McGraw Hill Professional, 2013

Reference Books:

1. Properties of Concrete, AM Nevelli, Prentice Hall Publishers, 2012, 5th edition.
2. Concrete Technology and Good Construction Practices by Y P Gupta, New Age International Private Ltd. 1st edition 2013.
3. Concrete Technology by A.R. Santha Kumar, Oxford University Press, New Delhi-2006.
4. Concrete: Microstructure, Properties and materials by P Kumar Mehta, P J M Monteiro, MC Graw Hill Education Publisher, New Delhi- 4th edition-2017.
5. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House 2015.
6. Concrete Technology by S.S Bhavikatti, I K International Publishing House 2015.

IS CODES:

1. IS 10262: 2019, Concrete Mix Proportioning- Guidelines (Second Revision).
2. IS 383: 2016 Coarse and Fine Aggregate for Concrete – Specification
3. IS 516: Method of Tests for Strength of Concrete.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
HYDROLOGY AND WATER RESOURCES ENGINEERING

Course Code:GR22A3003   **L/T/P/C:3/0/0/3**
III Year I Semester

Pre-Requisites: Introduction to Fluid Mechanics
Course Outcomes:
1. Measure, estimate and process rainfall data, runoff data, evaporation data, Evapotranspiration data and infiltration data.
2. Design a model in a region for direct run off hydrograph, unit hydrograph, S-Curve hydrograph, and Synthetic unit hydrograph.
3. Calculate the discharge of radial flow to wells in a region of confined and unconfined aquifers by determining the aquifer parameters by field tests and pumping tests.
4. Design a suitable irrigation method depending on soil, water and plant conditions on the field & Prepare irrigation schedules and irrigation efficiencies for farmers on the field
5. Design irrigation canals and estimate discharge by SCS Curve Number Method, analyze the regional flood frequency, discuss the methods of stream gauging and evaluate the forces acting on gravity dam.

UNIT I
Introduction to Engineering Hydrology and its applications: Hydrologic Cycle, types and forms of precipitation, rainfall measurement, types of Rain gauges, computation of average rainfall over a basin, processing of rainfall data- adjustment of record-Rainfall Double Mass Curve. Runoff-Factors affecting Runoff over a Catchment-Empirical and Rational Formulae.
Abstraction from rainfall: Evaporation, factors effecting Evaporation, Measurement of evaporation–Evapotranspiration-Penman and Blaney & Criddle Methods -Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices- Important aspects of National Water Policy 2012.

UNIT II
Distribution of Runoff: Hydrograph Analysis; Flood Hydrograph – Effective Rainfall - Base Flow-Base Flow Separation - Direct Runoff Hydrograph– Unit Hydrograph, definition and limitations of application of Unit hydrograph, Derivation of Unit Hydrograph from Direct Runoff Hydrograph and vice versa S- Curve hydrograph, Synthetic Unit Hydrograph

UNIT III
Ground water Occurrence: Types of aquifers, aquifer parameters,' porosity' Specific yield, permeability, transmissivity and storage coefficient, Darcy's law, radial flow to wells in confined and unconfined aquifers, Types of wells, Well Construction - Well Development.

UNIT IV
Necessity and importance of irrigation: Advantages and ill-effects of irrigation, Types of irrigation, Methods of application of irrigation water, Indian Agriculture soils, Methods of improving soil fertility-Crop rotation, preparation land for irrigation, Standards of quality for irrigation water.
Soil-water-plant relationship: Vertical distribution of soil moisture, soil moisture constants, soil moisture tension, consumptive use, Duty and delta, factors Affecting duty- design discharge for a water course. The depth and frequency of Irrigation, Irrigation efficiencies- Water Logging.

UNIT V
Classification of canals: Design of Irrigation canals by Kennedy's and Laceys theories, balancing

depth of cutting, IS standards for canal design canal lining.

Design discharge over a catchment: computation of design discharge–Rational formula, SCS curve number method, flood frequency analysis introductory part only. Stream gauging- measurement and estimation of stream flow.

Dams: Types of Reservoirs, Dams and Spillways. Stability Analysis on Gravity Dams and Earthen Dams. Very Basic Concepts only in Water Data visualization and extraction from India- WRIS (Water Resources Information Systems) and BHUVAN-Names and Numbers of ten important IS codes in Water Resources Engineering- Listing only Software Applications to WRE- Listing only

Text Books

1. A Text book of Hydrology by P. Jaya Rami Reddy,3rd Edition, Laxmi publications,2016.
2. Engineering Hydrology by K. Subramanya, Fourth Edition, McGraw HillEducation,2017.
3. Irrigation and Water Power Engineering- B.C.Punmia, Pande B.B.Lal, Ashok Kumar Jain,Arun Kumar Jain-Laxmi Publications, 17th edition- 2021.

Reference Books

1. Irrigation Engineering & Hydraulic Structures- Santosh Kumar Garg,first edition 2006.
2. Elementary Hydrology by V.P.Singh, PHI publications, Fascimile edition-1991
3. Irrigation and Water Resources &Water Power by P. N. Modi, Standard Book House,11th edition 2019.
4. Irrigation Water Management by D.K. Majumdar, Prentice Hall of India., 2nd edition-2013.
5. Applied Hydrology by Ven Te Chow, David R Maidment, Larry W Mays, Tata Mc Graw Hill Education, first edition 2017.
6. Introduction to Hydrology by Warren Viessman, Jr. Garyl Lewis- Pearson, 5th edition2003.
7. NPTEL Web and Video Courses.
8. HEC-HMS (hec.usace.army.mil/software/hec-hms/features.aspx)
9. MODFLOW (usgs.gov/mission-areas/water-resources)
10. SWAT (swat.tamu.edu)
11. India –WRIS (www.indiawris.gov.in)
12. BHUVAN (bhuvan.nrsc.gov.in)
13. Handbook of Hydrology–Edited by David R. Maidment, MC Graw HillEducation,1992.
14. Handbook of Applied Hydrology -Edited by V.T.Chow, Mc Graw Hill education,1964.
15. Groundwater Hydrology– David K. Todd and Larry W. Mays Wiley 3rd Edition-2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DESIGN OF REINFORCED CONCRETE STRUCTURES

Course Code:GR22A3004   **L/T/P/C: 2/1/0/3**
III Year I Semester

Prerequisite: Solid Mechanics, Structural Analysis, Building Materials and Construction Planning and Engineering Graphics.

Course Outcomes:
1. Summarize the basic design concepts.
2. Evaluate the behaviour and design of RC member under flexure, shear, torsion, and bond.
3. Evaluate the behaviour and design of slabs, staircase, and canopy.
4. Evaluate the behaviour and design of columns.
5. Evaluate the behaviour and design of footings and salient features of limit state of serviceability.

UNIT I

Concepts of R.C Design: Study of the strength, behaviour, and design of indeterminate reinforced concrete structures. Loads and stresses, load combinations. Working stress method and limit state approach as per IS-456-2000. Analysis and design of singly and doubly reinforced rectangular beams.

UNIT II

Analysis and Design of Beams: Analysis and design of singly and doubly reinforced Flanged sections using limit state method. Design for shear, torsion and bond using limit state concept. Mechanism of shear and bond failure. Development length of bars; I.S. code provisions design examples in simply supported and continuous beams with detailing.

UNIT III

Design of Slabs: Design of two-way slab and one way slab using I S coefficients. Placement of reinforcement in slabs. Design of flat slab. Design of Staircase and Canopy (portico).

UNIT IV

Design of Columns: Design of Short columns, columns with uni-axial and bi-axial bending. Designof long columns, use of design charts - I S code provisions.

UNIT V

Design of Foundation: Wall footing, Isolated and combined footing for columns. Limit state design of serviceability for deflection, cracking and codal provisions.

Text Books
1. Limit State design by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jai, Laxmi publication Pvt. Ltd., New Delhi, 2016. Revised edition
2. Limit State Design of Reinforced Concrete by P.C. Varghese, 2nd Edition, PHI, New Delhi, 2011
3. Fundamentals of reinforced concrete design by M.L.Gambhir, Prentice Hall of India Private Ltd.,2010, New Delhi. 1st Edition,

Reference Books

1. Reinforced concrete structural elements-behavior, analysis and design by Purushotam, Tata Mc.Graw Hill, New Delhi, 1984.
2. Design of Reinforced Concrete Structures by N.Subramaniyan. Oxford University Press.
3. Reinforced Concrete Design by S. Unnikrishna Pillai & Devdas Menon, 3rd Edition, TMH, NewDelhi, 2009.
4. Reinforced Concrete Design by N. Krishna Raju and R.N. Pranesh, 8th Edition, New Age International, New Delhi, 2004.
5. Design of Reinforced Concrete Structures by I. C. Syal and A. K. Goel, S. Chand & company.
6. Reinforced Concrete by H J Shah. Charotar Publishing House Pvt. Limited. 12th Edition.
7. Design of concrete structures by J.N. Bandhyopadhyay PHI Learning Private Limited.

CODE BOOKS:

1. IS 456-2000; Indian Standard Code of Practice for Plain and Reinforced Concrete.
2. SP 16: Design Aids for Reinforced Concrete

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
STRUCTURAL ANALYSIS-II
(PROFESSIONAL ELECTIVE - I)

Course Code:GR22A3005   **L/T/P/C: 3/0/0/3**
III Year I Semester

Pre-requisites: Solid Mechanics, Structural Analysis -I

Course Outcomes:
1. Analyze various types of frames with and without sway using Slope deflection and Moment distribution methods.
2. Analyze various types of frames using Kani's methods of Analysis.
3. Evaluate the shear forces, bending moments and axial forces in beams, columns and at joints ofmulti-storey frames using approximate methods of analysis.
4. Analyze the simple beams and frames using stiffness matrix and flexibility matrix methods of analysis.
5. Apply the principles of virtual work to estimate the collapse load and plastic moment carrying capacity of simple beams and frames.

UNIT I
Analysis of building frames- Slope deflection and Moment Distribution Methods of analysis to simple portal frames without and with sway- frames with inclined legs.

UNIT II
Analysis of building frames- Kani's Method for analysis of continuous beams and Portal frames (upto single bay two storeys).

UNIT III
Approximate method of Analysis: Frames with vertical loads using Substitute frame method – Frames with horizontal loads using Portal and Cantilever methods

UNIT IV
Matrix method of analysis: Static and Kinematic indeterminacies- different approaches to matrix methods- analysis using stiffness matrix methods for beams and frames (3 DOF) and flexibility matrix methods for beams and frames (2 DOF)

UNIT V
Plastic analysis: Concepts - Plastic hinges- mechanism- -Shape factors- upper and lower bound theorem- Plastic analysis for simple beam and simple portal frames

Text Books
1. Theory of structures - B.C.Punmia, Jain, Ashok Kumar Jain &Arun Kumar Jain, Laxmipublications, 13th edition-2017.
2. Indeterminate Structural Analysis - K.U. Muthu, H. Narendra, Maganti Janardhana, M.Vijayanand – I K International Publishing House Pvt. Ltd., 2014.
3. Structural Analysis 1 and II 4/e – S S Bhavikatti, Vikas Publishing House,4th edition, 2013

Reference Books
1. Advanced Structural Analysis - Devdas Menon, Narosa Publishing House Pvt Ltd, Edition 2015.
2. Analysis of structures-T.S.Thandava Moorthy, Oxford University Press.
3. Structural Analysis –Devdas Menon -Alpha Science International Ltd., 2007.
4. Advanced Structural Analysis - Devdas Menon - Narosa Publishers, 2009.
5. Wang C.K., " Indeterminate Structural Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010
6. William Weaver Jr. & James M. Gere, "Matrix Analysis of Framed Structures", CBS Publishers and Distributors, Delhi, 2004.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
TRAFFIC ENGINEERING AND MANAGEMENT
(PROFESSIONAL ELECTIVE - I)

Course Code: GR22A3006   **L/T/P/C: 3/0/0/3**
III Year I Semester

Course Outcomes:
1. Solve traffic problems and evaluate its characteristics.
2. Plan various traffic surveys and demonstrate the solutions.
3. Show traffic regulation and control measures at intersection.
4. Illustrate basic traffic signal phasing and timing plan.
5. Demonstrate Traffic management Systems.

UNIT-I
Traffic Planning and Characteristics- Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow. Characteristics of Vehicles and Road Users, Skid Resistance and Braking Efficiency (Problems), Components of Traffic Engineering- Road, Traffic and Land Use Characteristics

UNIT- II
Traffic Surveys and Analysis - Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of Service – Concept, applications, significance.

UNIT -III
Intersections - Conflicts at Intersections, Classification of Intersections at Grade, - Channelized and Unchanallised Intersection - Grade Separated Intersections-Concept and layout, Principles of Intersection Design, Elements of Intersection Design, Rotary Intersection, and elements.

UNIT IV
Traffic Control-Traffic signs- Road markings - Traffic signal design using Websters method and IRC method - Traffic control aids and Street furniture, Street Lighting, Computer applications in Signal design.

UNIT V
Traffic Management- Traffic System Management (TSM) and Travel Demand Management (TDM), Traffic Forecasting techniques, Restrictions on turning movements, One-way Streets,Traffic Segregation, Traffic Calming, Tidal flow operations, Exclusive Bus Lanes - Introduction to Intelligence Transport System (ITS)

Text Books
1. Khanna, S.K, Justo, A and Veeraragavan, A, 'Highway Engineering', Nem Chand & Bros. Revised 10th Edition, 2014
2. Kadiyali L.R. and Lal N B, Principles and Practices of Highway Engineering; Seventh Edition, First Reprint; Khanna Publishers, New Delhi, 6th edition 2018
3. Kadiyali L R, Traffic Engineering and Transport Planning, Khanna Technical Publications, Delhi, 8th edition, 2000.

Reference Books

1. Khisty C J and Lall B Kent; Transportation Engineering: An Introduction, Third Edition, 1st Indian Adaptation; Pearson India Education Service Pvt. Ltd, New Delhi 2017.
2. Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planning and Management.
3. Guidelines of Ministry of Road Transport and Highways, Government of India. 2020
4. Subhash C. Saxena, A Course in Traffic Planning and Design, Dhanpat Rai Publications, New Delhi, 6th edition 1989.
   Papacoastas, C. S. and Prevedouros, Transportation Engineering and Planning, Third Edition, Third Impression; Pearson Education, 2018.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SURFACE HYDROLOGY
(PROFESSIONAL ELECTIVE - I)

Course Code: GR22A3007   **L/T/P/C: 3/0/0/3**
III Year I Semester

Pre-Requisites: Hydrology and Water Resource Engineering

Course Outcomes:

1. Examine the different types of hydrology definitions.
2. Evaluate the consumptive use, infiltration, and evaporation.
3. Compute the runoff discharges in streams and rivers.
4. Illustrate the application of hydrographs by computing rainfall and run off.
5. Examine the flood estimation by various methods.

UNIT I
Introduction: Hydrology- definition, Surface and ground water hydrology, Hydrologic cycle-Precipitation, Evaporation, Infiltration, Rain-gauges, Mass rainfall curve, characteristics, Mean rainfall on a basin-Arithmetic, Theissen and Isohytol Methods, Intensity-duration analysis, Intensity-frequency-duration analysis, depth-area- duration curves, estimation of missing rainfall data, consistency of rainfall records- double mass curves, rain-gauge network analysis.

UNIT II
Evaporation & Infiltration: Evaporation process, Factors affecting, estimation, measurement of Evaporation, Evaporation pans, Transpiration, Evapotranspiration, PET, Consumptive use Lysimeter, formulae for estimating PET. Infiltration process, factors affecting, measurement of infiltration, infiltrometers, infiltration capacity curve, Horton's Relation, Infiltration Indices.

UNIT III
Stream flow and Runoff: Measurement of stage, measurement of velocities-surface floats, velocity rods and current meter, measurement of discharge in a river, stage- dischargedition e relation, extension of stage- discharge curves, selection of site for stream- discharge gauging. Components of Runoff - factors affecting and estimation of runoff - basin yield - flow duration

UNIT IV
Hydrographs: Hydrograph-components, separation of hydrograph into base flow, and DRO methods, Unit Hydrograph-principles, derivation of UH of Isolated unit storms, UH for various durations, S-curve technique. Estimation of runoff from UH, limitations of UH theory, Synthetic UH, IUH.

UNIT V
Design Flood: Maximum flood and design flood, estimation of flood- different methods, flood frequency analysis- probability table, different plotting positions, Gumble's extreme value theory, Log Pearson type-III analysis, selection of design flood. Flood routing: Flood Routing through reservoirs-Puls method and modification plus method. Channel routing-Muskinghum method, derivation of routing equations, Goodrich method.
Flood Control: Flood control measures, flood control through reservoirs, channel improvements, Bank protection measures, Flood fighting, flood proofing, flood forecasting and flood warning.

Text Books

1. "A textbook of Hydrology", P. Jayaram Reddy,3rd edition,2011, Laxmi Publications, New Delhi. 2021 latest edition

2. "Engineering Hydrology", K Subramanya, 4th edition, Tata-Mc Graw Hill Publishing company limited, New Delhi,2021.

3. "Hydrology", Madan Mohan Das, Mim Mohan Das, PHI Learning Private Ltd., New Delhi,2022.

Reference Books

1. "Hydrology", by, Elements of Engineering Hydrology by V.P. Singh (Tata McGraw-Hill)

2. "Engineering Hydrology", EM Wilson, The Mac million press limited. 2021

3. "Hydrology", H M Raghunath, New Age International Pvt Ltd,8th edition, 2022

4. "Introduction to Hydrology", W.Viessman Jr. & G L Lewis, Harper & Row Publications, 2nd edition 2021

5. Handbook of Applied Hydrology, Second Edition by VP Singh · 2017.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PAVEMENT MATERIALS
(PROFESSIONAL ELECTIVE - I)

Course Code: GR22A3008   **L/T/P/C: 3/0/0/3**
III Year I Semester

Course Outcomes:
1. Characterize the soil based on the geotechnical properties and justify the applicability.
2. Analyze the engineering properties of aggregates and customizing for application under various field situations.
3. Characterize the binder based on the properties and justify the applicability.
4. Apply appropriate mix design in flexible pavement construction depending upon the traffic and climatic conditions.
5. Demonstrate the utility of Advanced and alternative pavement materials.

UNIT I
Subgrade Soil Characterization: Different types of soils, Mechanical response of soil; Properties of subgrade layers; Suitable lab and field tests-, CBR, Sieve analysis, Field Density; Suitability of different type of soil for the construction of highway embankments and pavement layers Field compaction and control.

UNIT II
Aggregate Characterization: Origin, Classification, Types of aggregates; Sampling of aggregates; Mechanical and shape properties of aggregates, Aggregate texture and skid resistance, polishing of aggregates; Proportioning and Blending of aggregates: Super pave gradation; Use of locally available materials in lieu of aggregates.

UNIT III
Binder Characterization: Bitumen- Origin, preparation, properties and tests, constitution of bituminous road binders; requirements; Criterion for selection of different binders.
Cement - Production of cement; Types of cements and basic cement; Physical and chemical properties of cement, Special cements; Quality tests on cement.

UNIT IV
Bituminous Mixes: Mechanical properties: Resilient modulus, dynamic modulus and fatigue characteristics of bituminous mixes. Weathering and Durability of Bituminous Materials and Mixes, bituminous mix design methods and Specifications. Performance based Bitumen Specifications: Introduction to Superpave mix design.
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UNIT V
Advanced Paving Materials: Recycled aggregates, geosynthetics, industrial wastes – characterization. recycled and waste materials (green materials), Recycled asphalt pavement (RAP) material. Bituminous emulsion and Cutbacks, Crum rubber, and rubber modified bitumen and anti-Stripping agents on pavement performance. Pozzolanic and geopolymer materials as alternate cement

Text Books
1. Soil Mechanics and Foundation Engineering- K.R. Arora, Standard Publishers Distributors, Delhi (2005).
2. Highway Engineering - S.K. Khanna & C.E.G. Justo, Nemchand & Bros, edition 2020.
3. Highway Materials testing– S.K. Khanna & C.E.G. Justo. Nem Chand & Brothers,2013.

Reference Books

1. Concrete Technology by M.S.Shetty. – S.Chand & Co. ; 2004
2. Principles of Pavement Design – E. J. Yoder, M. W. Witczak,1991.
3. Atkins, N. Harold, Highway Materials, Soils and Concretes, Fourth Edition, 2002, Prentice-Hall.
4. Das, A. And Chakroborty, P. Principles of Transportation Engineering, 1st Edition, PHI Publication (2017).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GEOTECHNICAL ENGINEERING LAB

Course Code: GR22A3010   **L/T/P/C: 0/0/4/2**
III Year I Semester

Pre- Requisites: Geotechnical Engineering

Course Outcomes:
1. Identify the soil behaviour and its mechanism.
2. Interpret basic properties of soil in simple and complex applications.
3. Develop proficiency in handling experimental data.
4. Excel in experiment research and to succeed with real time projects.
5. Propose extensive research in experimental methods and geotechnical designs.

List of experiments:

Task1: Liquid limit and plastic limit

Task2: Grain size distribution by sieve analysis

Task3: Field density by core cutter method

Task4: Field density by sand replacement method

Task5: Relative density of sands

Task6: Standard and modified compaction test

Task7: Permeability of soil by constant and variable head test

Task8: California Bearing Ratio Test

Task9: Consolidation test

Task10: Unconfined compression test

Task11: Direct shear test

Task12: Vane shear test

Task13: Tri-axial test (Demonstration)

Reference Books
1. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, Delhi, 5 th edition (2000), Reprint (2009).
2. C.Venkataramiah, Geotechnical Engineering, New age International publishers (2002),6th edition (2018).
3. AlamSingh, "Soil Engineeringing Theory and Practice" Vol1: Fundamentals & General Principles, Vol 2: Geotechnical Testing & Instrumentation,
4. Murthy, V. N.S., "Principles of Soil Mechanics and Foundation Engineering" CBS Publisher distributors Pvt. Ltd. Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONCRETE TECHNOLOGY LAB

Course Code: GR22A3011   **L/T/P/C: 0/0/4/2**
III Year I Semester

Pre-Requisites: Concrete Technology
Course Outcomes:
1. Identify the suitable materials used for concrete for particular purpose.
2. Interpret the quality control of Cement and concrete.
3. Identify, describe, and carry out the main laboratory tests relevant to the use of concrete onsite.
4. Design normal concrete mixes.
5. Interpret the properties in tern to design or invent the new materials.

List of Experiments:
1. Normal Consistency test on cement
2. Initial Setting time and final setting time of cement
3. Fineness test of cement
4. Specific gravity of cement
5. Soundness test of cement
6. Compressive strength of cement
7. Sieve analysis of Coarse and fine aggregate
8. Bulking of sand (Field test & Laboratory Test)
9. Workability test on concrete using slump Cone
10. Workability test on concrete by compaction factor test
11. Workability test on concrete by Vee-Bee Test
12. compressive strength of concrete
13. Split tensile strength test on concrete.

Reference Books
1. Concrete Technology Theory and Practice, Shetty M. S, S. CHAND, 8th edition, 2019.
2. Concrete Technology: Theory and Practice Gambhir Murari Lal, Mcgraw Hill, fifth edition., 2013.
3. IS 269:2013 – Ordinary Portland cement, 33 grade- Specification (Fifth Revision)
4. IS 383:2016 – coarse and fine aggregates for concrete- Specification (Third Revision)
5. IS 10262 :2019, Concrete Mix Proportioning- Guidelines (Second Revision).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONSTITUTION OF INDIA

Course Code: GR22A2003   **L/T/P/C: 2/0/0/0**
III Year I Semester

Course Outcomes
1. Students will be able to know the importance of Constitution and Government
2. Students will be able to become Good Citizens and know their fundamental rights, duties, and principles.
3. Students will learn about the role of PM, President, Council of Ministers etc and it will help students learn about Local Administration.
4. The students understand the importance of Election Commission and the Students will become awareof how a Country and State are run in Democracy.
5. They will know about Secularism, Federalism, Democracy, Liberty, Freedom of Expression, Special Status of States etc.,

UNIT I
Introduction: Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

UNIT II
Union Government and its Administration: Structure of the Indian Union: Federalism, Centre - State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha

UNIT III
State Government and its Administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions

UNIT IV
Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI:Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials.

UNIT V
Composition of Judiciary and Election Commission: Composition of Indian Judiciary, Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC.

Books Recommended:
1. 'Indian Polity' by Laxmikanth 5th Edition, McGraw Hill Edition.
2. Indian Constitution by Subhash C. Kashyap, Vision Books Publisher
3. 'Introduction to Indian Constitution' by D.D. Basu, 21st Edition, LexisNexis Publisher
4. 'Indian Administration by Avasthi and Avasthi-by lakshminarainagarwal publication.

III YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DESIGN OF STEEL STRUCTURES

Course Code: GR22A3079   **L/T/P/C: 2/1/0/3**
III Year II Semester

Prerequisite: Mathematics**,** Engineering Mechanics, Engineering Drawing, Solid Mechanics.

Course Outcomes:
1. Identify various types of structural steel and its properties. Also able to define concepts ofLSD.
2. Classify and compute various types of connections.
3. Design tension and compression members.
4. Design steel beams and purlins.
5. Design various eccentric connections.

UNIT I
Materials: Properties of materials. Concepts of limit state method, loads and stresses. Types of structural steel- making of iron and steel. Deflection limits, serviceability and stability check as per IS 800-2007.

UNIT II
Bolted Connections: IS – 800 – 2007 specifications, Design strength and efficiency of joint.
Welded connections: Types of welded joints, specifications and design requirements.

UNIT III
Design of tension member: Design of tension members subjected to axial tension and bending, splicing of tension member and lug angle.
Design of compression members: Design of columns, laced and battened columns, column- splice,column slab base and gusset base.

UNIT IV
Design of Beams: Design of flexural members, lateral stability of beams, lateral torsional buckling, shear strength of beams; web buckling, web crippling, built-up beams, lintels and purlins.

UNIT V
Eccentric and Moment connections: Introduction, beam-column connections; connections subjected to eccentric shear, bolted framed connections, bolted seat connections, bolted bracket connections, welded framed connections, welded seat connections, welded bracket connection, moment resistant connection; bolted moment connections and welded moment connections.

Text Books
1. Design of steel structures – N. Subramanian, Oxford University Press – 2018.
2. Limit State Design of steel structures, S.K.Duggal, Tata McGraw – Hill, 2019
3. Design of Steel Structures Vol. 1 & 2 – Ramchandra, Standard Publications. 2010.

Reference Books
1. Design of steel structures, S. S. Bhavikatti, IK int Publication House, New Delhi, 2019
2. Design of steel structures, BC Punmia A. K. Jain , Ashok Kumar Jain, LaxmiPublications, 2015.
3. Limit State Design of Steel Structures, by S. Kanthimathinathan, Dreamtech Press, 2019.
4. Design of steel structures, by Elias G. Abu-Saba, cbspd publisher, 2000.
5. Design of steel structures, by R. R. Gadpal, Nirali Prakashan publisher, 2000.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FOUNDATION ENGINEERING

Course Code: GR22A3080   **L/T/P/C: 3/0/0/3**
III Year II Semester

Prerequisites: Geotechnical Engineering
Course Outcomes:
1. Identify various soil exploration methods and interpret the results.
2. Assess the stability of slopes.
3. Compute earth pressures and stability of retaining wls.
4. Apply bearing capacity equations for shallow foundations and analyze settlement.
5. Estimate pile and pile group capacity and recognize the shapes and components of wellfoundations.

UNIT I
Soil Exploration: Introduction, methods of site exploration and soil investigation, methods of boring, soil samplers, penetrometer tests, analysis of borehole logs, preparation of soil investigationreport.

UNIIT II
Stability of Slopes: Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, stability analysis by standard method of slices, Taylor's stabilityNumber. Stability of earth dam slopes under different conditions.

UNIT III
Earth pressure and retaining walls: Introduction, Rankine's theory of earth pressure, active and passive earth pressures, Coulomb's earth pressure theory, Culmann's graphical method, types of retaining walls, stability of cantilever retaining walls.

UNIT IV
Bearing capacity and settlement analysis of shallow foundations: Types and choice of foundation, location of depth, modes of soil failure, safe bearing capacity by Terzaghi, Meyerhof, Skempton and IS methods. Effect of water table on bearing capacity, safe bearing pressure based on N value, settlement analysis, contact pressure, settlement from plate load test.

UNIT V
Deep foundations: Types of piles, static pile formulae, dynamic pile formulae, pile load tests, loadcarrying capacity of pile groups in sands and clays, negative skin friction, types and different shapes of well foundations, components of well foundations.

Text Books
1. Gopal Ranjan and ASR Rao, Basic and Applied Soil Mechanics, New Age International Pvt. Ltd, New Delhi, 3rd edition (2016).
2. Braja M. Das, Principles of Foundation Engineering, Cengage Learning, New Delhi, 8th edition (2017).
3. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, Delhi, 5th edition (2000), Reprint (2020).

Reference Books
1. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundations, Laxmi publications Pvt. Ltd., New Delhi, 16th edition, Reprint (2017).

2. VNS Murthy, Soil Mechanics and Foundation Engineering, CBS Publishers, and Distributors.
3. Bowles, J.E., Foundation Analysis and Design, McGraw-Hill Publishing Company, New York, 5th edition 2001.
4. Singh.A, Modern Geotechnical Engineering, 3 rd Ed., CBS Publishers, New Delhi, 2006.
5. N. Som, Theory and Practice of Foundation Design, Prentice Hall, New Delhi, 2003.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENVIRONMENTAL ENGINEERING

Course Code: GR22A3081   **L/T/P/C: 2/0/0/2**
III Year II Semester

Pre-Requisites: Engineering Chemistry, Environmental Science.
Course Outcomes:
1. Analyze characteristics of water and wastewater.
2. Assess water demand and design components of water distribution systems.
3. Design conveyance elements of wastewater collection systems.
4. Assess sources of water and wastewater.
5. Plan and design water treatment units and wastewater treatment systems.

UNIT I
Sources, Quality and Quantity Perspectives of Water: Surface sources, subsurface sources, physical, chemical and biological characteristics, BIS standards for potable water, Estimation of water demand, water consumption rate, fluctuations in rate of demand, design period, population forecasting methods. Collection and Conveyance of Water, Intakes, types of Intakes.

UNIT II
Water Pollution: Types of pollutants, their sources, and impacts.
Water Treatment: Layout and general outline of water treatment units, screening, plain sedimentation, sedimentation aided with coagulation, filtration, disinfection, water softening, miscellaneous treatments. Design of Clarifiers, working of slow and rapid gravity filters, multimedia filters.

UNIT III
Distribution Systems: Requirements of a good distribution system, methods of distribution, systems of supply of water, Distribution reservoirs, layout of distribution system, design of distribution system, analysis of pipe networks, appurtenances in distribution system- Joints, Valves and Water Meters.

UNIT IV
Quality and Quantity Perspectives of wastewater: Physical, chemical, and biological characteristics of wastewater, analysis of wastewater, Importance of BOD and COD, Effluent standards, BIS for disposal of Industrial Waste water, impacts of disposal, Wastewater Collection, Estimation of dry weather flow and stormwater flow.

UNIT V
Primary Treatment of wastewater: Preliminary & primary treatment of wastewater: screening, grit removal basins, removal of oil and grease, sedimentation, sedimentation aided with coagulation.
Secondary Treatment of wastewater: Principles and classification of secondary treatment, activated sludge process, trickling filters, miscellaneous methods such as oxidation ditch, oxidation ponds, aerated lagoons, rotating biological contractors. Disposal of wastewater, self- purification of streams, sewage irrigation, BIS standards for waste water irrigation, Treatment and disposal of sludge, On-site disposal methods.
Tertiary Treatment of wastewater: Principles and classification of Tertiary treatment

Text Books
1. Water Supply Engineering, Vol. 1, Waste Water Engineering, Vol. II, B.C.Punmia, Ashok Jain & Arun Jain, Laxmi Publications Pvt. Ltd, New Delhi.,2nd edition, 2016.

2. Elements of environmental engineering by K.N. Duggal, S. Chand Publishers, Revised edition, 2018.

3. Sewage treatment & Disposal and waste water Engineering-Environmental Engineering (Vol.II) by

4. P.N. Modi, Standard Book House, 17th edition, 2020.

Reference Books

1. Environmental Engineering Vol. I and II by S.K. Garg, Khanna Publishers, 35th Edition, 2022.

2. Water and Waste Water Technology by Mark J Hammer and Mark J. Hammer Jr., Pearson 7th Edition, 2011.

3. Water and Waste Water Engineering by Fair, Geyer and Okun- Wiley, 3rd Edition, 2010.

4. Waste water treatment- concepts and design approach by G.L. Karia and R.A. Christian, Prentice Hall of India., 2nd Edition, 2013.

5. Wastewater Engineering by Metcalf and Eddy., 5th Edition-2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MASONRY STRUCTURES
(PROFESSIONAL ELECTIVE-II)

Course Code: GR22A3082   **L/T/P/C: 3/0/0/3**
III Year II Semester

Pre-Requisites: Structural Analysis, Design of Reinforced Concrete Structures.

Course Outcomes:
1. Identify the types of masonry units and Strength and stability of concentrically loaded masonry walls and factors affecting them.
2. Analyze the emerging permissible compressive, tensile and shear stress and factors influencing them for masonry elements.
3. Identify the concept of effective height of walls and columns, effective length, effective thickness of wall and factors affecting them.
4. Analyze how to design load bearing masonry walls for buildings up to three stories using IS:1905 and SP-20.
5. Explain the concept of reinforced masonry and its applications, and how to bring flexural and compression elements (beams and columns) of reinforced masonry shear walls.

UNIT I
Introduction: Brick stone, and block masonry units - Strength, modulus of elasticity and water absorption of masonry materials - classification and properties of mortars, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking and remedial methods.
Strength and stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of ageing, workmanship, strength formulae and mechanism of failure of masonry subjected to direct compression.

UNIT II
Load Analysis: Permissible compressive stresses- stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses. Load considerations for masonry: walls carrying axial load, eccentric load with different eccentric ratios— walls with openings and free-standing wall.

UNIT III
Design considerations: Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action and Lintels.

UNIT IV
Masonry Design: Design of load bearing masonry walls for building up to 3storeys using IS 1905-1987 and SP20 Procedure.

UNIT V
Masonry Types: Reinforced masonry and its application, flexural and compression elements of reinforced masonry, shear walls. Composite masonry walls, composite wall beam elements, infilled frames.

Text Books
1. Henry, A.W(1990), "Structural masonry", published by Macmillan Education Ltd. 3rd Edition.
2. Dayarathnam.P (1987), "Brick and reinforced brick structures", Oxford & IBH Publication, 2nd Edition-2017.

3. Masonry Structures: Behaviour & Design by Drysdale, R. G. Hamid, A. H. and Baker, L.R, Prentice Hall. 3rd Edition.

Reference Books
1. Reinforced Masonry Design by R.S. Schneider and W.L. Dickey, Prentice Hall
2. Sinha, B.P and Davies, S.R(1997), "Design of Masonry Structures", E &FN spon.
3. Design of Masonry Structures by A.W. Hendry, B.P. Sinha and Davis, S.R, E&FN Spon, UK
4. Design of Reinforced and Prestressed Masonry by Curtin, Thomas Telford
5. Structural Masonry by Sahlin, S, Prentice Hall

CODES:
1. IS 1905-1987 (3rd revision), "Code of practice for structural use of unreinforced masonry", BIS, New Delhi.
2. SP 20 (S& T) 1991, "Hand book on Masonry Design and Construction (1strevision)", BIS New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ROCK MECHANICS
(PROFESSIONAL ELECTIVE-II)

Course Code: GR22A3083   **L/T/P/C: 3/0/0/3**
III Year II Semester

Pre-Requisites: Engineering Geology
Course Outcomes:
1. Identify the objectives of geotechnical data collection and rock mass classification methods, and successfully collect and analyze a range of geotechnical datasets for design purposes.
2. Annotate on impact of geological features on civil engineering projects.
3. Analyze the problems associated with different geological features on civil engineering structures and suggest alternatives.
4. Demonstrate various methods to improving the properties of rock masses.
5. Describe the theory and analysis of in situ and induced stresses in a rock mass and structurallycontrolled failure.

UNIT-I
Importance and application of rock mechanics to engineering problems, Rock mass classification, Lithological classification of rocks, Engineering classification of intact and fissured rocks, Classification of fissures, Physical-mechanical properties of rocks.

UNIT-II
Joints and faults, Engineering properties of rocks, Stability of rock slope, Modes of failure in rock mass, Definition of stress in rock, Simple methods of determining in-situ stresses and stress distribution around openings.

UNIT-III
Causes and impacts of subsidence, Mechanics of surface subsidence, discontinuous and continuous subsidence. Monitoring, prediction, control and management of subsidence.

UNIT-IV
Analysis by simple field Bishop's method and use of Hoek's chart, Foundations on rocks, Consideration of uplift pressures; Methods of improving the properties of rock masses.

UNIT-V
Mechanics of rock burst and bumps, Stability of slopes. Instrumentation and measurement of in- situ stresses and rock strength, Photoelasticity.

Text Books

1. Jager. J C & Cook NGW Fundamentals of Rock Mechanics, Wiley India Pvt.Ltd,4th edition2012.
2. Jumikis Alfred's. R, Rock Mechanics, CRC Press, 2nd edition,1988.
3. Goodman, R.E. (1989), 'Introduction to Rock Mechanics', John Wiley, Chichester, 2nd edition.

Reference Books

1. Hudson, J.A. and Harrison, J.P. (2000), 'Engineering Rock Mechanics', Pergamon Press, Amsterdam.

2. Peng. Syd. S. Coal Mining Ground Control West Virginia University.

3. Brady, BHG& Brown.ET, Rock mechanics for underground mining, George Allen &Unwin Ltd, 1992.

4. Hudson, J.A. and Harrison, J.P. (2000), 'Engineering Rock Mechanics', PergamonPress, Amsterdam**.**

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
OPEN CHANNEL FLOW
(PROFESSIONAL ELECTIVE-II)

Course Code:GR22A3084   **L/T/P/C: 3/0/0/3**
III Year II Semester

Pre-requisites: Hydraulics and Water Resource Engineering

Course outcomes:
1. Explain properties and the type of channel flows.
2. Design the different shapes channel section.
3. Compute the energy loss due to hydraulic jump.
4. Apply the dynamic equations and different method for energy loss in the Gradually Varied Flow
5. Apply the dynamic equation in Rapidly Varied Flow.

UNIT I
Introduction: Basic Concepts, types of channels, types of flows in open channels Geometric properties of various sections, Velocity, and pressure distribution. Velocity distribution coefficients. Effects of slope on pressure distribution.

UNIT II
Uniform Flow: Chezy's equation, Darey - Weisbach friction factor. Manning's formula, Factors effecting Manning's roughness coefficient, Equivalent Channels of compound section. Conveyance of a channel section. Section factor for uniform flow, Channels of first and second kind - Hydraulically efficient channel sections - rectangular, trapezoidal, triangular and circular: Hydraulic exponent N, Compound sections, composite roughness.

UNIT III
Critical Flow in Open Channel: Energy in open channel flow: Specific energy – features, Criterion for critical state of flow - Critical depth in Rectangular, Triangular, Trapezoidal and circular channels; section factor - specific force.

UNIT IV
Gradually Varied Flow: Types of non-uniform flow, Dynamic equation: Governing equation for wide rectangular channels - Surface Profiles - classification. Characteristics-Control sections- Transitional depth - Length of surface profiles - Standard step method - Direct integration methods - Brasses' method Tolmkit method, Bekhmeteff's method. Chow's method.

UNIT V
Rapidly Varied Flow: Hydraulic jump application of momentum equation Types of jump, Location of jump, Characteristics of jump in rectangular channels Dimensionless method; Jump on sloping floor; Oblique jump. Spatially Varied Flow: Basic Principles and assumptions. Dynamic equation for flow with increasing and decreasing discharges; Analysis of flow profiles. Flow In Non — Prismatic Channels: Transitions — humps, flumes, gradual and sudden transitions.

Text Books
1. Flow in open channels — K. Subramanya TMH Publishing Co. Ltd '7th edition, 2022.
2. Flow through open channels — K.G. Ranga Raju. THM Publishing Co. Ltd.8st edition,2021.
3. Elements of Water Resources Engineering by K.N.Duggal and J.P.Soni (New Age International)

Reference Books

1. Open Channel Hydraulics — French R.H. McGraw Hill book Company, 8th Edition,2021.
2. Open Channel Flow -Hanif Chaudhary. M. Printice — Hall of India Pvt. Ltd., 2022.
3. Open Channel Hydraulics — V.T. Chow, McGraw Hill book company, new edition 2021.
4. Open Channel Flow by Das, Madan Mohan PHI Learning Pvt Ltd.2011 third print.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GREEN BUILDING TECHNOLOGY
(PROFESSIONAL ELECTIVE -II)

Course Code: GR22A3085   **L/T/P/C: 3/0/0/3**

III Year II Semester

Prerequisite: Environmental Science, Building materials and construction planning, Concrete Technology.

Course Outcomes:
1. Correlate the underlying principles, history, and the impacts of green building technology and to identify the criteria for rating systems along with the established Indian codes and guidelines.
2. Identify various Renewable and Non-renewable sources of energy along with their carbon footprints and building modeling and energy analysis, monitoring and metering.
3. Recognize the energy efficient green building materials and the cost-effective Building Technologies and materials with low embodied energy and incorporate them into design.
4. Explain broad perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course.
5. Explain the application of design guidelines of Green Building considering the Energy Conservation Measures and to Perform cost/benefit and life-cycle analysis of green buildings.

UNIT I
Concept of Green Buildings: Definition of Green Buildings, typical features of green buildings, Necessity, Initiatives, environmental benefits economic benefits, health and social benefits, Major energy efficiency areas for building, Contribution of buildings towards Global Warming, Green buildings in India
Green building Assessment: Green Building Rating Systems (BREEAM, USGBC, LEED, IGBC, TERI-GRIHA, GREEN STAR), Criteria for rating, Energy efficient criteria, Codes and Certification Programs.

UNIT II
Sources of Energy: Renewable and Non-renewable sources of energy; Coal, Petroleum, Nuclear, Wind, Solar, Hydro, Geothermal sources; potential of these sources, hazards, pollution; Global scenario with reference to demand and supply in India, Global efforts to reduce carbon emissions, Building modeling , Energy analysis, Commissioning, Metering, Monitoring.

Carbon emission: Forecasting, Control of carbon emission, Air quality and its monitoring carbon footprint; Environmental issues, Minimizing carbon emission, Energy retrofits.

UNIT III
Green Building Materials: Sustainably managed Materials, renewable and recyclable resources; energy efficient materials; Embodied Energy of Materials, Green cement, Biodegradable materials, Smart materials, Volatile Organic Compounds (VOC's), Natural Non-Petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials, Engineering evaluation of these materials.
Green Building Planning and Specifications: Environment friendly and cost-effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Energy Conservation Measures in Buildings, Waste &Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight.

UNIT IV
Design of Green Buildings: Sustainable sites, Impact of building on environment, Life cycle assessment,

Principles of sustainable development in Building Design, Design on Bioclimatic and solar passive architecture, Considerations of energy consumption, water use, and system reliability, indoor air quality, noise level, comfort, cost efficiency in building design, Advanced Green building technologies and innovations.

UNIT V

Construction of Green Buildings: Energy efficient construction, Practices for thermal efficiency and natural lighting. Eco- friendly water proofing; ECB codes building rating, Maintenance of green buildings, Cost and Performance Comparisons and Benchmarking, Green Project Management Methods and Best Practices, Cost/benefit analysis of green buildings, Life-cycle analysis of green buildings, Case studies of rated buildings (new and existing)

Text Books

1. Alternative Building Materials and Technologies – By K S Jagadeesh, B V Venkata Rama Reddy &K S Nanjunda Rao – 2nd Edition, New Age International Publishers (2017)
2. Integrated Life Cycle Design of Structures – By AskoSarja – SPON Press, first edition 2019.
3. Non-conventional Energy Resources – By D S Chauhan and S K Sreevasthava – New AgeInternational Publishers, 3rd edition 2017.

Reference Books

1. Sustainable Energy Systems Engineering: The Complete Green Building Design Resource(McGraw hill publication): by Gevorkian-2007
2. Understanding Green Building Guidelines: For Students and Young Professionals, Traci RoseRider, W. W. Norton & Company Publisher, 2010.
3. Abe Kruger and Carl," Green Building, Principles and practices in Residential Construction", In2012, Seville Publication
4. Ross Spiegel, Dru Meadows, "Green Building Materials: A Guide to product selection
5. andSpecification",3rd Edition, October 2010
6. IGBC Rating systems Reference guide
7. Free abridged versions of LEED reference guides
8. ECBC latest version
9. US GBC's Reference Material:
10. http://www.ncrec.gov/pdfs/bicar/Greenbuilding.pdf

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENVIRONMENTAL ENGINEERING LAB

Course Code: GR22A3087   **L/T/P/C: 0/0/4/2**
III Year II Semester

Pre-Requisites: Engineering Chemistry

Course Outcomes:
1. Describe the knowledge of physical, chemical, and biological parameters of water and their importance.
2. Develop the social responsibility to eradicate water borne diseases.
3. Recognize the methods to control environmental pollution.
4. Express water quality parameters in written reports
5. Generalize the various quality control aspects of industrial effluents by performing the different lab tests.

List of Experiments:
1. Determination of pH and Turbidity
2. Determination of Conductivity and Total dissolved solids.
3. Determination of Alkalinity/Acidity.
4. Determination of Chlorides and iron.
5. Determination and Estimation of total solids, organic solids and inorganic solids.
6. Determination of Nitrogen/total Phosphorous.
7. Determination of Dissolved Oxygen (DO) and B.O.D
8. Determination of C.O.D
9. Determination of Optimum coagulant dose.
10. Determination of Chlorine demand.
11. Presumptive coliform test.

Reference Books
1. Standard Methods for Analysis of water and Wastewater – APHA.
2. Sawyer and Mc. Carty , Chemistry for Environmental Engineering, Mc Graw- Hill publications,2017.
3. IS 10500 (2012): Drinking water; http://cgwb.gov.in/documents/wq-standards.pdf
4. IS 3025 Methods of sampling and test physical and chemical for water and wastewater: by Indian standard burro kindle Edition, 2020.
5. https://ee1-nitk.vlabs.ac.in/
6. https://ee2-nitk.vlabs.ac.in/
7. S.K. Garg, Environmental Engineering (Vol. I) Water Supply Engineering, Khanna Publishers,35th Edition, 2022.
8. S.K. Garg, Environmental Engineering (Vol. II) Sewage Waste Disposal and Air Pollution Engineering, Khanna Publishers, 41st Edition, 2022.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GIS LAB

Course Code:GR22A3088   **L/T/P/C: 0/0/4/2**
III Year II Semester

Pre- Requisites: Surveying and Geomatics

Course Outcomes:

1. Inculcate hands on experience on fundamental commands.
2. Demonstrate proficiency in the basic functions of geospatial software.
3. Create awareness on raster layer to vector layer conversion
4. Analyze proficiency in the creation and acquisition of spatial data.
5. Recognize conversion of DEM to contour map and Contour to DEM map

SOFTWARE: Q GIS (Open Source)

EXCERCISES:

1. Demonstrating the concept of Labeling in GIS using Quantum GIS
2. Demonstrating the concept of Symbolism in GIS using Quantum GIS.
3. Creation of point features Maps using Toposheets (Ex- Trees, Post office, Wells etc.,)
4. Creation of Line features Maps using Toposheets (Ex – Road Networks, Railway Tracks etc.)
5. Creation of polygon features Maps using Toposheets (Ex – Waterbodies,Forest areas, buildings etc.,)
6. Creation of thematic maps for a region of interest.
7. Identify the demographic study using attribute tool.
8. Creation of buffer zones for given maps.
9. Preparation of contour maps, flow accumulation maps from Digital Elevation model maps
10. GIS applications in various civil engineering aspects- Network Analysis, Watershed Analysis.
11. Performing SQL queries on created Thematic maps (Pre-Requisites: 6,8,9 exercises)

Reference Books

1. Introduction to Geographic Information Systems by Kang-tsung Chang, Tata McGraw-Hill Publishing Company Limited- 2008.
2. Concept and Techniques of GIS by C.P.L.O Albert, K.W.Yong,Prentice Hall Publishers(2010).
3. Concept and Techniques of GIS by C.P.L.O. Albert, K.W. Yong, Prentice HallPublishers (2002).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MINI PROJECT WITH SEMINAR

Course Code:GR22A3089   **L/T/P/C: 0/0/4/2**
III Year II Semester

Pre-Requisite: Civil Engineering courses

Course Outcomes:
1. Make use of fundamental knowledge and practical knowledge to implement towards industries.
2. Utilizing software and design, analyze the engineering Knowledge in accordance with applicable standards.
3. Analyze project management skills and scheduling of work in stipulated time.
4. Evaluate and demonstrate the problem finding ability in Engineering Technologies.
5. Develop technical information by means of written and oral reports.

IV YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ESTIMATION AND COSTING

Course Code:GR22A4001   **L/T/P/C: 2/1/0/3**
IV Year I Semester

Pre-Requisite: BMCP, Concrete Technology, Engineering Mathematics, Surveying

Course Outcomes:
1. Estimate the quantities of materials and different types of materials required for different types of Buildings, Roads and Structures.
2. Examine the tendering process for executing any civil engineering work.
3. Recognize the process and importance of cost estimation, cost budgeting and cost control.
4. Estimate the rate per unit of any item of work.
5. Assess the value of any property and interpret the process and importance of valuation of buildings and other structures.

UNIT I
General items of work in building: Standard Units, Principles of working out quantities for detailed and abstract estimates, approximate methods of Estimating. Detailed Estimates of Buildings – center line method, longwall short wall method.

UNIT II
Earthwork for roads hill roads (two level sections only) and canals. Quantities of materials for different types of roads.

UNIT III
Rate Analysis –Working out data for various items of work over head and contingent charges. Reinforcement bar bending and bar requirement schedules.

UNIT IV
Contracts: Types of contracts – contract Documents – Conditions of contract, contract procedures, Tendering process, Rights, and responsibilities of parties to contracts

UNIT V
Valuation of buildings: Purpose and principles of valuation, Depreciation, methods of calculating depreciation, methods of valuation, Rental method, development method, profit based method.

Text Books
1. Estimating & Costing in Civil Engineering: Theory and Practice including Specifications and Valuations by B.N.Dutta, UBS publishers, 28th Edition, 2020.
2. Estimating & Costing by G.S.Birdie, Dhanpat Raj Publication Company, 6th edition, 2014
3. Valuation of real properties by S.C. Rangawala, Charotar publishing house, 10th edition, 2015.

Reference Books
1. Estimating, Costing & Specifications by M. Chakraborthi, Laxmi publications, 29th Edition, 2006.
2. Standard schedule of rates and standard Data Book by Public works department.
3. SP:27, Handbook of method of measurement of building works, Bureau of Indian Standards, 1987.

4. IS:1200, Methods of measurements
5. National Building code, 2016.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
TRANSPORTATION ENGINEERING

Course Code: GR22A4002   **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Demonstrate basic principles of highway engineering and project survey requirements.
2. Analyze the geometric features of road pertaining to horizontal and vertical alignment.
3. Interpret the factors influencing road vehicle performance, characteristics, and design of traffic signal phasing.
4. Illustrate the basic intersection and advanced intersection performance characteristics.
5. Demonstrate the geometrics of Railway engineering and Airport engineering in transportation.

UNIT I
Highway Development and Planning: Highway development in India – Necessity for Highway Planning- Different Road Development Plans- Classification of Roads- Road Network Patterns – Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

UNIT II
Highway Geometric Design: Importance of Geometric Design- Design controls and Criteria-Highway Cross Section Elements -Sight Distances-Stopping sight Distance, Overtaking Sight Distance, Intermediate Sight Distance and Head light sight distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves- Design of Vertical Alignment-Gradients- Vertical curves-Summit Curves and Valley Curves.

UNITIII
Traffic Engineering: Traffic flow parameters-Volume, Speed, Density and headway- Traffic Volume Studies- Data Collection and Presentation-speed studies- Data Collection and Presentation- Parking Studies, Parking types and Parking characteristics- Road Accidents- Causes and Preventive measures - Presentation of Accident Data–Condition Diagram and Collision Diagrams.

Traffic Regulation and Management: Road Traffic Signs–Types and Specifications–Road Markings-Need for Road Markings-Types of Road Markings- Design of Traffic Signals – Webster Method –IRC Method.

UNIT IV
Intersections: Types of Intersections – Conflicts at Intersections- Types of At-Grade Intersections-Channelization: Objectives –Traffic Islands and Design Criteria-Types of Grade Separated Intersections-Rotary Intersection – Concept of Rotary and Design Criteria- Advantages and Disadvantages of Rotary Intersection.

UNIT V
Introduction to Railway Engineering and Airport Engineering: Permanent Way and functions of Rail, Sleeper and Ballast-Gradients-Grade Compensation-Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – Crossings and Turnouts.
Factors affecting Selection of site for Airport – Aircraft Characteristics- Geometric Design of Runway-Computation of Runway length – Correction for runway length – Orientation of Runway – Wind Rose Diagram – Runway Lighting system.

Text Books
1.Highway Engineering – S.K. Khanna &C.E.G. Justo, Nemchand & Bros., 10th edition (2019).

2.Highway Engineering – L.R.Kadiyali & Lal- Khanna Publications 6th edition (2012).

3.Airport Planning and Design- S.K.Khanna and Arora, Nem Chand & Bros. 6th edition (2017)

Reference Books

1.Railway engineering- A Textbook of Railway Engineering- Subhash C.Saxena, Satyapal Arora – Dhanpat Rai & Sons – 6th edition(2012).

2.Highway Engineering – S. P. Bindra, Dhanpat Rai & Sons. – 4th Edition (1981)

3.Traffic Engineering & Transportation Planning –Dr.L.R.Kadyali, Khanna Publications – 8th Edition – 2011.

4.Railway Engineering – A text book of Transportation Engineering –S.P.Chandola Publisher, S. Chand & Co., 1st Edition, 2001

5.Air Transportation Planning & design – Virendhra Kumar &Statish Chandhra –Gal Gotia Publishers 1st Edition, 1999.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BRIDGE ENGINEERING
(PROFESSIONAL ELECTIVE -III)

Course Code:GR22A4003   **L/T/P/C: 3/0/0/3**
IV Year I Semester

Pre-Requisites: Design of Reinforced Concrete Structures, Structural Analysis II

Course Outcomes:
1. Explain the bridge types and IRC loading standards.
2. Analyze and Design the Slab bridges.
3. Analyze and Design the T Beam bridges.
4. Design the Plate girder bridges.
5. Design the Piers caps and Abutments.

UNIT I
Introduction– Bridges- Types- Slab bridges, T Beam, Arch bridges, Cable Stayed bridges, prestressed concrete bridges, Truss Bridges, Culverts, – Nomenclature- Selection of Bridge Site- Economical span- Abutments pier and end connections- types of foundations- Open, Pile, Well Foundations, Bearings – Types- Introduction to Loading standards- Railway and IRC Loading.

UNIT II
Slab bridges-Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs- dispersion length- Design of interior panel of slab- Guyon's – Massonet Method
–Hendry- Jaegar Methods- Courbon's theory- Pigeaud's method.

UNIT III
T-Beam bridges– Analysis and design of various elements of bridge –Design of deck slab, Longitudinal girders, Secondary beams- Reinforcement detailing.

UNIT IV
Plate Girder Bridges: Elements of plate girder and their design-web- flange- intermediate stiffener- vertical stiffeners- bearing stiffener- Splices, Design problem with detailing.

UNIT V
Design of Piers - pier caps and Abutments, different types of bearings.

Text Books
1. 'Design of Concrete Bridges' by Aswini, Vazirani, Ratwani, Khanna Publishers, 2nd edition1995.
2. 'Essentials of Bridge Engineering' by Johnson Victor D, Oxford; 6th edition (1 January 2019).
3. 'Design of Bridge Structures' by T. R. Jagadeesh, M.A. Jayaram, PHI, third edition, 2020.

Reference Books
1. 'Design of RC Structures' by B. C. Punmia, Jain & Jain, Lakshmi Publications, 10th Edition2015.
2. 'Design of Steel Structures' by B. C. Punmia, Jain & Jain, Lakshmi Publications, 2nd Edition2015.
3. 'Design of Bridges' by Krishna Raju , Oxford & IBH Publishing Company Private, Limited – 5th

Edition 2019.

4. 'Bridge Design: Concepts and Analysis', António J. Reis, José J. Oliveira Pedro, John Wiley & Sons, 2019 Edition

5. 'Bridge Engineering Handbook: Fundamentals', Wai-Fah Chen , Lian Duan, CRC Press; 2nd Edition (24 January 2014).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GROUND IMPROVEMENT TECHNIQUES
(PROFESSIONAL ELECTIVE -III)

Course Code:GR22A4004   **L/T/P/C: 3/0/0/3**
IV Year I Semester

Pre- Requisites: Geotechnical Engineering, Foundation Engineering

Course Outcomes:
1. Select of various techniques along with dewatering technique for the field related problem.
2. Interpret of available field conditions in section of different densification methods.
3. Choose the appropriate grouting technology and different stabilization methods by understanding the mechanics.
4. Analyze the suitability and practicability in the application of reinforced earth walls.
5. Develop the mechanism of identifying and application of suitable geosynthetics in problematic soils.

UNIT I
Introduction: Need for ground improvement, objectives, classification of ground improvement techniques. Dewatering: Methods of dewatering - sumps, single and multistage well points, vacuum well points, electro-osmosis method, horizontal wells and drains.

UNIT II
In-situ densification methods in granular soils: Vibration at the ground surface, impact at the ground surface, vibration at depth, impact at depth. In-situ densification methods in cohesive soils: Preloading, vertical drains, sand drains, stone and lime columns, thermal methods.

UNIT III
Grouting: Characteristics of grouts, grouting methods, grouting technology, ascending, descending and stage grouting. Stabilization: Methods of stabilization, mechanism of cement and lime stabilization, factors effecting stabilization.

UNIT IV
Reinforced Earth: Mechanism, components of reinforced earth, types of reinforcing elements, applications, factors governing design of reinforced earth walls, design principles of reinforced earth walls, soil nailing.

UNIT V
Geosynthetics: Types of geo synthetics, functions and applications of geo synthetic materials geotextiles, geogrids, and geomembranes.
Expansive soils: Problems of expansive soils, tests for identification, swelling pressure tests, improvement of expansive soils, foundation techniques inexpansive soils, under-reamed piles.

Text Books
1. Dr. P. Purushotham Raj, Ground Improvement Techniques, Laxmi Publications, New Delhi, 2nd edition 2021.

2. Rao G. V. "Geosynthetics an Introduction". Sai Master Geo environmental Service Pvt. Ltd., Hyderabad (2020),

3. Mandal J. N. and Divshikar D. G. "A Guide to Geotextile Testing" New Age International Publisher.

Reference Books

1. Moseley M.P. and K. Kirsch, Ground Improvement, Blackie Academic and Professional, Florida, 2nd Edition (2007).

2. Hausmann M.R. Engineering Principles of Ground Modification, Mc Graw Hill International Edition (1990).

3. Xanthakos P.P, Abramson, L.W and Brucwe, D.A, Ground Control and Improvement, John Wiley and Sons, New York, USA (1994).

4. Robert M. Koerner, Designing with Geosynthetics, Xlibris Corporation, 6th Edition (2012).

5. F.H.Chen, Foundations on Expansive soils, Elsevier Science, 2nd Edition (1988).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GROUNDWATER
(PROFESSIONAL ELECTIVE-III)

Course Code: GR22A4005   **L/T/P/C: 3/0/0/3**
IV Year I Semester

Pre-Requisites: Hydrology and Water Resources Engineering

Course outcomes:

1. Estimate the porosity and specific yield of aquifers.
2. Apply ground water flow equation.
3. Compute Dupuit's and Theim's equations.
4. Apply the Surface methods and subsurface method of exploration.
5. Construct the Artificial recharge pits.

UNIT I
Ground Water Occurrence: Ground water hydrologic cycle, origin of ground water, rock properties effecting ground water, vertical distribution of ground water, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention.

UNIT II
Ground Water Movement: Permeability, Darcy's law, storage coefficient. Transmissivity, differential equation governing ground water flow in three dimensions derivation, ground water flow equation in polar coordinate system. Ground water flow contours their applications.

UNIT III
Steady groundwater flows towards a well in confined and unconfined aquifers – Dupuit's and Theim's equations, Assumptions, Formation constants, yield of an open well interface and well tests – Recuperation Test.
Unsteady flow towards a well – Non equilibrium equations – Theis' solution – Jocob and Chow's simplifications, Leaky aquifers – Well Interference.

UNIT IV
Surface and Subsurface Investigation: Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods Geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.
Artificial Recharge of Ground Water: Concept of artificial recharge – recharge methods, relative merits, Applications of GIS and Remote Sensing in Artificial Recharge of Ground water along with Case studies.

UNIT V
Well Construction – Drilling Equipment used for Well Construction–Bore log – Interpretation of Log Data.
Saline Water Intrusion in aquifer: Occurrence of saline water intrusions, Ghyben- Herzberg relation, Shape of interface, control of seawater intrusion. Groundwater Basin Management: Concepts of conjunction use, Case studies.Listing of Case Studies using MODFLOW

Text Books

1. Ground water Hydrology by David Keith Todd, John Wiley & Son, New York, 3rd Edition-2005.
2. Ground water byH. M. Raghunath, New Age Publishers, 3rd Edition-2007.
3. Ground Water Hydrology by D.K. Todd and L.R Mays John Willey, 3rd Edition-2005.

Reference Books

1. Irrigation Water Management: Principles and Practice by Majumdar Dilip Kumar 2001.
2. Ground Water and Well Drilling a Reference Book on Ground Water And Wells (Pb 2018) byPraveen Kumar.
3. Groundwater Hydrology by H.Bower, Mc Graw Hill Inc. US,2000.
4. Groundwater System Planning & Management – R. Willes & W. W. G. Yeh, Prentice Hall.,1987.
5. Groundwater Hydrology of Springs: Engineering, Theory, Management And Sustainability byNeven Kresic (2009).
6. Applied Hydrogeology by C. W. Fetta, Pearson, 4th edition,2000.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
TALL BUILDINGS
(PROFESSIONAL ELECTIVE - III)

Course Code: GR22A4006   **L/T/P/C: 3/0/0/3**
IV Year I Semester

Pre-Requisites: Structural analysis II and Design of Reinforced Concrete structures

Course outcomes:
1. Evaluate the components and various types of tall buildings.
2. Illustrate concepts and material properties used in tall building constructions.
3. Analyze the behaviour of tall buildings subjected to different types of loads.
4. Analyze the tall buildings with and without shear walls.
5. Analyze shear walls with and without openings.

UNIT I
Introduction: Evolution of tall buildings-Classification of Buildings – Low-rise, medium-rise, high rise – Ordinary framed buildings & Shear-wall buildings –Behaviour of buildings under lateral loads like Wind loads, Earthquake loads & Blast loads – Basic structural & functional design requirements – Strength, Stiffness & Stability

UNIT II
Design Criteria and Materials-Development of High-Rise Structures – General Planning Considerations – Design philosophies – Materials used for Construction – High Strength Concrete – High Performance Concrete – Self Compacting Concrete – Glass – High Strength Steel

UNIT III
Loading -Gravity Loading – Dead Load – Live Load – Live load reduction technique – Impact Load – Construction Load – Sequential Loading. Lateral Loading – Wind load – Earthquake Load. Combination of Loads.

UNIT IV
Behaviour of Various Structural Systems-Factors affecting growth, Height and Structural form. High rise behaviour of Various structural systems – Rigid frames, braced frames, In filled frames, shear walls, coupled shear walls, wall frames, tubular structures, cores, outrigger – braced and hybrid mega systems.

UNIT V
Methods of analysis: Shear walls with and without openings - Estimation of stiffness by simple cantilever theory & Deep Beam theory- Equivalent frame for large frames.

Text Books
1. Design of Tall Buildings by Taranath M. McGraw Hill, first edition, 2010.
2. Bryan Stafford Smith, Alex coull, "Tall Building Structures, Analysis and Design", John Wiley and Sons, Inc., 1991.
3. Taranath B.S., "Structural Analysis and Design of Tall Buildings", McGraw Hill, first edition, 2011.

Reference Books
1. Lin.T.Y, Stotes Burry.D, "Structural Concepts and systems for Architects and Engineers",John Wiley, 1988.
2. LynnS.Beedle,"Advances in Tall Buildings",CBS Publishers and Distributors, Delhi, 1986.

3. Wolfgang Schueller "High Rise Building Structures", John Wiley and Sons, NewYork 1977.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FINITE ELEMENT METHODS
(PROFESSIONAL ELECTIVE - IV)

Course Code:GR22A4007   **L/T/P/C: 3/0/0/3**
IV Year I Semester

Prerequisite: Engineering Mechanics, Strength of materials, structural analysis

Course Outcomes:
1. Illustrate steps involved and minimum potential energy principle in Finite Element Method.
2. Analyze one dimensional element like bar, beam and truss element using FEM approach.
3. Estimate of stress and strains in planar elements and displacements using appropriate modelling in CST elements.
4. Determination of stress and strains in four nodded quadrilateral and higher order elements using Iso parametric approach.
5. Evaluation of stress and strains in axisymmetric elements and error finding using Numerical Methods.

UNIT I
Introduction: Concepts of FEM – Steps involved – merits & demerits – energy principles– Discretization – Rayleigh –Ritz method of functional approximation.
Principles of Elasticity: Equilibrium equations – strain displacement relationships in matrix form – Constitutive relationships for plane stress, plane strain and Axi-symmetric bodies of revolution with Axi-symmetric loading.

UNIT II
One Dimensional FEM: Stiffness matrix for bar element - shape functions for one dimensional elements – one dimensional problems.

UNIT III
Two Dimensional FEM: Different types of elements for plane stress and plane strain analysis – Displacement models – generalized co-ordinates – shape functions – convergent and compatibility requirements – Geometric invariance – Natural coordinate system – area and volume coordinates

UNIT IV
Generation of element stiffness and nodal load matrices for 3-noded triangular element and four noded rectangular elements.

Isoperimetric formulation: Concepts of iso-parametric elements for 2D analysis - formulation ofCST element,4–noded and 8-noded iso-parametric quadrilateral elements
– Lagrangian and Serendipity elements.

UNIT V
Axi-symmetric analysis: Basic principles -Formulation of 4-nodediso-parametric axi- symmetric element
Solution Techniques: Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads.

Text Books
1. Finite Elements Methods in Engineering by Tirupati.R. Chandrepatla and Ashok D. Belegundu - Pearson Education Publications.2011

2. Finite element analysis by S.S. Bhavikatti-New age International publishers, 2015
3. Finite element analysis by David V Hutton, Tata Mcgraw Hill, New Delhi, 2017

Reference Books

1. Concepts and Applications of Finite Element Analysis by Robert D.Cook, David S. Malkus and Michael E.Plesha. Jhon Wiley & Sons, 2001
2. Finite Element analysis – Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers, 2018
3. Text book of Finite Element analysis by P.Seshu – Prentice Hall of India, 2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PORTS AND HARBOUR ENGINEERING
(PROFESSIONAL ELECTIVE - IV)

Course Code: GR22A4008   **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcome:
1. Demonstrate the role of ports and harbour in water transportation.
2. Assess port features, passenger demand forecasting, cargo handling capacity.
3. Demonstrate the infrastructure facilities of ports and associated utility.
4. Demonstrate harbour features, planning and general design.
5. To be aware of the infrastructure facilities of harbours and associated utility

UNIT I
Introduction: Water Transportation in India Scope, Merits, Developments, Inland waterways, River, Canal, Inland water transportation, Development of shipping in India, need for Ports and Harbours, General Planning for a Harbour, and Ports.

UNIT II
Ports: Characteristics of good seaport and principles of seaport planning, size of seaport, site selection criteria and layout of seaport, Dry ports, Transshipment ports, Surveys to be carried out for seaport planning, regional and intercontinental transportation development, forecasting cargo & passenger demand, regional connectivity, cargo handling capacity of port.

UNIT III
Port facility: Port building facilities, Transit sheds, Warehouses, Cargo handling facility, Services for shipping terminals, Inland port facilities planning. Navigational aids, types, requirements of signals, lighthouses, beacon light, buoys.
Dredging & coastal protection: Types of dredgers, choices, usage of dredged material, sea wall protection-sea wall revetment, bulkhead.

UNIT IV
Harbour: Characteristics of good harbour, classification of harbours, Site selection, Harbour dimensioning and layout, features of harbour, Breakwaters - function, types, general design principles, wharves, quays, jetties, piers, pier heads, dolphin, fenders, mooring accessories.

UNIT V
Harbour Facility: Repair facilities, wet docks, lift docks, dry docks, gates for graving docks, floating docks, slipways, locks, and gates. Ferry, Transfer bridges, floating landing stages, transit sheds, warehouses, cold storage, aprons, cargo handling equipment, purpose, and general description stack area.

Text Books
1. Bindra S.P., Docks & Harbour Engineering, Dhanpat Rai Publications, 3rd Edition, 2012
2. Srinivasan R., Harbours, Docks & Tunnel Engineering, Charotar Publishing House, Anand, 28th Edition 2016.
3. Dock and Harbor Engineering by Ozha & Ozha, Charota Books, Anand. 7th Edition, 2012

Reference Books

1. Port Engineering by Pera Bruun, Gulf Publishing Company 2nd Edition, 1976
2. Coastal Hydraulics Sea and Inland Port Structures by Muir Wood, A.M., and Fleming. C.A Hall stead press. 2nd Edition, 2013
3. Alonzo Def. Quinn, Design and Construction of Ports and Marine Structure, McGraw - Hill Book Company, New York, 2nd Edition, 1972.
4. Dock and Harbor Engineering by Seetharaman, S, Umesh Publications. 2nd Edition, 2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PHYSICO-CHEMICAL PROCESSES FOR WATER AND WASTEWATER TREATMENT
(PROFESSIONAL ELECTIVE - IV)

Course Code:GR22A4009   **L/T/P/C: 3/0/0/3**

IV Year I Semester

Pre-Requisites: Environmental Engineering

Course Outcomes:
1. Knowledge of surface water methods of data collection and analysis.
2. Ability to prepare the treatment flow of water and wastewater treatment plants.
3. Understand the various principles involved in the treatment of waste water.
4. Design reactors for homogenous reactions under isothermal conditions for single and multiple reactions.
5. Knowledge on thermal characteristics of various reactions.

UNIT I
Water purification in natural systems- variation in water flow and the steps to estimate - water for domestic and industrial requirement -waste water quantity- List the standards of potable water quality, gas flow, physical processes, chemical processes, and biological processes. Primary, secondary and tertiary treatment.

UNIT II
Unit operations, unit processes - Aeration and gas transfer - Sedimentation, different types of settling, sedimentation tank design. Coagulation and flocculation, coagulation processes, stability of colloids, destabilization of colloids, destabilization in water and wastewater treatment, transport of colloidal particles, design aspects.

UNIT III
Filtration: filtration processes, Hydraulics of flow through porous media, Rate control patterns and methods, Filter effluent quality parameters, mathematical model for deep granular filters, slow sand filtration, rapid sand filtration, pre-coat filtration, design aspects.
Disinfection: Types of disinfectants, Kinetics of disinfection, chlorination and its theory, Design of Chlorinators.

UNIT IV
Precipitation: Hardness removal, Iron, Mn, and heavy metal removal; Adsorption, adsorption equilibria and adsorption isotherm, rates of adsorption, Sorption kinetics in batch reactors, continuous reactors, factors affecting adsorption.

UNIT V
Ion Exchange - exchange processes, materials and reactions, methods of operation, Application, design aspects. Membrane Processes, Reverse osmosis, Ultrafiltration, Electrodialysis.

Text Books
1. Metcalf and Eddy, Wastewater Engineering: Treatment and Reuse, McGraw Hill Education,4th Edition, 2017.
2. Benefield, L.D. and Randall C.W., Biological Processes Design for wastewaters, Prentice-Hall, Inc.

1980.

3. Shyam. R. Asolek and Soli. J. Arceivala, Wastewater Treatment for Pollution Control and Reuse, McGraw-Hill Professional; 3rd edition, 2006.

Reference Books

1. Hammer MJ, Water and Wastewater Technology, PHI Publications, 7th edition 2013.
2. RANGWALA, Water Supply And Sanitary Engineering, Charotar Publishing House Pvt. Ltd., 29th Edition, 2016.
3. Husain, S,K, Textbook of Water Supply and Sanitary Engineering, Cbs Publishers And Distributors Pvt Ltd, 3rd Edition, 2018.
4. E W Steel and Terence J McGhee, Water supply and Sewerage, McGraw Hill Book Company,6th edition 1991.
5. S.K. Garg, Environmental Engineering Vol. I and II, Khanna Publishers, 35th Edition, 2022.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
REHABILITATION AND RETROFITTING OF STRUCTURES
(PROFESSIONAL ELECTIVE - IV)

Course Code:GR22A4010   **L/T/P/C: 3/0/0/3**
IV Year I Semester

Pre-requisite: Concrete Technology, Design of Reinforced Concrete Structures

Course Outcomes:

1. Recognize various mechanisms for Structural distress and deterioration.
2. Summarize the measures to prevent corrosion in concrete and steel structures
3. Apply the Inspection and Repair methods of distressed concrete and steel structures
4. Examine the methods of Rehabilitation in distressed concrete and steel structures
5. Inspect health monitoring and conditional assessment surveys on concrete and steel Structures

Unit I
Structural distress mechanisms- Maintenance and Repair Strategies - Inspections - Assessment procedure for evaluating a damaged structure, causes of deterioration - Cracks - causes - structural and non-structural damages- Physical deterioration due to moisture, temperature, shrinkage, freeze-thaw, abrasion, erosion, cavitation, crystallization of salts, Efflorescence, exposure to severe environment like marine exposure, Chemical deterioration due to corrosion of reinforcement (chloride induced, carbonation induced), Alkali-silica reaction, sulphate attack, Acid attack - case studies

UNIT II
Basics of corrosion phenomena- electrochemical process - Corrosion protection techniques - Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection- Case studies

UNIT III
Inspection and Testing - Damage assessment techniques- Non-Destructive testing systems – Drone Technology in condition assessment of structures - Repairs in under-water structures- -materials for repair - Repair of structures distressed due to fire, Leakage, earthquake - Demolition Techniques - Engineered demolition methods - Effects due to climate, temperature, Sustained elevated temperature- fire damaged structures - Fire rating of structures- Case studies.

UNIT IV
Simple systems of rehabilitation of structures - Guniting, Epoxy injection, Shoring, Underpinning, Use of carbon fiber wrapping, FRPs and carbon composites in repairs - strengthening methods in concrete and steel structures – Retrofitting -FRP wrapping- base isolators-different types of dampers- Jacketing - Case studies

UNIT V
Structural health monitoring of structures- Sensors -Building instrumentation- smart sensing technology - strain rosette - Condition survey- Special Concretes - Quality assurance for concrete- Construction chemicals for repairs- design and construction errors- Case studies

Text Books

1. P.I.Modi & C.N. Patel, Repairs and Rehabilitation of Concrete Structures, PHI Publication, 2016.
2. B.L.Guptha, Amit Gupta, Maintainence and Repair of Civil Structures, Standard publishers and Distributors,2007.
3. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987

Reference Books

1. Varghese. P.C Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall IndiaPvt Ltd 2014
2. Shetty M.S., "Concrete Technology - Theoryand Practice", S.Chand and Company, 8thedition 2018.
3. DovKominetzky. M.S., "Design and Construction Failures", Galgotia PublicationsPvt.Ltd.,2001
4. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
5. Gambhir. M.L., "Concrete Technology", McGraw Hill, 2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
TRANSPORTATION ENGINEERING LAB

Course Code: GR22A4012   **L/T/P/C: 0/0/4/2**
IV Year I Semester

Course Outcomes:

1. Estimate desired characteristics of aggregates.

2. Distinguish suitable materials for road construction.

3. Categorize pavement materials by their physical and mechanical properties.

4. Demonstrate various experiments on bitumen to measure various properties.

5. Demonstrate bituminous mixes as per pavement requirement.

Task1: TESTS ON AGGREGATES

1. Crushing value
2. Impact value
3. Specific gravity and water absorption
4. Abrasion test
5. Shape test- Elongation Index
6. Shape test- Flakiness Index

Task2: TESTS ON BITUMEN

1. Penetration test
2. Ductility test
3. Softening point test
4. Flash and fire point tests

Task3: TESTS ON BITUMINOUS MIXES

1. Bitumen Extraction test- Demonstration
2. Marshall Stability test -Demonstration

REFERENCE BOOKS

1. Highway Engineering – S. K. Khanna & C. E. G. Justo. New Chand & Brothers (2011).

2. Highway Material Testing - S. K. Khanna & C. E. G. Justo (2013).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMPUTER APPLICATIONS IN STRUCTURAL ENGINEERING LAB

Course Code: GR22A4013   **L/T/P/C: 0/0/4/2**
IV Year I Semester

Prerequisites: CAD Lab, Structural analysis, Design of reinforced concrete structures, Design of Steel structures

Course Outcomes
1. Apply the concept of analyzing the 2D beam and frame with various support and load combinations.
2. Develop the 3D model by analyzing and designing a multi-storeyed building with wind and seismic load and its load combinations.
3. Build up the RCC water tank through analyzing and designing multi-storeyed building with different shapes.
4. Create the steel sections and truss members by analyzing and designing with suitable elements and shapes.
5. Develop the geometric shapes for the reinforcement detailing of beams, footings, and staircases.

Syllabus:
1. Analysis of beams for simply supported, over hanging, cantilever and fixed conditions under different load conditions.
2. Analysis and Design of multi-storeyed building with simple 2D frame.
3. Analysis and Design of multi-storeyed building with 3D frame with Dead Load and Live Load
4. Analysis and Design of multi-storeyed building with 3D frame under Wind load and its load combinations.
5. Analysis and Design of multi-storeyed building with 3D frame under Seismic Load and its load combinations.
6. Analysis and Design of RCC Rectangular Over Head Tank.
7. Analysis and Design of RCC Circular Over Head Tank.
8. Analysis and Design of beams for various steel sections (I, C, T, L and composite sections).
9. Analysis and Design of Simple truss.
10. Reinforcement Detailing of Simply Supported, Cantilever and Flanged Beams.
11. Reinforcement Detailing of Isolated footing (Circular/Rectangular and Square).
12. Reinforcement Detailing of Combined footing with Strap beam.
13. Reinforcement Detailing of Staircases.

Reference Books
1. STAAD. Pro Reference Guide, Chetan Publication; 2010th Edition (1 January2010).
2. Advanced Structural Analysis, A K Jain, Nem Chand & Bros. 3rd Edition, 2015.
3. Advanced Structural Analysis, Devadas Menon, Alpha Science Intl.,Ltd (Publisher),2009.
4. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain Reinforced Cement Concrete Design, Laxmi Publications, 2015
5. IS:5525 -1969: Recommendation for detailing of reinforcement in reinforced concrete works.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROJECT WORK – PHASE I

Course Code:GR22A4082   **L/T/P/C: 0/0/12/6**
IV Year I Semester

Pre-Requisites: Knowledge of all Civil Engineering subjects and Laboratories, communication skills

Course Outcomes:

1. Practice and acquire the knowledge within the chosen area of technology for Project Development.

2. Identify, discuss, and justify the technical aspects of the chosen project with a comprehensive and systematic approach.

3. Design and develop Engineering Projects by implementing technical aspects.

4. Work as an individual or in a team in development of Technical Projects.

5. Compile and report effectively the project related activities and findings.

IV YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PRESTRESSED CONCRETE
(PROFESSIONAL ELECTIVE- V)

Course Code:GR22A4087   **L/T/P/C: 3/0/0/3**
IV Year II Semester

Prerequisite: Strength of Materials, Concrete Technology, Design of Reinforced Concrete Structuresand Design of Steel Structures.

Course Outcomes:
1. Acquire the basic aspects of pre stressed concrete fundamentals which include pre and post-tensioning processes.
2. Determine the losses in pre-stressed concrete structures.
3. Analyze and design the pre stressed concrete beams and also analyze an end block and transmission length.
4. Analyze and design the composite sections of pre stressed concrete.
5. Determine the deflection and crack width of prestressed concrete members.

UNIT I
Introduction: Historic development – General principles of Prestressing, Pretensioning and Post tensioning – Advantages and limitations of Prestressed concrete – Materials – High strength concrete, high tensile steel and their characteristics. I.S.Code provisions, Methods and Systems of Prestressing; Pre-tensioning and post tensioning methods – Analysis of Post tensioning - Different systems of Prestressing like Hoyer System, Magnel System, Freyssinet system and Gifford – Udall System.

UNIT II
Losses of Prestress: Losses of Prestress in Pre-tensioned and Post-tensioned members due to various causes like Elastic shortage of concrete, Shrinkage of concrete, Creep of concrete, Relaxation of steel, Slip in anchorage bending of member and Frictional losses. Analysis of sections for flexure; Elastic analysis of concrete beams prestressed with Straight, Concentric, Eccentric, Bent and Parabolic Tendons.

UNIT III
Design of PSC Beams: Allowable stress, Design criteria as per I.S.Code – 1343, Elastic design of simple sections like; Rectangular and I-section for Flexure, Shear, and Principal stresses – Kern – Lines, Cable profile.

Analysis of End Blocks: by Guyon's method and Mugnel method - Anchorage Zone Stresses – Approximate method of design – Anchorage zone reinforcement – Transfer of prestress in pre-tensioned members.

UNIT IV
Composite section: Introduction – Analysis of stresses – General designs considerations. Composite construction with Precast PSC Beams and Cast-In-Situ RC Slabs. Creep and Shrinkage eff sections.

UNIT V

Deflections of PSC Beams: Importance of control of deflection – Factors influencing Deflection – Short term deflection of Uncracked members and Prediction of long term deflections. Crack width calculations.

Text Books

1. Prestressed Concrete by Krishna Raju; - Tata Mc.Graw Hill Publications, 2018.
2. Prestressed Concrete by K.U.Muthu, Azmil Ibrahim, Maganti Janardhana, M. Vijayanand, PHI Learning Private Limited, Delhi, 2016.
3. Prestressed Concrete by Shrikanth B. Vanakudre, Ashish A. Yaligar, Khanna Book Publishing Co. (P) LTD. New Delhi.

Reference Books

1. Design of Prestressed concrete structures (Third Edition) by T.Y. Lin & Ned H.Burns, John Wiley & Sons. 2010.
2. Prestressed Concrete by Ramamrutham; Dhanpatrai Publications, 2016.
3. Prestressed Concrete Design, by Dr. Praveen Nagarajan , Pearson Education India publisher, 2013.
4. Prestressed Concrete Analysis and Design: Fundamentals, by Antoine E. Naaman, Techno Pr 3000 publisher, 2004.
5. Analysis and Design of Prestressed Concrete Structures, by Shamsher Bahadur Singh, Wiley publisher, 2023.
6. Prestressed Concrete by N.Rajasekharan; - Narosa publications.
7. Prestressed Concrete by N. Rajagopalan Narosa Publishing House, 2010

Codes: IS 1343 - BIS code of practice for Prestressed concrete.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
URBAN TRANSPORTATION AND PLANNING
(PROFESSIONAL ELECTIVE -V)

Course Code: GR22A4088   **L/T/P/C: 3/0/0/3**
IV Year II Semester

Prerequisite: Transportation Engineering.

Course Outcomes: Upon completion of this course, the students should be able to:
1. Interpret the urban activity system and travel patterns.
2. Demonstrate the classical methods of urban transportation planning.
3. Apply four stage travel demand modeling.
4. Identify urban transportation problems.
5. Estimate urban travel demand.

UNIT I
Urban morphology - Urbanization and travel demand –Urban activity systems and travel patterns – Systems approach – Trip based, and Activity based approach – Urban Transportation Planning – Goals, Objectives, and Constraints

UNIT II
Inventory, Model building- Forecasting and Evaluation - Study area delineation – Zoning - UTP survey;Trip generation models – Trip classification - productions and attractions – Trip rate analysis - Multiple regression models - Category analysis.

UNIT III
Trip distribution models – Growth factor models, Gravity model and Opportunity modes; Modal split models – Mode choice behavior – Trip end and trip interchange models - Probabilistic models – Utility functions - Logit models - Two stage model.

UNIT IV
Traffic assignment – Transportation networks – Minimum Path Algorithms - Assignment methods – Allor Nothing assignment, Capacity restrained assignment and Multi path assignment – Route-choice behavior; Land use transportation models – Urban forms and structures - Location models - Accessibility– Land use models - Lowry derivative models

UNIT V
Quick response techniques - Non-Transport solutions for transport problems; Preparation of alternative plans - Evaluation techniques – Plan implementation - Monitoring - Financing of Project – urban development planning policy; Urban flooding- Overview- reasons and impact of Urban Floods, Factors for Urban Flooding, Steps taken to Mitigate Urban Flooding

Text Books
1. Traffic Engineering and Transportation Planning, Kadiyali, LR, Khanna Publishers, New Delhi. 7th Edition, 2016
2. Principles of Urban Transport Systems Planning, Hutchinson, B.G., Mc Graw Hill, New York, 1974.
3. Transportation Engineering - An Introduction, Khisty C.J. & B.K.Lall, Pearson Education Inc., 3rd Edition 2016.

Reference Books

1. Papacostas C.S. and Prevedouros, P.D., Transportation Engineering & Planning, PHI, New Delhi, 3rd Edition, 2009.

2. John W Dickey, Metropolitan Transportation Planning, Tata McGraw-Hill publishing company Ltd, New Delhi 2nd Edition, 2017

3. NPTEL videos on Urban Transportation Planning, Dr. V. Tamizh Arasan, IIT Madras, September 2020

4. Paul.H. Wright, Transportation Engineering – Planning & Design, John Wiley & Sons, New York, 4th Edition, 1998.

5. Bruton, M. J., An Introduction to Transportation Planning (The Living Environment), UCL Press, London, UK, 3rd Edition, 2021.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DESIGN OF HYDRAULIC STRUCTURES
(PROFESSIONAL ELECIVE - V)

Course Code:GR22A4089   **L/T/P/C: 3/0/0/3**

IV Year II Semester

Pre-Requisites: Hydraulics and Water Resource Engineering

Course Outcomes:
1. Plan and assess the capacity of reservoir by mass curve method and design different types of irrigation channels.
2. Evaluate the forces acting on gravity dams and analyze the stability of the gravity dam.
3. Apply the principles of design of the earthen dams and Ogee spillways.
4. Design various diversion head works by using Bligh's and Khosla's theory.
5. Design of various hydraulic structures like canal falls, canal regulator works, and cross drainage works along with their suitability& explain the components of hydroelectric schemes.

UNIT I
Reservoir Planning and Canals design: Estimation of crop water requirement; Fixing the capacities of reservoirs by mass curves of inflow and outflow. Analysis for surface and sub-surface flow at hydraulic structures, Cross section of channels, Silt control methods in canals.Estimation of channel losses. Design of unlined channels by Lacey's method - Relevant three IS codes-Names and Numbers only.

UNIT II
Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary, common profile and practical profile of a gravity dam, limiting height of a low gravity dam, Factors of Safety - 'stability Analysis, Foundation for a Gravity Dam, drainage and inspection galleries and their impact, stress analysis of a gravity dam. Relevant three IS codes- Names and Numbers only.
Spillways: types of spillways, Design principles of Ogee spillways – Spillway gates- Relevant three IS codes- Names and Numbers only.

UNIT III
Earth dams: Types of Earth dams, causes of failure of earth dam, criteria for safe design of earth dam, seepage through earth dam-graphical method, measures for control of seepage through embankments and foundations.

UNIT IV
Diversion Head works: Types of Diversion head works- weirs and barrages, layout of diversion head work - components. Causes and failure of weirs and Barrages on permeable foundations, Silt Ejectors and Silt Excluders weirs on Permeable Foundations - creep.
Theories - Bligh's, Lanet and Khosla's theories, Determination of uplift pressure- Various Correction Factors - Design principles of weirs on permeable foundations using creep theories-exit gradient, U/s and D/s Sheet Piles - Launching Apron – Relevant three IS codes- Namesand Numbers only.

UNIT V
Canal falls: Types of falls and their location, design principles of Notch fall and sarada type fall. Canal regulation works, principles of design of distributor and head regulators, canal cross regulators-canal outlets, types of canal modules, proportionality, sensitivity, and flexibility. Cross drainage works types: selection of site, design principles of aqueduct siphon aqueduct and super passage. Components of Hydroelectric schemes and selection of turbines
Relevant three IS codes- Names and Numbers only.

Text Books

1. Irrigation Engineering and Hydraulic Structures - S.K Garg , 2013, 25th Revised Edition.
2. Irrigation and Water Power Engineering - B.C.Punmia, Pande B.B.Lal, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications - 16th Edition , 2009.
3. Irrigation Engineering and Hydraulic Structures - S.R.Sahasrabuddhe , 2011, 3rd Edition , S.K.Kataria & Sons

Reference Books

1. Irrigation Engineering and Hydraulic structures. S.R.Sahasrabudhe, 2013 S.K.Kataria &sons
2. Irrigation and water power engineering. B.C.Punmia, Pande B.B.Lal, Ashok kumar jain, Arun kumar Jain- Laxmi publications 16th edition 2009.
3. Theory and Design of Irrigation Structures-Volume II – R.S. Varshney, S.C.Gupta andR.L.Gupta 2014
4. Water Power Engineering by M.M.Dandekar and K.N.Sharma, 2nd edition 2013.
5. IS Code 6512: Criteria for Design of Solid Gravity Dams, 1984.
6. IS Code 7894: Code of Practice for Stability Analysis of Earth Dams, 1975.
7. IS Code 8826: Guidelines for Design of Large Earth and Rockfill Dams, 1978.
8. IS Code 6966: Part 1: 1989 Guidelines for hydraulic design of barrages and weirs: Part1 Alluvial Reaches
9. IS Code 7720: 1991 Criteria for Investigation, Planning and Layout for Barrages and Weirs
10. IS code: 7112-2002 Criteria for design of cross section for Unlined canals in Alluvial Soils
11. IS code: 10430 :2000 Criteria for Design of Lined Canals and Guidance for selectionof type of lining.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONSTRUCTION PROJECT PLANNING AND SYSTEMS
(PROFESSIONAL ELECTIVE - V)

Course Code: GR22A4090   **L/T/P/C:3/0/0/3**
IV Year II Semester

Pre-Requisite: Building Materials and Construction planning, Computational methods.

Course Outcomes:
1. Understand how structures are built and projects are developed on the field.
2. Analyze good idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project economics.
3. Interpret Plan, control and monitor construction projects with respect to time and cost, and also to Optimize construction projects based on costs.
4. Remember how construction projects are administered with respect to contract structures and issues.
5. Summarize ideas and understandings to others with effective communication processes.

UNIT I
Construction Planning and Scheduling: Definition of Projects; Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT Assumptions underlying PERT analysis, determining three-time estimates, analysis, slack computations, calculation of probability of completion. Allocation of Resources- materials, equipment, staff, labour and finance; resource levelling and optimal schedules; Project organization, documentation and reporting systems.

UNIT II
Construction Methods and Contract Management: Control & monitoring; Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management; Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation.

UNIT III
Construction Materials and Resource Leveling: Materials, concepts of planning, procurement, and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and levelling. Common Good Practices in Construction.
Introduction to formwork: Requirements and Selection of Formwork, Formwork Materials-Timber, Plywood, Steel, Aluminum, Plastic, and Accessories. Form work selection.

UNIT IV

Project Monitoring & Control: Project Monitoring &Control- Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management.

UNIT V

Quality Control and Quality Assurance: Quality control, concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

Text Books
1. Varghese, P.C., "Building Construction", Prentice Hall India, 2007.
2. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
3. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

Reference Books
1. Chudley, R., Construction Technology, ELBS Publishers, 2007.
2. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011.
3. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006.
4. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
EARTHQUAKE ENGINEERING
(PROFESSIONAL ELECTIVE -VI)

Course Code:GR22A4091   **L/T/P/C: 3/0/0/3**
IV Year II Semester

Pre-Requisites: Engineering Geology, Design of Reinforced Concrete Structures
Course Outcomes
1. Recognize the importance of earthquake phenomenon and determine the response of structural system subjected to vibration including earthquake.
2. Apply the concept of seismic resistant design and concept of lateral load distribution on buildings.
3. Determine the principles of earthquake resistant design in the structure due to ground motion as per codal provisions.
4. Estimate the behaviour of the structural system under diverse effects of building design under seismic action.
5. Apply the concept of ductile detailing in RCC structures.

UNIT I
Engineering Seismology – Earthquake phenomenon – cause of earthquakes-Faults- Plate tectonics-Seismic waves – Magnitude/Intensity of an earthquake-scales – Energy Released-Earthquake measuring instruments seismogram – Seismoscope, Seismograph, – Earthquake ground motion – Seismic zones of India. Elastic rebound theory – Theory of Vibrations – Elements of a vibratory system- Degrees of Freedom-Continuous system- Lumped mass idealization-Oscillatory Motion-Simple Harmonic Motion-Free vibration of single degree of freedom (SDOF) system.

UNIT II
Concept of Earthquake Resistant Design – Ductility, Hysteric response & energy dissipation – response modifications factor – design spectrum, capacity design – Classification of structural system – IS code provisions for seismic design of structures – multi-storeyed buildings – design criteria – P-Δ effects, storey drift – design examples ductile detailing of RCC structures.

UNIT III
Reinforced Concrete Buildings: Principles of earthquake resistant deign of RC members - Structural models for frame buildings – Seismic methods of analysis- IS codal methods for seismic design - – Vertical irregularities – Plan configuration problems- Lateral load resisting systems- Determination of design lateral forces as per IS 1893 (Part-1):2016- Equivalent lateral force procedure- Lateral distribution of base shear – Response Spectrum.

UNIT IV
Seismic Behavior of RC Structures: Load Transfer Path – Strength Hierarchy – Reversal of Stresses – Importance of Beam Column Joints – Importance of Stiffness and Ductility (Capacity Design Concept) in Structures - Effect of Short Column – Effect of Soft Storey – Improper Detailing, Effect of Masonry Infill Walls – Effect of Eccentricity – Effect of Pounding – Effect of Floating Columns and of Setbacks– Earthquake Resistant Features of RC Structures.

UNIT V
Ductility Considerations in Earthquake Resistant Design of RC Buildings: Impact of Ductility-Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing

considerations as per IS 13920-2016 – Behaviour of beams, columns, and joints in RC buildings during earthquakes. Lateral load resisting systems, Special moment resisting frames - shear walls - diaphragms.

Text Books

1. Highway and traffic Engineering-Subash Saxena, CBS Publisher distributors Pvt. Ltd. (2020) Delhi.
2. Highway Engineering-S.K. Khanna & C.E.G. Justo, Nemchand & Bros.10th edition 2018.
3. Pavement Design by R Srinivasa Kumar, University Press (India) Pvt Ltd, 2013

Reference Books

1. Principles of traffic and highway engineering- Garber & Hoel, 5th Edition, 2014.
2. Pavement Analysis and Design – Yang H. Huang, 2nd Edition
3. Principles of Pavement Design – E. J. Yoder, M. W. Witczak, 2nd Edition, 1991
4. Ministry of transport, "Road Development plan for India,19881-2001", Indian Road Congress, New Delhi,1984.
5. Alam Singh, "Soil Engineering in Theory and Practice" Asia Publishing House, CBS Publisher & Distributors P Ltd; 2nd Edition (January 1, 2010)
6. Mittal, Satyendra, and Shukla J. P., "Soil Testing for Engineering" Khanna Publisher, Delhi.2008
7. The Desing of Flexible pavements IRC 37-2001.
8. The Desing of Rigid pavements IRC 58-2002.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PAVEMENT DESIGN
(PROFESSIONAL ELECTIVE -VI)

Course Code:GR22A4092   **L/T/P/C:3/0/0/3**

IV Year II Semester

Pre-Requisites: Transportation Engineering.
Course Outcomes:
1. Illustrate highway design methods, constraints and controlling factors.
2. Apply the design standards in designing principal elements of the highway.
3. Identify the resource constraints and utilize the available materials in a sustainable way.
4. Examine the basic parameter of traffic engineering and the methods which help to estimate those parameters.
5. Estimate the major failure modes of flexible and rigid pavement and helps in proper maintenance.

UNIT I
Introduction to pavement design: Types of Pavements-Functions of individual layers, Variables considered in Pavement Design- Factors affecting Pavement Design: Wheel loads, Tire Pressure, Contact Pressure, ESWL & ESAL concepts

UNIT II
Material characteristics: Tests on sub-grade, Tests on aggregates-Aggregate properties and theirimportance-Tests on Bitumen-Requirements of design mix-Marshall method of mix design.

UNIT III
Stresses in flexible and rigid pavements: Stresses in Flexible Pavements-Layered systems concept-One layer system-Boussinesq two layer system-Burmister theory of Pavement design. Stresses in Rigid pavements -Importance of Joints in rigid Pavements-Types of joints use of tie bars and dowel bars-Relative Stiffness-Modulus of Subgrade Reaction-Stresses due to warping Stresses due to loads-Stresses due to friction.

UNIT IV
Flexible and rigid pavement design: Flexible Pavement Design concepts-CBR method of Flexible Pavement design-IRC method of design-Asphalt Institute method and AASTHO methods. Rigid Pavement design concepts-IRC method of Rigid pavement design-PCA method-Design of tie bars and dowel bars.

UNIT V
Highway construction and maintenance: Construction: Construction of Bituminous Pavements, construction of Cement Concrete Roads. Highway maintenance –Pavement failures: failures in flexible Pavements, Rigid Pavement failures, Pavement evaluation-Overlay design by Benkelman Beam method.

Text Books
1. Highway and traffic Engineering-Subash Saxena, CBS Publisher distributors Pvt. Ltd. (2020) Delhi.
2. Highway Engineering-S.K. Khanna & C.E.G. Justo, Nemchand & Bros.10 th edition 2018.
3. Pavement Design by R Srinivasa Kumar, University Press (India) Pvt Ltd, 2013

Reference Books
1.Principles of traffic and highway engineering- Garber & Hoel, 5 th edition, 2014.
2.Pavement Analysis and Design – Yang H. Huang, 2 nd edition
3.Principles of Pavement Design – E. J. Yoder, M. W. Witczak,2nd edition, 1991
4.Ministry of transport,"Road Development plan for India,19881-2001", Indian Road   Congress,

New Delhi,1984.

5. Alam Singh, "Soil Engineering in Theory and Practice" Asia Publishing House, CBS Publisher & Distributors P Ltd; 2nd edition (January 1, 2010)

6. Mittal, Satyendra, and Shukla J. P., "Soil Testing for Engineering" Khanna Publisher, Delhi.2008

7. The Desing of Flexible pavements IRC 37-2001.

8. The Desing of Rigid pavements IRC 58-2002.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
IRRIGATION MANAGEMENT
(PROFESSIONAL ELECTIVE-VI)

Course Code: GR22A4093   **L/T/P/C: 3/0/0/3**
IV Year II Semester

Pre-Requisites: Hydrology and Water Resources Engineering

Course Outcomes:

1. Inculcate knowledge of soil physical & chemical properties with respect to soil water plant relationship.

2. Acquire the knowledge to estimate water requirement for various principal crops.

3. Apply the various methods to design and development of irrigation structures.

4. Design the conveyance of water through field channels through underground pipe lines.

5. Analyze irrigated areas and design drainage systems.

UNIT I
Introduction: Necessity of irrigation and Scope, Benefits of Irrigation, Types of Irrigation, Physical and Chemical properties of soils, Field Capacity, Temporary and Permanent Wilting Points, Hydraulic Conductivity.

UNIT II
Water Requirement for Crops: Meteorological Parameters needed in estimating water requirement of crops, their measurements, Methods for estimating evapotranspiration of crops, Consumptive Use, Irrigation Requirement of Principal Crops, Duty, Delta and Base Period and Interrelationships, Factors Affecting the Duty, Cropping Patterns, Irrigation Efficiencies.

UNIT III
Methods of Irrigation: Surface Irrigation Methods, Border, Check, Furrow, Sub-irrigation Methods and their Relative Merits, Principles of Design of Surface Irrigation Methods, Micro- Irrigation, Sprinkler and Drip Irrigation Methods and their advantages and disadvantages.

UNIT IV
Planning of Irrigation Projects, Command Area Development Programmes, Classification of Irrigable Soils, soils Management, Texture and structure of Soils, Soil groups of India, Soil Water plant Relations in Irrigation, Measurement of Soil Moisture. Land Grading Survey and Design, Equipment of Land Grading, Field Layout suiting different crops. Conveyance of Irrigation Water, Field Channels, Different lining materials, Design of field channels, Drop structures, Conveyance of water through underground pipe lines.

UNIT V
Irrigation Management, Diagnostic Analysis of Irrigation System, Micro Irrigation, Water Logging, Reclamation, Water Quality for Irrigation, Participatory Irrigation Management, Strategies, Conflict Management, Legal aspects in water sharing and management.
Listing of Applications of Software in Irrigation Management

Text Books
1. Irrigation: Theory and Practice by Michael. A.M, S. Chand,2nd Edition, 2009.
2. Land and Water Management Engineering by V.V.N. Murthy, Kalyani Publishers, 2013.
3. Irrigation –Theory and Practice" by Withers and Vipond, S, Cornell University Press,1980.

Reference Books
1. Irrigation Water Management Principle and Practice 2nd Edition 2014 Edition by Majumdar.
2. Irrigation Engineering and Hydraulic structures by Santhosh kumar Garg, Khanna Publishers.
3. Soil and Water Management Systems by Schwab G.O., Fangmeir, D.D. and Elliot W.J,John Wiley & Sons, 1996.
4. Irrigation and Water Resources Engineering by Asawa, G.L, New age Publishers,2005.
5. Theory and Design of Hydraulic structures by Varshney, Gupta & Gupta (1979).
6. Irrigation Engineering by R.K. Sharma and T.K. Sharma, S. Chand Publishers 2015.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONSTRUCTION EQUIPMENT AND AUTOMATION
(PROFESSIONAL ELECTIVE- VI)

Course Code: GR22A4094   **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1. Understand how structures are built and projects are developed on the field.
2. Understand modern construction practices.
3. Examine the proper selection, application, utilization, and productivity of heavy equipment.
4. Interpret cost analysis for owning and operating heavy equipment.
5. Optimize construction projects cost based on Equipment Operational and Maintenance costs.

UNIT I
Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; plastering machines; Prestressing jacks and grouting equipment.

UNIT II
Cranes, Hoists, and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities: Use of Drones for spread out sites; Use of robots for repetitive activities.

UNIT III
Earthmoving, Excavating, and Lifting Equipment Selection - Bulldozers, Front-end Loaders, Scrapers, Trucks, Excavators, Backhoes, Front shovels, Cranes; Piles and Pile-Driving Equipment; Production of Crushed-stone Aggregate; Concreting Equipment

UNIT IV
Planning Process for Equipment and Methods; Cost of Owning and Operating Construction Equipment - Ownership cost, Depreciation, Operating cost, Ownership and operating costscalculation methods

UNIT – V
Equipment Life and Replacement Procedures - Physical, profit and economic life, Replacement analysis; Engineering Fundamentals of Moving Earth - Rolling resistance, Effect of grade on tractive effort.

Text Books
1. D. G. Gransberg, C. M. Popescu and R. C. Ryan, Construction equipment management for engineers, estimators, and owners, Taylor & Francis, New York, 2006.
2. R. L. Peurifoy, C. J. Schexnayder, A. Shapira and R. Schmitt, Construction planning, equipment, and methods, 8th Edition., McGraw Hill, New York, 2008.
3. F. Harris, R. McCaffer and F. Edum-Fotwe, Modern construction management, 6th Edition, Blackwell Publishing, Oxford, 2006

Reference Books

1. K. Knutson, C. J. Schexnayder, C. M. Fiori and R. Mayo, Construction management fundamentals, 2nd Edition., McGraw Hill, New York, 2008.
2. Cameron K. Andres, Ronald C. Smith, Principles and Practices of Commercial Construction, 8th Edition, Prentice Hall, 2009.
3. Arora and Bindra, Building Construction, Dhanpat Rai, 2012.
4. National Building Code of India, Bureau of Indian Standards, 2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROJECT WORK – PHASE II

Course Code: GR22A4145   **L/T/P/C: 0/0/12/6**
IV Year II Semester

Pre-Requisite: Knowledge of all Civil Engineering subjects and Laboratories, communication skills

Course Outcomes:
1. Practice and acquire the knowledge within the chosen area of technology for Project Development.
2. Identify, discuss, and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
3. Design and develop Engineering Projects by implementing technical aspects.
4. Work as an individual or in a team in development of Technical Projects.
5. Compile and report effectively the project related activities and findings.

OPEN ELECTIVES

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SOFT SKILLS AND INTERPERSONAL SKILLS
(OPEN ELECTIVE)

Course Code: GR22A3145   **L/T/P/C:3/0/0/3**

Course Outcomes
- Develop soft skills communication skills, leadership skills etc.
- Implement goal setting techniques to build a promising career and evaluate the power of confidence building and self-esteem with examples.
- Design formal reports and proposals with appropriate formal expressions.
- Create a healthy workplace environment by treating others with respect and dignity.
- Describe team dynamics and exchange ideas about the elements of positive teamwork.

Unit 1: Soft Skills
➢ Introduction to soft skills, Definition of Soft skills, Importance of soft skills
➢ Communication skills, Usage of English in Business/Corporate scenario
➢ Nonverbal communication - Proxemics
➢ Presentation skills

Unit 2: Team Building & Leadership Qualities
➢ Qualities of a good leader
➢ Problem solving and Decision Making
➢ Strategic management
➢ Crisis management

Unit 3: Personality Development
➢ Motivation
➢ Goal setting
➢ Self-esteem
➢ Team skills

Unit 4: Developing Reports and Proposals
➢ Understanding reports and proposals
➢ Planning reports and proposals
➢ Writing beginning, body and ending
➢ Formats of reports and proposals

Unit 5: Interpersonal Skills
➢ Understanding professional relationships
➢ Networking professionally
➢ Showing basic office courtesies
➢ Interview skills.

Text Books
1. Soft Skills-Key to success in workplace and life Meenakshi Raman, Raman Upadhyay, CENAGE

Reference Books
1. Soft skills for Everyone - Jeff Butterfield, CENAGE Learning
2. Soft skills for Interpersonal Communication - S.Balasubramaniam (ORIENT BLACKSWAN)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOUR
(OPEN ELECTIVE)

Course Code: GR22A4049   **L/T/P/C: 3/0/0/3**

Course Outcomes
1. To acquaint the student with the determinants of intra -individual, inter-personnel, and inter-group behaviour in an organizational setting.
2. To Understand individual behavior in organizations, including diversity, attitudes, job satisfaction, emotions, moods, personality, values, perception, decision making, and motivational theories and apply in the organizational context.
3. To assess the group behavior in organizations, including communication, leadership, power and politics, conflict, and negotiations in the framework of organization and to familiarize the concepts, techniques, and practices of human resource development in the current organizational view.
4. To impart and apprise the capable of applying the principles and techniques as professionals for developing human resources in an organization.
5. To report the current trends and applications in HRD and Balanced Scorecard to measures the performance and to develop, implement, and evaluate organizational human resource development strategies aimed at promoting organizational effectiveness in different organizational environments.

Unit I - Introduction to OB: Organizational Behaviour- Concept and Emergence of OB Concept; Nature and Theoretical frameworks; Models of Organizational Behaviour, Challenges and Opportunities for Organizational Behavior;

Unit II- Individual Behaviour: Individual Behaviour: Personality, Learning, Values and Attitudes, Perception, Stress at work. Management's assumptions about people- McGregor's Theory X and Theory Y. Motivation - Maslow's Need Hierarchy, Herzberg's Two Factors Theory, Vroom's Expectancy Theory.

Unit III-Inter-personal and Group Behaviour: Interpersonal communication and Feedback; Transactional Analysis (TA); Johari Window. Group Behaviour: Group Dynamics, Cohesiveness and Productivity; Management of Dysfunctional groups; Group Decision Making. Leadership- Concept and Styles.

Unit IV -Introduction to Human Resource Development: Concept; Relationship between human resource management and human resource development; HRD mechanisms, processes, and outcomes; HRD matrix; Roles and competencies of HRD professionals; Challenges in HRD, steps in HRD Process.

Unit V-HRD Applications and Trends: Coaching and mentoring; Career management and development; Competency mapping; Balanced Score Card. HRD in Organizations: Selected cases covering HRD practices in government Organizations, manufacturing, and service industries and MNCs.

Text Books
1. Robbins, Stephen P. and Timothy A. Judge, Organizational Behaviour, Prentice -Hall, New Delhi.
2. Werner J. M., DeSimone, R.L., Human resource development, South Western.

Reference Books
1. Luthans, Fred, Organizational Behaviour, McGraw-Hill, New York.
2. Gregory, Moorhead and Ricky W. Griffin, Managing Organizational Behaviour, Thomson South Western Publication.

3. Pareek, Udai and V. Sisodia, "HRD in the New Millennium, Tata McGraw - Hill Publishing Co. Ltd., New Delhi, 1999.
4. Haldar, U. K., Human resource development, Oxford University Press India.
5. Rao, T.V., Future of HRD, Macmillan Publishers India.
6. Rao, T.V., HRD Score Card 2500: Based on HRD audit, Response Books, SAGE Publications.
7. Mankin, D., Human resource development, Oxford University Press India.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CYBER LAW AND ETHICS
(OPEN ELECTIVE)

Course Code: GR22A4077   **L/T/P/C: 3/0/0/3**

Course Outcomes

1. Students identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2. Students locate and apply case law and common law to current legal dilemmas in the technology field.
3. Students apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
4. Students will be able understand cybercrime and ethical practices and the student will be able to know and learn web technologies and related issues.
5. The student will be in a position to interface with various issues pertaining to Intellectual Property, copy rights, patents rights etc. and provide an overview of cybercrime and framework.

Unit I - The Legal System: Sources of Law and The Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court), Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

Unit II - Introduction cyber law: Computers and its Impact in Society, Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level. , NITI Aayog and some current aspects.

Unit –III - Constitutional & Human Rights Issues in Cyber space: Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace, Access to Internet, Right to Privacy, Right to Data Protection.

Unit –IV Cyber Crimes & Legal Framework: Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud, Cyber terrorism, Cyber Defamation, Different offences under IT Act

Unit –V Intellectual Property Issues in Cyber Space: Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues.

Text Books

1. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
2. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012)
3. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)
4. Jonthan Rosenoer, Cyber Law, Springer, New York, (1997).
5. Sudhir Naib, The Information Technology Act, 2005: A Handbook.
6. S. R. Bhansali, Information Technology Act, 2000
7. University Book House Pvt. Ltd. Jaipur (2003).
8. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ECONOMIC POLICIES IN INDIA
(OPEN ELECTIVE)

Course Code: GR22A4147   **L/T/P/C: 3/0/0/3**

Course Outcomes

1. Familiarize with the nature of business environment and its components.
2. The students will be able to demonstrate and develop conceptual framework of business environment.
3. Understand the definition of ethics and the importance and role of ethical behaviour in the business world today.
4. Explain the effects of government policy on the economic environment.
5. Outline how an entity operates in a business environment.

Unit 1: Business environment-factors effecting Business Environment-need for industrial policies, Overview of Indian Economy, Trends towards market economy, problems of underdevelopment – meaning, Main problems, reasons, of underdevelopment.

Unit :2 Factors and measure, Meaning of Economic development, National income, Per capital income, Quality of life, Capital Formation – Savings, Investment.

Unit 3: NITI Aayog and Planning in India, Niti Aayog and its function, how is Niti Aayog different from planning commission, Meaning, Importance, Main reasons of adopting, planning in India, Objectives of planning, Economic development, moderation, stability, self-sufficiency, employment etc, foreign aid, Employment. Allocation of Resources,

Unit 4: Private and Public Sector, Public Sector – role and growth, Achievements of the public sector, Private Sector – Importance Problems, New foreign Trade Policy.

Unit 5: Present Economic Policy, Main feature, Globalization, Expansion of Private sector, more market orient approach. Public distribution system, Industrial policies before and after 1991, Industrial Licensing, Monetary and Fiscal Policy, elements of Indian current GDP and review of current budget.

Text Books
1. Francis Cherunilam: Business Environment: Text and Cases. 18/e. Himalaya. 2009.
2. Misra and Puri: Indian Economy, Himalaya, 2009.

Reference Books
1. Indian Economy- A. N. Agarwal
2. Indian Economy – Mishra &Puri
3. Indian Development and planning – M. L. Jhingan
4. Indian Economy – R. S. Rastogi Yozna and Kurukshetra Magazines

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATA SCIENCE FOR ENGINEERS
(OPEN ELECTIVE)

Course Code: GR22A3049   **L/T/P/C:3/0/0/3**

Course Outcomes
1. Illustrate a flow process for data science problems.
2. Demonstrate the mathematical foundations for data science.
3. Analyze the data science process and predictive modelling.
4. Develop R codes for data science solutions.
5. Correlate results to the solution approach followed.

UNIT I
Introduction to R, Variables and datatypes in R, Data frames, Recasting and joining of data frames, Recasting and joining of data frames, Arithmetic, Logical and Matrix operations in R, Advanced programming in R : Functions, Control structures, Data visualization in R Basic graphics.

UNIT II
Linear Algebra and Statistics for Data Science: Solving Linear Equations, Linear Algebra Distance, Hyperplanes and Half spaces, Eigenvalues, Eigenvectors, Statistical Modelling, Random Variables and Probability Mass/Density Functions, Sample Statistics.

UNIT III
Introduction to Data Science, Solving Data Analysis Problems - A Guided Thought Process, Predictive Modelling, Linear Regression, Model Assessment, Diagnostics to Improve Linear Model Fit.

UNIT IV
Simple Linear Regression Model Building, Cross Validation, Multiple Linear Regression Modelling Building and Selection.

UNIT V
Classification, K - Nearest Neighbors (KNN), K - Nearest Neighbors implementation in R, K - means Clustering, K - means implementation in R.

Text Books
1. Data Science for Engineers, 1st Edition, Raghunathan Rengaswamy, Resmi Suresh, CRC Press, Taylor & Francis Group.
2. Introduction to Linear Algebra, Fifth Edition, Gilbert Strang, ISBN: 978-09802327-7-6.
3. Applied Statistics and Probability for Engineers, Douglas Montgomery, George C Runger, Fifth Edition, John Wiley & Sons, Inc.

Reference Books
1. Hands On Introduction to Data Science Hardcover – 2 April 2020 by Chirag Shah (Author)
2. Essential Math for Data Science: Take Control of Your Data with Fundamental Linear Algebra, Probability, and Statistics by Thomas Nield (Author)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATA ANALYTICS USING OPEN-SOURCE TOOLS
(OPEN ELECTIVE)

Course Code: GR22A3120   **L/T/P/C: 3/0/0/3**

Course Outcomes:
1. Interpret about graphics techniques in data analysis.
2. Implement data modeling techniques for a dataset.
3. Develop the simulation for mining and clustering the data.
4. Infer the data using business intelligence and predictive analytics.
5. Implement the data analytics using Programming Environments

UNIT I

Graphics: A Single Variable – Dot and Jitter Plots, Histograms and Kernel Density Estimates, The Cumulative Distribution Function, Rank-Order Plots and Lift Charts, Summary Statistics and Box Plots, Practice using Numpy, Two Variables- Scatter Plots, Smoothing, Logarithmic Plots, Banking, Practice using Matplotlib, Time as A Variable- Time-Series Analysis, More Than Two Variables-False-color plots, Multi plots.

UNIT II

Modeling Data: Guesstimation and the back of the envelope- Principles, Perturbation Theory and Error Propagation, Models from scaling arguments- Models, Arguments from Scale, Mean-Field Approximations, Common Time-Evolution Scenarios, Arguments from probability models- The Binomial Distribution and Bernoulli Trials, The Gaussian Distribution and the Central Limit Theorem, Power-Law Distributions and Non-Normal Statistics, Bayesian Statistics.

UNIT III

Mining Data: Simulations- Monte Carlo Simulations, Resampling Methods, Discrete Euent Simulations with SimPy, Finding Clusters- Distance and Similarity Measures, Clustering Methods, Pre and Postprocessing, Pycluster, Seeing the Forest for the trees- PCA, Kohonen Maps, PCA with R.

UNIT IV

Applications: Reporting, Business intelligence and Dashboards- Corporate Metrics and Dashboards, Data Quality Issues, Financial calculations and modeling- The Time Value of Money, Uncertainty in Planning and Opportunity Costs, Cost Concepts and Depreciation, Predictive analytics- algorithms for classification.

UNIT V

Programming Environments and Data analytics
Programming Environments: Software Tools, A Catalog of Scientific Software - Matlab, R, Python
Results from Calculus: Common Functions, Calculus, Useful Tricks -Binomial theorem, Linear transformation.
Working with data: Sources for Data, Cleaning and Conditioning, Sampling, Data File Formats, The Care and Feeding of Your Data Zoo.

Text Books

1. Philipp K. Janert, Data Analysis with Open Source Tools, O'Reilly Media, Inc, November 2010: 1st Edition.

Reference Books

1. G James, D. Witten, T Hastie, and R. Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer, 2013

2. Chambers, John, Software for Data Analysis Programming with R, Springer, 2008

3. Trevor Hastie Robert Tibshirani Jerome Friedman, The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Springer, 2014

4. Mark Gardener, Beginning R: The Statistical Programming Language, Wiley, 2013

5. Upadhyaya and A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
AUGMENTED REALITY AND VIRTUAL REALITY
(OPEN ELECTIVE)

Course Code: GR22A4054 **L/T/P/C:3/0/0/3**

Course Outcomes:
1. Analyze about augmented reality.
2. Identify AR devices for various applications.
3. Analyze about virtual reality.
4. Interpret about usage of VR devices and human factors involved.
5. Apply AR & VR technology in various domains.

UNIT I
Introduction to Augmented Reality, The Relationship Between Augmented Reality and Other Technologies, Augmented Reality Concepts, How Does Augmented Reality Work? Ingredients of an Augmented Reality Experience.

UNIT II
Augmented Reality Hardware, Major Hardware Components for Augmented Reality Systems, Augmented Reality Software, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

UNIT III
Virtual Reality: The Three I's of Virtual Reality, A Short History of Early Virtual Reality, Early Commercial VR Technology, VR Becomes an Industry, The Five Classic Components of a VRSystem. Input Devices: Trackers, Navigation, and Gesture Interfaces: Three-Dimensional Position Trackers, Navigation and Manipulation Interfaces

UNIT IV
Output Devices: Graphics, Three-Dimensional Sound, and Haptic Displays : Graphics Displays,Sound Displays, Haptic Feedback.
Human Factors in VR: Methodology and Terminology, User Performance Studies, VR Healthand Safety Issues, VR and Society

UNIT V:
Augmented Reality Applications, What Makes a Good Augmented Reality Application? Application Areas: Education, Gaming, Robotics, Health care, Manufacturing, Evaluating Augmented Reality Applications.

Text Books
1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, MorganKaufmann, 2013.
2. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley IEEE Press, 2003/2006.

Reference Books

1. LaValle, "Virtual Reality", Cambridge University Press, 2016.
2. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual RealityApplications: Foundations of Effective Design", Morgan Kaufmann, 2009.
3. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
4. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BASICS OF JAVA PROGRAMMING
(OPEN ELECTIVE)

Course Code: GR22A3072   **L/T/P/C: 3/0/0/3**

Course Outcomes

1. Apply knowledge on key attributes of Object-Oriented Programming (OOP) and control structures.
2. create and manipulate classes and objects, employ various methods and method utilization.
3. Demonstrate expertise in both array-based and string-based structures.
4. understanding of Java's inheritance and interface concepts
5. proficient at organizing Java code using packages and exception handling.

UNIT I
Java Programming Fundamentals: Java Language, Key Attributes of Object-Oriented Programming, Java Development Kit, Simple Program, Create Blocks of Code, Keywords, Identifiers, The Java Class Libraries.
Data Types and Operators: Java's Primitive Types, Literals, Variables, Scope and Lifetime of Variables, Operators- Arithmetic, Relational, Logical, Bitwise, Assignment. Type conversion in Assignments, Using a Cast, Operator Precedence.
Program Control Structures: if, switch, for, enhanced for, while, do-while, break, continue.

UNIT II
Introduction to Classes, Objects and Methods: Class Fundamentals, Objects creation, Reference Variables and Assignment, Methods, returning a Value, Using Parameters, passing objects to methods, passing arguments, Method Overloading, Constructors, Parameterized Constructors, Overloading Constructors. new Operator, this Keyword, Command-Line Arguments.

UNIT III
Arrays: Introduction to Arrays, 1D Arrays, Multidimensional Arrays, Irregular Arrays, Using the Length Member. Arrays class of util package.
Strings: String class, constructors, length(), string literals, concatenation, Character extraction, string comparison, searching strings, modifying, data conversion, changing the case, joining, split(). String Buffer class: constructors, length(), capacity(), ensure Capacity(), set Length(), charAt(), setCharAt(), get Chars(), append(), insert(), reverse(), delete(), deleteCharAt(), replace().

UNIT IV
Inheritance: Basics, Inheritance Types, Using Super, Multilevel Hierarchy, Super class Reference Books and Subclass Objects, Method Overriding, Abstract Classes, Using final. **Interfaces:** Fundamentals, Creating and Implementing an Interface, Using Interface Reference Books, Implementing Multiple Interfaces, Extending Interfaces, Nested Interface.

UNIT V
Packages: Package Fundamentals, Member Access, Importing Packages, Static import.
Exception Handling: Exception Hierarchy, Fundamentals, Handling errors, Multiple Catch, Throwing and Rethrowing an Exception, Throwable, using finally, using throws, Creating Exception Sub classes.

Text Books

1. Herbert Schildt, Dale Skrien, Java Fundamentals A Comprehensive Introduction, 1/e, Tata McGraw

Hill, 2017.

2. Herbert Schildt, The Java complete Reference Books, 9/e, Tata McGraw Hill,2014.

Reference Books

1. Y. Daniel Liang, An Introduction to JAVA Programming, 10/e, Tata McGraw Hill.

2. Kathy Sierra, Head First Java, 2/e, Shroff Publishers, 2012.

3. Balagurusamy, Programming with JAVA, 2/e, Tata McGraw Hill, 2014.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTRODUCTION TO DBMS
(OPEN ELECTIVE)

Course Code: GR22A3141   **L/T/P/C: 3/0/0/3**

Course Outcomes
1. Identify the role of Database System Applications and the design issues related.
2. Design the logical model for the applications.
3. Construct a Database Schema, manipulate data using a SQL.
4. Apply the Schema Refinement techniques for a database design for optimized access.
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.

UNIT I
Introduction to Database And System Architecture: Database Systems and their Applications, Database Vs File System, View of Data, Data Models, Database Languages- DDL and DML, Transaction Management, Database users and Administrators, Database System Structure.

UNIT II
Introduction to Database Design: ER Diagrams, Entities, Attributes and Entity sets, Relationships and Relationship set, Extended ER Features, Conceptual Design with the ER Model, Logical database Design.
 Relational Model: Introduction to Relational Model, Basic Structure, Database Schema, Keys, Relational Algebra

UNIT III
SQL Queries and Constraints: SQL Data Definition, Types of SQL Commands, Form of Basic SQL Query, SQL Operators, Set Operators, Nested Queries, Aggregate Operators, NULL values, Integrity Constraints Over Relations, Joins, Introduction to Views, Destroying
/ Altering Tables and Views, Cursors, Triggers.

UNIT IV
Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Properties of Decomposition, Reasoning about FD, Normal Forms.

UNIT V
Transaction Management: Transaction Concept, Transaction State, Concurrent Executions, Serializability, Testing for Serializability.
Concurrency Control: Lock based Protocols, Timestamp based protocols,
Recovery System: Recovery and Atomicity, Log based recovery, Shadow Paging, Recovery with concurrent Transactions.

Text Books
1. "Data base Management Systems", Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rd Edition.
2. "Data base System Concepts", Silberschatz, Korth, McGraw hill, V Edition.
3. "Introduction to Database Systems", C.J.Date Pearson Education.

Reference Books
1. "Database Systems design, Implementation, and Management", Rob & Coronel 5th Edition.
2. "Database Management Systems", P. Radha Krishna HI-TECH Publications 2005.
3. "Database Management System", Elmasri Navate, Pearson Education.
4. "Database Management System", Mathew Leon, Leo

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTRODUCTION TO DATA MINING
(OPEN ELECTIVE)

Course Code: GR22A4080   **L/T/P/C:3/0/0/3**

Course Outcomes
1. Learn the concepts of database technology evolutionary path which has led to the need for data mining and its applications.
2. Apply pre-processing statistical methods for any given raw data.
3. Apply Apriori and FP growth algorithms for forming strong association rules.
4. Extract knowledge and implementation of data mining techniques.
5. Apply the data mining algorithm for solving practical problems.

UNIT I
Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining.

UNIT II
Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction.
Introduction to Data Warehouse: Data Warehouse, Multi-dimensional Data Model, Data Warehouse Architecture, Data Marts.

UNIT III
Mining Frequent Patterns, Associations: Basic Concepts, Market Basket Analysis, Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of Association Rules.

UNIT IV
Classification: Issues Regarding Classification, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification.
Prediction: Issues Regarding Prediction, Regression techniques.
Accuracy and Error measures: Evaluating the accuracy of a Classifier or a Predictor.

UNIT V
Cluster Analysis Introduction: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods - k-Means and k-Medoids, Hierarchical Methods – Agglomerative, BIRCH.

Text Books
1. Data Mining– Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, Second Edition,2006.
2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.

Reference Books

1. Data Mining Techniques – Arun K. Pujari, Second Edition, Universities Press.
2. Data Warehousing in the Real World, Sam Aanhory and Dennis Murray, Pearson Edition, Asia.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROGRAMMING IN PYTHON
(OPEN ELECTIVE)

Course Code: GR22A3077   **L/T/P/C: 3/0/0/3**

Course Outcomes
1. Demonstrate the concepts of control flow, data structures and Functions in Python
2. Design python programs using functional programming
3. Implement the file handling operations, exception handling mechanism.
4. Design python programs using object-oriented programming and multithreadedprogramming concepts.
5. Develop GUI based applications using Tkinter.

UNIT I
Basic features of Python-Interactive execution, comments, types, variables, operators, expressions, Statements-assignment, input, print, Control flow-Conditionals, Loops, break statement, continue statement, pass statement, Functions, definition, call, scope and lifetimeof variables, keyword arguments, default parameter values, variable length arguments, recursive functions.

UNIT II
Sequences-Strings, Lists and Tuples-basic operations and functions, iterating over sequences, Sets and Dictionaries- operations and functions, Functional programming-mapping, filtering and reduction, Lambda functions, List comprehensions. Scope, namespaces, and modules, import statement, creating own modules, avoiding namespace collisions when importing modules.

UNIT III
Files-operations-opening, reading, writing, closing, file positions. Exceptions – raising and handling exceptions, try/except statements, finally clause, standard exceptions, custom exceptions., iterators and generators, Python program examples.

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

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

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

Reference Books

1. Introduction to Computer Science using Python, Charles Dierbach, Wiley India Edition.
2. Fundamentals of Python, K. A. Lambert, B.L. Juneja, Cengage Learning.
3. Think Python, how to think like a computer scientist, Allen B. Downey, SPD, O'Reilly.
4. Core Python Programming, Wesley J. Chun, second edition, pearson.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTERNET OF THINGS
(OPEN ELECTIVE)

Course Code: GR22A3147   **L/T/P/C: 3/0/0/3**

Prerequisites
Students are expected to have knowledge on Operating systems, Virtualization and Networking

Course Outcomes
1. Learn characteristics, applications, components and challenges of Internet of Things (IOT)
2. Create understanding of IOT networking concepts – terminologies, stack components, infrastructure and data protocols
3. Create understanding of the concept of Cloud based IOT technologies, cloud service providers and security aspects
4. Develop skills in understanding and programming the Arduino and Raspberry Pi hardware platforms
5. Make the student understand the requirements, components, challenges and develop various application areas - smart homes, smart grids, smart health care, smart cities and industrial IOT

UNIT I

Introduction to IOT: Characteristics of IOT, Applications of IOT, IOT Categories, IOT Enablers and Connectivity Layers, Sensors, Actuators, IOT Components & Implementation, Challenges for IOT

UNIT II

IOT Networking & Connectivity Technologies: Connectivity terminologies-IOT Node, LAN, WAN, Gateway, IOT protocol Stack vs. Web Stack, IOT Identification and Data Protocols-IPV4, IPV6,HTTP,MQTT,COAP,AMQP,DDS Connectivity Technologies – Zigbee, Bluetooth, LoRa

UNIT III

Cloud for IOT: IOT with Cloud-Challenges, Cloud service providers for IOT-Overview, Cloud service model, Cloud Computing – Security aspects, Case Study, Fog computing, Edge computing

UNIT IV

Hardware Platforms: Programming with Arduino-Features of Arduino, Components of Arduino Board, Arduino IDE, Program Elements, Raspberry Pi – Introduction, Architecture, PIN Configuration, Implementation of IOT with Raspberry Pi

UNIT V

IOT Applications: Smart Homes-Smart Home Origin, Technologies, Implementation, Smart Grids-Characteristics, Benefits, Architecture, Components, Smart Cities-Characteristics, Frameworks, Challenges, Industrial IOT-Requirements, Design Considerations, Applications

Text Books
1. Internet of Things, Jeeva Jose, Khanna Publishing, 2018
2. Internet of Things, Abhishek S Nagarajan, RMD Sundaram, Shriram K Vasudevan, Wiley, 2019

3. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan Trollope, David Hanes, Patrick Gassetete, Jerome Henry, Pearson Education Limted, 2017

Reference Books

1. The Internet of Things, Michael Miller, Pearson Education Limited, 2015
   IoT Applications, Security Threats, and Countermeasures, Padmalaya Nayak, Niranjan Ray, P. Ravichandran, Taylor &Francis,2021
2. Internet of Things: Architecture, Implementation and Security, MayurRamgir, Pearson Education Limited, 2019
3. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan Trollope, David Hanes, Patrick Gassetete, Jerome Henry, Pearson Education Limited, 2017

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SCRIPTING LANGUAGES
(OPEN ELECTIVE)

Course code: GR22A4085   **L/T/P/C: 3/0/0/3**

Course Outcomes
1. Analyze a problem, identify, and define the computing requirements appropriate to itssolution.
2. Design Web pages with DB.
3. Implement the PHP Authentication Methodologies.
4. Implement PHP Encryption functions and Mcrypt Package
5. Understand the syntax and functions in Perl and Python.

UNIT- I
PHP Basics
PHP Basics- Features, Embedding PHP Code in your Web pages, outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures. Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

UNIT -II
MySQL Basics
Introduction to MYSQL: Database Concepts, General Overview of MySQL database, Installation. Connecting and disconnecting from MySQl Server, Querying the database, Data Definition Language, Functions and Logical operators, Access privilege system.

UNIT -III
Advanced PHP Programming
Advanced PHP Programming: PHP and Web Forms, Files, PHP Authentication and Methodologies -Hard Coded, File Based, Database Based, IP Based, and Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package.

UNIT- IV
PERL: Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes,strings, pattern and regular expressions, subroutines.
Advanced PERL: Finer points of looping, pack and unpack, file system, data structures, packages,modules, objects, interfacing to the operating system.

UNIT -V
Python: Introduction to Python language, Python-syntax, statements, functions, Built-in-functions and Methods, Modules in Python, Exception Handling.

Text Books

1. The World of Scripting Languages, David Barron,Wiley India. Beginning PHP andMySQL, 3rd Edition, Jason Gilmore, A press Publications (Dream tech.).
2. Python Web Programming, Steve Holden and David Beazley, New Riders Publications.

Reference Books

1. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl andPHP, Lee and B.Ware (Addison Wesley) Pearson Education.
2. Programming Python,M.Lutz,SPD.
3. PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage
4. Learning Publications.
5. PHP 5.1,I.Bayross and S.Shah,The X Team,SPD.
6. Core Python Programming,Chun,Pearson Education.
7. Guide to Programming with Python,M.Dawson,Cengage Learning.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT
(OPEN ELECTIVE)

Course Code: GR22A4134   **L/T/P/C: 3/0/0/3**

Pre-Requisite(s): Fundamentals of Management, Operations Research

Course Outcomes:
1. Understand concepts of services and their significance in the economy and society and distinguish it from goods.
2. Understand the service strategy, design, and development.
3. Comprehend ways to design services and able to understand service guarantee, recovery, and failures.
4. Forecast the service demand, supply and facilitate various methods to operate and manage services.
5. Understand the service productivity and how innovation can be approached from services point of view

UNIT I
Introduction: Service operations, Role of service in economy and society, Indian service sector
Nature of Services and Service Encounters: Differences between services and operations, Service package, characteristics, various frameworks to design service operation system, Kind of service encounter, importance of encounters
Service-Dominant Logic: From Goods-Dominant logic to Service-Dominant logic, Value Co- creation

UNIT II
Service Strategy and Competitiveness: Development of Strategic Service Vision (SSV), Data Envelopment Analysis
New Service Development: NSD cycle, Service Blueprinting, Elements of service delivery system
Service Design: Customer Journey and Service Design, Design Thinking methods to aid Service Design
Locating facilities and designing their layout: models of facility locations (Huff's retail model), Role of service-scape in layout design
Service Quality: SERVQUAL, Walk through Audit, Dimensions of Service quality & other quality tools

UNIT III
Service Guarantee & Service Recovery: Service guarantee and its types; Service failure – reasons for failure and service recovery strategies.

UNIT IV
Forecasting Demand for Services: A review of different types of forecasting methods for demand forecasting.
Managing Capacity and Demand: Strategies for matching capacity and demand, Psychology of waiting, Application of various tools used in managing waiting line in services.
Managing Facilitating Goods: Review of inventory models, Role of inventory in services

Managing service supply relationship: Understanding the supply chain/hub of service, Strategies for managing suppliers of service

UNIT V
Service Innovation: Services Productivity, Need for Services Innovation
Student Project:
Option 1: Choose any service organization around and present it from the perspective of: nature of service, classification of service, blueprint or service design analysis, service quality, and any additional perspective you would like to add.

Option 2: Choose any latest research paper in services and explain your understanding and feedback on the same.

Text Books

1. Fitzsimmons & Fitzsimmons, Service Management: Operations, Strategy, Information Technology, McGraw Hill publications (7th Edition)

Reference Books

1. Wilson, A., Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2012). *Services marketing: Integrating customer focus across the firm*. McGraw Hill.
2. Lovelock, C. (2011). *Services Marketing, 7/e*. Pearson Education India
3. Reason, Ben, and Lovlie, Lavrans, (2016) Service Design for Business: A Practical Guide to Optimizing the Customer Experience, Pan Macmillan India,
4. Chesbrough, H. (2010). Open services innovation: Rethinking your business to grow and compete in a new era. John Wiley & Sons.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
IT PROJECT MANAGEMENT
(OPEN ELECTIVE)

Course Code: GR22A4135   **L/T/P/C: 3/0/0/3**

Course Outcomes
1. Learn the techniques to effectively plan manage, execute the projects.
2. Learn the techniques to control projects within time and cost targets with a focus on   Information Technology and Service Sector.
3. Learn various agile methodologies.
4. Apply agile project management techniques such as Scrum on real time applications.
5. Develop real time applications using agile project management techniques such asDevOps.

UNIT I
Project Overview and Feasibility Studies- Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal
Project Scheduling: Project Scheduling, Introduction to PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculation and its importance, Cost reduction by Crashing of activity.

UNIT II
Cost Control and Scheduling: Project Cost Control (PERT/Cost), Resource Scheduling & Resource Leveling
Project Management Features: Risk Analysis, Project Control, Project Audit and Project Termination.

UNIT III
Agile Project Management: Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum, Lean, DevOps and IT Service Management (ITIL).
Other Agile Methodologies: Introduction to XP, FDD, DSDM, Crystal

UNIT IV
Scrum: Various terminologies used in Scrum (Sprint, product backlog, sprint backlog, sprint review, retro perspective), various roles (Roles in Scrum), Best practices of Scrum.

UNIT V
DevOps: Overview and its Components, Containerization Using Docker, Managing Source Code and Automating Builds, Automated Testing and Test-Driven Development, Continuous Integration, Configuration Management, Continuous Deployment, Automated Monitoring.

Text Books
1.Mike Cohn, Succeeding with Agile: Software Development Using Scrum
2.Notes to be distributed by the course instructor on various topics.

Reference Books
1.Roman Pichler, Agile Product Management with Scrum
2.Ken Schwaber, Agile Project Management with Scrum (Microsoft Professional)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MARKETING RESEARCH AND MARKETING MANAGEMENT
(OPEN ELECTIVE)

Course Code: GR22A4136   **L/T/P/C: 3/0/0/3**

Course Outcomes
1. The students understand the significance of marketing management concepts, marketingenvironment, consumer behavior elements and strategies related to STP.
2. The student will be able to understand various product management strategies and the importance of branding and packing.
3. Comprehend the dynamics of marketing mix elements such as pricing, distribution, and promotion mix elements to leverage marketing concepts for effective decision making.
4. Students will demonstrate analytical skills in identification and resolution of problems pertaining to marketing management and marketing research and uses of various statistical tools in marketing research.
5. Understanding the concepts of internet marketing and the fundamentals of business-to- business marketing strategy, CRM strategies.

UNIT I
Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector.
Marketing Planning & Environment: Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social
Understanding the consumer: Determinants of consumer behavior, Factors influencing consumer behavior
Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning

UNIT II
Product Management: Product Life cycle concept, New Product development & strategy, Stages inNew Product development, Product decision and strategies, Branding & packaging

UNIT III
Pricing, Promotion and Distribution Strategy: Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising

UNIT IV
Marketing Research: Introduction, Type of Market Research, Scope, Objectives & Limitations Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research
Data Analysis: Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis

UNIT V
Internet Marketing: Introduction to Internet Marketing. Mapping fundamental concepts ofMarketing (7Ps, STP); Strategy and Planning for Internet Marketing
Business to Business Marketing: Fundamental of business markets. Organizational buying process.

Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationships, networks, and customer relationship management. Business to Business marketing strategy

Home Assignments:

Written Analyses of Cases – Students are expected to report on their analysis and recommendationsof what to do in specific business situations by applying concepts and principles learned in class (Case Studies to be shared by Faculty) e.g., "Marketing Myopia"

1. Field visit & live project covering steps involved in formulating Market Research Project
2. Measuring Internet Marketing Effectiveness: Metrics and Website Analytics

Text Books

1. Marketing Management (Analysis, Planning, Implementation & Control) – Philip Kotler
2. Fundamentals of Marketing – William J. Stanton & Others
3. Marketing Management – V.S. Ramaswamy and S. Namakumari
4. Marketing Research – Rajendra Nargundkar
5. Market Research – G.C. Beri
6. Market Research, Concepts, & Cases – Cooper Schindl

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTRODUCTION TO DATA SCIENCE
(OPEN ELECTIVE)

Course Code: GR22A3056   **L/T/P/C: 3/0/0/3**

Prerequisites:
Knowledge of Python programming, Linear algebra, Statistics, Probability and Calculus

Course Outcomes
1. Learn Numpy, Pandas for mathematical computation and Data Analysis
2. Analyze the importance of pre-processing techniques for Data Science
3. Learn and analyze various prediction and classification techniques on various datasets
4. Learn and analyze the applications of clustering techniques
5. Analyze Text data and Web scrapping data at morphological and syntactic and semantic levels using NLP techniques

UNIT I
Introduction to Data Science, Components of Data Science, Application of Data Science
NumPy: Array, Matrix and associated operations, Linear algebra and related operations
Pandas: Series, Data Frames, Panels, Reading files, Exploratory data analysis, Data preparation, Indexing, Slicing, Merging and Joining data. Working with MySQL databases
Data Pre-processing Techniques: Data Imputation, Data Encoding, Standardization and Normalization, Dimensionality reduction, Feature Selection methods

UNIT II
Regression Analysis: Introduction to Regression, Simple linear regression, Multi-linear regression, Evaluation metrics for regression
Classification Methods: Introduction to Classification, Naïve Bayes classifier, Decision Tree classifier, Support Vector Machines, Logistic Regression, Ensemble methods, Random Forest, Bagging, Boosting, Evaluation metrics for classification

UNIT III
Clustering Methods: Introduction to Clustering, Similarity distance measures, K-means algorithm, Hierarchical clustering algorithm, DB Scan algorithm, Evaluation metrics for clustering.

UNIT IV
NLP Overview, Tokenization, Stemming, stop words removal, POS tagging, Lemmatization, Feature extraction using SK learn, Text Classification, Text Clustering.

UNIT V
Learning Best Practices for Model Evaluation:
Pipelining, Hyperparameter Tuning, Debugging algorithms with learning and validation curves.

Text Books
1. Python Machine Learning, Second Edition by Sebastian Raschka Vahid Mirjalili Statistics and Machine Learning in Python Edouard Duchesnay,

Reference Books

1. Data Science from Scratch: First Principles with Python, Second Edition (Greyscale Indian Edition) Paperback – 5 May 2019 by Joel Grus (Author)
2. Practical Data Science with Python: Learn tools and techniques from hands-on examples to extract insights from data by Nathan George (Author)
3. HANDS ON INTRODUCTION TO DATA SCIENCE Hardcover – 2 April 2020 by Chirag Shah (Author)
4. Essential Math for Data Science: Take Control of Your Data with Fundamental Linear Algebra, Probability, and Statistics by Thomas Nield (Author)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
USER-CENTRIC HUMAN COMPUTER INTERACTION
(OPEN ELECTIVE)

Course Code: GR22A3127   **L/T/P/C: 3/0/0/3**

Course Outcomes

1. Learn the concepts of interaction design and how it relates to human computer interaction and other fields.
2. Design how technologies can be to change people's attitudes and behavior.
3. Apply the difference between qualitative and quantitative data and analysis.
4. Extract the social Mechanisms that are used by people to communicate and collaborate.
5. Explore the user Experience design and analyze the factors involved in design

UNIT I

Introduction: Introduction to User Centric Computing (UCC) and history, Issues and challenges, Latest research trends, User-Centric Design and Software Engineering.

UNIT II

Engineering User-Centric Systems: Components of SDLC - Contextual Inquiry, - Design Guidelines, Prototyping.

UNIT III

User-Centric Computing: The UCC framework with illustrative case study, User-Centric models-descriptive, predictive models and taxonomy, Introduction to GOMS family of models
Computational user models (classical), Keystroke-Level Model (KLM), (CMN)GOMS Model, The Fitts' Law, The Hick-Hyman Law.

UNIT IV

Computational user models(contemporary): 2D and 3D pointing models, The steering Law and constrained navigation, Model for hierarchical menu selection, Mobile typing models(single finger and two thumb typing), Model for touch performance(FFitts' law),
Formal system models: Introduction to formal models in UCD, Formal modelling of user-computer dialogue.

UNIT V

Empirical Research Methods: Introduction and research question formulation, Variables determination and experiment design, Data Analysis including model building.
User-Centric Design Evaluation: Introduction to User-Centric design evaluation and expert evaluation technique, User evaluation and model-based evaluation.

Text Books

1. Samit Bhattacharya (July, 2019). Human-Computer Interaction: User-Centric Computing for Design, McGraw-Hill India, Print Edition: ISBN-13: 978-93-5316-804-9; ISBN-10: 93-5316-804-X, E-book Edition: ISBN-13: 978-93-5316-805-6; ISBN-10: 93-5316-805-8
2. Alan Dix, Janet E. Finlay, Gregory D. Abowd and Russel Beale. (2003). Human-Computer Interaction (3rd

Edition), Pearson.

Reference Books

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen and Steven Jacobs. (2009). Designing the User Interfaces: Strategies for Effective Human-Computer Interaction (5th Edison), Pearson

   Website Links:

   https://paragnachaliya.in/wp-content/uploads/2017/08/HCI_Alan_Dix.pdf

GOKARAJU RANGARAJUINSTITUTE OF ENGINEERING AND TECHNOLOGY
DESIGN PATTERNS
(OPEN ELECTIVE)

Course Code: GR22A4063   **L/T/P/C: 3/0/0/3**

Course Outcomes

1. Ability to analyze and apply different design patterns for real life scenarios.
2. Ability to solve Object oriented design problems with a case study of designing a Document Editor.
3. Illustrates the skill apply creational design patterns.
4. Demonstrates the ability to apply different structural design patterns.
5. Analyze and apply different behavioral design patterns.

UNIT I

Introduction: What Is a Design Pattern? Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

UNIT II

A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation, Summary.

UNIT III

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.
Structural Pattern Part-I: Adapter, Bridge, Composite.

UNIT IV

Structural Pattern Part-II: Decorator, Façade, Flyweight, Proxy.
Behavioral Patterns Part-I: Chain of Responsibility, Command, Interpreter, Iterator.

UNIT V

Behavioral Patterns Part-II: Mediator, Memento, Observer, State, Strategy, Template Method Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns, A Brief History, The Pattern Community an Invitation, A Parting Thought.

Text Books:

1. Design Patterns by Erich Gamma, Pearson Education.

Reference Books

1. Pattern's in JAVA Vol-I by Mark Grand,Wiley DreamTech.
2. Pattern's in JAVA Vol-II by Mark Grand,Wiley DreamTech.
3. JAVA Enterprise Design Patterns Vol-III by Mark Grand,Wiley DreamTech.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
NON-CONVENTIONAL ENERGY SOURCES
(OPEN ELECTIVE)

Course Code:GR22A3019   **L/T/P/C: 3/0/0/3**

Course Outcomes

1. Illustrate the concepts of solar radiation at different instants.
2. Analyze the performance characteristics of PV modules.
3. Compare the performance of wind energy at various circumstances.
4. Make use of various sustainable energy resources for power generation.
5. Explain operation and performance of Wave energy, Fuel cells and Batteries.

UNIT I

Solar spectrum-Solar Radiation on Earth's surface- Solar radiation geometry-Solar radiation measurements-Solar radiation data-Solar radiation on horizontal and tilted surfaces. Solar Thermal Conversion-Flat plate collectors concentrated collectors- construction and thermal analysis- Solar Applications-Solar Ponds-Heliostat systems-water heater-air heater- solar still.

UNIT II

Photovoltaic Cells - Equivalent Circuit - V-I Characteristics- Photovoltaic Modules – Constructional details - Design considerations – Tracking - Maximum power point tracking – Algorithms - PV solar system design with energy backup - Solar Thermo electric conversion.

UNIT III

Fundamentals of wind energy-power available in wind-BetzLimit- Aerodynamics of wind turbine-Wind Turbines-Horizontal and vertical axis turbines – their configurations-Wind Energy conversion systems.

UNIT IV

Various fuels-Sources-Conversion Technologies-Wet Processes–Dry Processes-Biogas generation–Aerobic and an aerobic digestion- Factors affecting generation of bio gas – Classification of bio gas plants-Different Indian digesters-Digester design considerations- Gasification process-Gasifiers – Applications. Geo-thermal Energy-sources-Hydrothermal Convective-Geo-pressure resources-Petro-thermal systems (HDR)-Magma Resources-Prime Movers.

UNIT V

Principle of operation-Open and closed cycles, Energy from Tides-Principle of Tidal Power-Components of tidal Power Plants-Operation Methods-Estimation of Energy in Single and double basin systems-Energy and Power from Waves-Wave energy conversion devices-Fuel Cells-Design and Principle of operation-Types of Fuel Cells-Advantages and disadvantages- Types of Electrodes- Applications-Basics of Batteries –Constructional details of Lead acid batteries- Ni-Cd Batteries.

Text Books

1. G.D. Rai, Non-Conventional Energy Sources, Khanna publishers.
2. D.P.Kothari, Singal, Rakesh, Ranjan, Renewable Energy sources and Emerging Technologies, PHI, 2009.

Reference Books

1. B.H.Khan, Non-Conventional Energy Sources, PHI Publications.
2. John Twidell & Wier, Renewable Energy Resources, CRC Press, 2009.
3. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONCEPTS OF CONTROL SYSTEMS
(OPEN ELECTIVE)

Course Code: GR22A3095   **L/T/P/C: 3/0/0/3**

Course Outcomes
1. Infer the basic concept control systems.
2. Develop the mathematical model of the systems.
3. Analyze the time domain specifications and steady state error.
4. Outline the concept of stability of the system.
5. Solve the frequency response analysis.

UNIT I
BASIC CONCEPTS OF CONTROL SYSTEM
Terminology - plant, process, system, disturbances, controlled variable, manipulated variable etc., Block diagram of basic control system, application areas with examples. Classifications of control systems

UNIT II
MATHEMATICAL MODELLING OF SYSTEMS
Translational and rotational mechanical systems, electrical systems, Force voltage and force current analogy, Block diagram and signal flow graph representation of physical systems along with rules, properties, comparison and limitation, Mason's gain formula.

UNIT III
TIME RESPONSE ANALYSIS
Standard test signals along with examples of their usage, steady state errors for step, ramp and parabolic inputs, analysis of first and second order systems, Transient response specifications with numerical examples, Basic control actions and two position, proportional, P, PI, PID controllers, Limitations of time domain analysis.

UNIT IV
STABILITY
Concept of stability, types of stability, Routh's stability criterion, special cases with numerical examples, stability of closed loop system, concept of root locus, open loop and closed loop transfer poles, step by step procedure for root loci, numerical examples.

UNIT V
FREQUENCY RESPONSE ANALYSIS
Need of frequency response analysis, Sinusoidal response of linear system, methods used in frequency response, Bode Plot, Frequency domain specifications.

Text Books
1. I J Nagrath, M.Gopal, Control System Engineering, New Age International Publishers, 5th edition.
2. Norman S Nise, Control system engineering, John Wiley & Sons, Inc., 6th edition

Reference Books
1. Richard C. Dorf, Robert H Bishop, Modern control systems, Pearson Education International, Twelfth edition.
2. A Nagoor Kani, Control Systems, CBS Publishers.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC
(OPEN ELECTIVE)

Course Code: GR22A4022   **L/T/P/C: 3/0/0/3**

Course Outcomes

1. Outline importance of BNN, ANN and its learning techniques and architectures.
2. Summarize the algorithms for various applications using Back propagation networks.
3. Interpret the concept of Fuzzy and Crisp sets.
4. Model Fuzzy membership Function and rules for Applications.
5. Analyze the parameters of Genetic Algorithm.

UNIT I
NEURAL NETWORKS I (Introduction & Architecture)
Neuron, Nerve structure and synapse, Biological Neural network, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques.

UNIT II
NEURAL NETWORKS II (Back Propagation Networks)
Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient; back propagation algorithm, factors affecting back propagation training, application of Neural Networks in Load Forecasting.

UNIT III
FUZZY LOGIC I (Introduction)
Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

UNIT IV
FUZZY LOGIC II (Fuzzy Membership, Rules)
Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and
Fuzzy algorithms, Fuzzifications & Defuzzification's, Fuzzy Controller, application of Fuzzy logic control in washing machines.

UNIT V
GENETIC ALGORITHMS (GA)
Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, application of genetic algorithm in economic load dispatch.

Text Books

1. J M Zurada , "An Introduction to ANN",Jaico Publishing House.
2. Neural Networks, Fuzzy Logic, And Genetic Algorithms: Synthesis and Applications - by S. Rajasekaran, G. A. Vijayalakshmi PAI, PHI publishers.

Reference Books

1. Hung T. Nguyen, Nadipuram R. Prasad, Carol L. Walker and Elbert A. Walker, "A First Course in Fuzzy and Neural Control" Chapman & Hall, CRC.
2. Driankov, Dimitra, "An Introduction to Fuzzy Control", Narosa Publication.
3. Timothy J Ross, "Fuzzy Logic with Engg. Applications", McGraw. Hill.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PRINCIPLES OF COMMUNICATIONS
(OPEN ELECTIVE)

Course Code: GR22A3040   **L/T/P/C: 3/0/0/3**

Course Outcomes:
1. Apply concepts of modulation, frequency translation, gain and attenuation in communication systems.
2. Analyze the power spectrum characteristics of different modulation techniques.
3. Understand the role of multiplexing techniques in optimizing bandwidth utilization of Communication Systems.
4. Evaluate the suitability of specific digital modulation techniques for different communication applications.
5. Critically perform error analysis of each modulation scheme.

UNIT - I: Basics of Communication Systems
Definition and scope of communication systems, Types of communication systems: Analog and Digital, Block diagram of a communication system, Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

UNIT - II: Analog Modulation
Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM) and its variants, Power Spectrum of different modulations, Comparison of modulation techniques.

UNIT - III: Pulse Analog Modulation
Ideal sampling, Sampling theorem, aliasing, interpolation, natural and flat top sampling in time and frequency domains. Introduction to PAM, PWM, PPM modulation schemes. Frequency Division Multiplexing (FDM) and Time division multiplexing (TDM).

UNIT – IV: Digital Modulation
Basics of digital modulation, Advantages of digital modulation over analog modulation, Types of digital modulation: ASK, FSK, PSK, QAM, Comparison of digital modulation techniques

UNIT - V: Performance Analysis of Analog and Digital Modulation
Sources of Noise in Communication Systems, Super heterodyne Receiver, Figure of Merit, Noise Figure. Signal-to-Noise Ratio (SNR) and Eb/N0 ratio, Bit Error Rate (BER) and its significance, Error performance analysis for different modulation schemes, Channel capacity and bandwidth efficiency.

Text Books
1. An Introduction to Analog and Digital Communications, 2nd Edition, Simon Haykin, Michael Moher, John Wiley, March 2006.
2. Communication Systems by Simon Haykin, Second Edition, Wiley Student Edition, 2007.
3. Digital Communications by John G. Proakis and Masoud Salehi, 5e, McGraw Hill Publications, 2014.

Reference Books
1. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education, 2005.
2. Digital & Analog Communication Systems By K.S. Shanmugam, John Wiley

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SENSOR TECHNOLOGY
(OPEN ELECTIVE)

Course Code: GR22A3113   **L/T/P/C: 3/0/0/3**

Course Outcomes

1. Demonstrate the concept of resistive sensors which can be employed for real life applications.
2. Realize the concept of reactive sensors and understand the implications while deploying them in practice.
3. Understand the working principle of special purpose sensors and the need for developing smart sensors.
4. Comprehend the design and development of various wearable sensors for use in healthcare applications.
5. Able to design and perform experiments on the sensors and develop the projects based on the customer needs.

UNIT-I
General concepts and terminology of Sensor systems, Transducers classification-sensors and actuators, General input-output configurations, Static and dynamic characteristics of measurement system.

UNIT-II
Resistive sensors- Potentiometers, strain gages (piezo-resistive effect), resistive temperature detectors (RTD), thermistors, light dependent resistor (LDR), resistive hygrometers, resistive gas sensors.

UNIT-III
Inductive sensors - variable reluctance sensors, Hall effect, Eddy current sensors, Linear variable differential transformers (LVDT), variable transformers, magneto-elastic, magneto-resistive, and magneto strictive sensors. Capacitive sensors- variable capacitor, differential capacitor.

UNIT-IV
Accelerometers: Characteristics and working principle, Types- Capacitive, Piezoresistive, piezoelectric; Gyroscopes: Characteristics and working principle, Rotor Gyroscope; Diaphragm Pressure Sensor – resistive & capacitive type (micro press sensor).

UNIT-V
Overview of various smart sensors: Digital temperature sensor (DS1621, TMP36GZ), Humidity sensor (DHT11, DHT22), Gas sensor (MQ2, MQ8), Pressure sensors (BMP180), Accelerometers (ADXL335); Structural health monitoring sensors, Introduction to MEMS and Flexible sensors.

Text Books
1. B. C. Nakra, K.K. Choudhury, "Instrumentation, Measurement and Analysis" -3rd Edition, Tata McGraw, 2009
2. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 3rd Edition Springer, 2010.

Reference Books
1. A.K. Sawhney, "Electrical and Electronic Measurements and Instrumentation", DhanpatRai.
2. Er. R.K. Rajput, "Electronic Measurements and Instrumentation", S. Chand & Company Ltd. 3rd

Edition.

3. Bentley, John P., "Principles of Measurement Systems", 4th edition, Pearson/Prentice Hall, 2005
4. Jon. S. Wilson, "Sensor Technology Hand Book", Elsevier Inc., 2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMMUNICATION TECHNOLOGIES
(OPEN ELECTIVE)

Course Code: GR22A4045   **L/T/P/C: 3/0/0/3**

Course Outcomes
1. Analyze the properties of basic Modulation techniques and apply them to Digital Communication
2. Apply error probability concepts to evaluate the performance of spread spectrum systems.
3. Understand the principle concepts of telecommunication systems and networking
4. Analyze link budgets for satellite communication, considering factors such as path loss, atmospheric effects, and antenna gain.
5. Evaluate the suitability of various technologies in cellular, mobile and wireless communication scenarios.

UNIT- I: Review of Digital Communication System
Review of fundamental concepts and parameters in Digital Communication. Digital modulation schemes, Power spectra of digital modulation signals.

UNIT- II: Spread-Spectrum Modulation
Introduction, Pseudo-Noise sequences, direct- sequence spread spectrum (DSSS) with coherent BPSK, processing gain, probability of error, frequency-hop spread spectrum (FHSS). Application of spread spectrum: CDMA.

UNIT- III: Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony. **Networking and Local Area Networks:** Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

UNIT- IV
Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.
Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT-V:
Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA.
Wireless Technologies: Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless Networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Text Books:
1. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education, 2005.
2. Simon Haykin and Michael Moher, "Modern Wireless Communications," Pearson Education, 2005.
3. Marvin K. Simon, Sami M. Hinedi and W. C. Lindsay, "Digital Communication Techniques," Eastern Economy Edition, 2010.

Reference Books

1. Principles of communication systems By Taub Schilling, T.M.H
2. Andrew J Viterbi, "CDMA principles spread spectrum communications," Adison Wesley, 1995.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INDUSTRIAL AUTOMATION AND CONTROL
(OPEN ELECTIVE)

Course Code: GR22A3030   **L/T/P/C:3/0/0/3**

Prerequisites: Manufacturing Technology

Course Outcomes:
1. Explain the major automation theories, approaches and methodologies used in manufacturing.
2. Apply the knowledge for implementing the automated flow lines.
3. Employ the assembly systems and line balancing for automation.
4. Implement the knowledge of material handling and storage systems in current industries.
5. Design adaptive control system for automated manufacturing.

UNIT I
Introduction: Introduction to automation, principles, reasons, types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding, tool changing, and machine tool control transfer the automaton.

UNIT II
Automated flow lines: Methods of work part transport transfer, Mechanical buffer storage control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines**.**

UNIT III
Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT IV
Automated material handling and storage systems: Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems. Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT V
Adaptive control systems: Introduction, adaptive control with optimization, adaptive control with constraints, application of adaptive control in machining operations. Consideration of various parameters such as cutting force, temperatures, vibration and acoustic emission in the adaptive controls systems.

Text Books
1. Mikell P.Groover, Automation, Production Systems, and Computer- integrated Manufacturing, prentice Hall, 2014
2. Serope Kalpakjian and Steven R. Schmid, Manufacturing – Engineering and Technology, 7th edition, Pearson, 2013

Reference Books
1. Automation, Production Systems, and Computer-Integrated Manufacturing. (2016). India: Pearson India.
2. Bolz, R. W. (2012). Manufacturing Automation Management: A Productivity Handbook. United States: Springer US.
3. Boucher, T. O. (2012). Computer Automation in Manufacturing: An Introduction. Switzerland: Springer US.
4. Altintas, Y. (2012). Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design. United States: Cambridge University Press.
5. Morriss, S. B. (1995). Automated manufacturing systems. United Kingdom: Glencoe.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMPOSITE MATERIALS
(OPEN ELECTIVE)

Course Code: GR22A3105   **L/T/P/C: 3/0/0/3**

Prerequisites: Material Engineering

Course Outcomes

1. Identify the types of composite materials and their characteristic features.

2. Explain the methods employed in composite fabrication.

3. Differentiate the strengthening mechanisms of composite and its corresponding effect on performance.

4. Analyze the various criterions for isotropic, anisotropic, and composite materials, prediction of laminates failure.

5. Examine experimental techniques utilized for failure mode of composites.

UNIT I

Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke's law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness.

UNIT II

Manufacturing of composite materials, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes

UNIT III

Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria.

UNIT IV

Von Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai- Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates.

UNIT V

Analysis of laminated plates- equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies.

Text Books

1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill,1994.
2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill,1998.

Reference Books

1. Clyne, T. W. and Withers, P. J., "Introduction to Metal Matrix Composites", Cambridge University Press, 1993.
2. Strong, A.B., "Fundamentals of Composite Manufacturing", SME, 1989.
3. Sharma, S.C., "Composite materials", Narosa Publications, 2000.
4. Broutman, L.J. and Krock,R.M., " Modern Composite Materials", Addison-Wesley, 1967.
5. Introduction to Composite Materials Design by Ever J. Barbero 3rd Edition 2017

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
OPERATIONS RESEARCH
(OPEN ELECTIVE)

Course Code: GR22A3018 **L/T/P/C: 3/0/0/3**

Course Outcomes

1. Apply the various linear programming techniques for optimal allocation of limited resources such as machine, material, and money.

2. Solve transportation problems to minimize cost and understand the principles of assignment of jobs and recruitment policies.

3. Solve sequencing problems and distinguish various inventory models and develop proper inventory policies.

4. Apply game theory to analyze various business competitions and analyze the various waiting line-oriented situations.

5. Develop optimum replacement policy and Dynamic Programming Techniques.

UNIT I
Introduction: Development – Definition– Characteristics and Phases of operations Research– Types of models – operation Research models– applications.
Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

UNIT II
Transportation models: Formulation – Methods for finding feasible solutions; North west corner rule, least cost entry method, Vogel's approximation method. Optimal solution; MODI method. Unbalanced transportation problem and Degeneracy.
Assignment models - Formulation – Optimal solution - Variants of Assignment Problem

UNIT III
Sequencing: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.
Inventory: Introduction – Single item – Deterministic models – Purchase inventory modelwith one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be a discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

UNIT IV
Theory of games: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle– m X 2 and 2 X n games -graphical method.
Waiting lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

UNIT V
Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement.

Dynamic programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

Text Books

1. Operations Research - Prem Kumar Gupta and D S Hira/ S Chand Publishing/ 2015
2. Operations Research / S. D.Sharma / KedarNath RamNath Publication/2020

Reference Books

1. Operations Research / R.Panneerselvam, 3rd Edition/PHI Publications/ 2023
2. Operations Research An Introduction - Hamdy A Taha/8 th Edition/ Prentice Hall/2006
3. Principles of Operations Research: With Applications to Managerial Decisions - Harvey M. Wagner/Prentice-Hall Operations Research/2020
4. Operations Research - Kanthi Swarup, P.K. Gupta, Man Mohan Sultan Chand & Sons/ 2019
5. Operations Research / A.M.Natarajan, P.Balasubramani,A. Tamilarasi / Pearson Education/2006

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING MATERIALS FOR SUSTAINABILITY
(OPEN ELECTIVE)

Course Code: GR22A3009   **L/T/P/C: 3/0/0/3**

Pre-requisites: Building materials and construction planning, Concrete Technology

Course Outcomes:
1. Describe the different types of environmental factors effecting materials
2. Report the work in sustainability for research and education
3. Illustrating the broad perspective in thinking for sustainable practices
4. Perform cost/benefit analysis and life-cycle analysis of green buildings.
5. Identify and compare cost and performance of building materials

UNIT I

Sustainability – Introduction, Need and concept of sustainability, Social- environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols – Clean Development Mechanism (CDM), Environmental legislations in India – Water Act, Air Act

UNIT II

Air Pollution, effects of Air Pollution; Water pollution-sources, Sustainable wastewater treatment, Solid waste-sources, impacts of solid waste, zero waste concept, 3R concept, Global environmental issues-Resource degradation, climatic change, Global warming, Ozone layer depletion, Regional and Local Environmental issues. Carbon credits and carbon trading, carbon foot print.

UNIT III

Green Building Materials, Basic concepts of sustainable habitat, green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainably managed Materials, Depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials; non-renewable Energy of Materials

UNIT IV

Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds like acetone, formaldehyde, BTEX substances, Natural Non-Petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials, Engineering evaluation of these materials.

UNIT V

Green Building Planning and Specifications, Environment friendly and cost effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Alternative Construction Methods, Energy Conservation Measures in Buildings, Waste &Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight, Plumbing and its Effect on Energy Consumption.

Text Books

1. Alternative Building Materials and Technologies (2007) – K S Jagadeesh, B V Venkata RamaReddy & K S Nanjunda Rao – New Age International Publishers
2. Integrated Life Cycle Design of Structures (2002)– AskoSarja – SPON Press
3. Non-conventional Energy Resources (2012) – D S Chauhan and S K Srivastava – New AgeInternational Publishers

Reference Books

1. Green Buildings (2007) McGraw hill publication by Gevorkian
2. Emerald Architecture (2008) case studies in green buildings, The Magazine of Sustainable Design
3. Understanding Green Building Guideline (2010): For Students and Young Professionals, Traci Rose Rider, W. W. Norton & Company Publisher.
4. Understanding Green Building Materials (2011) Traci Rose Rider, W. W. Norton & Company Publisher.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GEOGRAPHIC INFORMATION SYSTEMS AND SCIENCE
(OPEN ELECTIVE)

Course Code:GR22A3086   **L/T/P/C: 3/0/0/3**

Pre-Requisites: Surveying and Geomatics

Course Outcomes:
1. Interpret the fundamental concepts of Geographic Information Science and Technology along with different data structures.
2. Demonstrate Map creation and design principles, including thematic map display, employment of map projections and cartographic design.
3. Analyze the types of digital maps for different themes.
4. Apply the spatial analysis to remote sensing data to generate thematic maps.
5. Solve the real-life problems associated with geospatial and remote sensing.

UNIT I
Fundamentals of GIS – Information Systems, Modelling Real World Features Data, Data Formats, Applications of GIS, – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Database Management – Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware – Computing, printing and scanning systems; Software – Standard Packages like Arc view, ArcGIS (commercial) & Auto-CAD Map, Map Info etc. QGISopen software- Salient features.

UNIT II
Topology – Types of Errors, Editing and Error Rectification, Types of Topology, Modeling topological Relationships, Tolerances.

UNIT III
Map – mapping concepts, analysis with paper-based maps, limitations, Computer Automated Cartography– History and Developments, GIS- Definition, advantages of digital maps.

UNIT IV
Spatial Analysis and Modelling – Proximity Analysis, Overlay Analysis, Buffer Analysis, Network Analysis, Spatial Auto Correlation, Gravity Modelling, DTM/DEM, Integration with Remote Sensing data

UNIT V
GIS Project Planning and Implementation – Under Standing the Requirements, Phases of Planning, Specifications, Data Procurement, Tendering, Human Resources, Back Up, Monitoring Progress

Text Books
1. Concepts & Techniques of GIS by C. P. Lo Albert, K. W. Yonng, Prentice Hall (India) Publications, 2nd edition, 2016.
2. Fundamental of GIS by Mechanical designs John Wiley &Sons, 4th edition, 2008.
3. Principals of Geographic Information Systems – Peter Beur and Rachael A.Mc Donnell, Oxford Publishers 2016.

Reference Books
1. Remote Sensing and Geographical Information systems by M. Anji Reddy JNTU Hyderabad.4th Edition 2014, B. S. Publications.

2. Introduction to Geographic Information Systems by Kang-tsung Chang, Tata McGraw-Hill Publishing Company Limited- 2008.

3. Remote sensing of the environment –An earth resource perspective by John R Jensen, Prentice Hall 4. GIS by Kang – tsung chang, TMH Publications & Co., 2nd edition, 2013.

4. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications, 1st edition,2016.

5. Remote Sensing and its applications by LRA Narayana, University Press 1999.

6. Remote sensing and image interpretation by Thomas Lillesand, 7th Edition, John Wiley & sons,6th Edition 2011.

7. Fundamentals of Geographic Information systems by Michael N. Demers, 4th Edition, Wiley Publishers, 2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENVIRONMENTAL IMPACT ASSESSMENT
(OPEN ELECTIVE)

Course Code:GR22A4011   **L/T/P/C: 3/0/0/3**

Pre-Requisites: Environmental science

Course Outcomes:
1. Identify, predict, and evaluate the environmental effects of proposed actions and projects.
2. Explain the appropriate methodologies for environmental impact prediction and assessment.
3. Analyze the importance of Public Participation, Fault Tree Analysis and Consequence analysis in EIA.
4. Understand the activities in environmental auditing.
5. Plan EIA for developmental projects.

UNIT I
Introduction: Concepts of EIA methodologies – Sustainable development- Need for Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – Evolution of EIA: Screening and scoping; Rapid EIA and Comprehensive EIA

UNIT II
Introduction to EIA, Criteria for the selection of EIA Methodology, General Framework for Environmental Impact Assessment, Characterization and site assessment. Environmental Risk Analysis, Definition of Risk, Matrix Method; Checklist method.

UNIT III
Prediction and Assessment: Public participation Fault tree analysis, Consequence Analysis; Socioeconomic aspects, measures of the effectiveness of pollution control activities;

UNIT IV
Environmental Legislation: Introduction to Environmental Management Systems; Environmental Statement - procedures; Environmental Audit: Cost-Benefit Analysis;

UNIT V
Life Cycle Assessment, Resource Balance, Energy Balance & Management Review - Operational Control - Case Studies on EIA with reference to Indian Scenario.

Text Books
1. Y Anjaneyulu, and Valli Manikkam, Environmental Impact Assessment Methodologies, BSP Books PVT Ltd., 2nd edition, 2011.
2. R.R. Barthwal, Environmental Impact Assessment, New Age International Private Limited, 2nd edition, 2012.
3. Canter R.L., Environmental Impact Assessment, Mc Graw Hill International Edition, 2nd edition, 1997.

Reference Books
1. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Hand book",

McGraw Hill Inc., New York, 1996.

2. Judith Petts, Handbook of Environmental Impact Assessment Vol. I &II, Blackwell Science,1999.

3. Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.

4. Anji Reddy Mareddy, Environmental Impact Assessment: Theory and Practice, Butterworth-Heinemann publisher, 1st Edition, 2017.

5. MoEF & CC, Govt. of India: EIA notification and subsequent amendments