Academic Regulations
Programme Structure
and
Detailed Syllabus

Bachelor of Technology(B.Tech)
in
Electronics and Communication Engineering

(Four Year Regular Programme)

(Applicable for Batches admitted from 2024-25)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

Bachupally, Kukatpally, Hyderabad- 500 090

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD

Academic Regulations for B.Tech (Regular) under GR24

(Applicable for Batches Admitted from 2024-25)

Under Graduate Degree Programme in Engineering and Technology (UG)

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

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

GR24 Regulations shall govern the above programmes offered by the Departments with effect from the students admitted to the programmes in 2024-25 academic year is given below.

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

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

3. **Programme Pattern:**

a) Each Academic Year of study is divided into two semesters.

b) Minimum number of instruction days in each semester is 90.

c) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).

d) The total credits for the Programme are 160.

e) A student has a choice to register for all courses in a semester / one less or one additional course from other semesters provided the student satisfies prerequisites.

f) All the registered credits except Mandatory and Value-added Courses will be considered for the calculation of final CGPA.

g) Each semester has 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC, and course structure as suggested by AICTE are followed. The terms 'subject' and 'course' imply the same meaning.

h) All courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.

- One credit for one hour/week/semester for Theory/Lecture (L) courses and Tutorials (T).
- One credit for two hours/week/semester for Laboratory/Practical (P) courses.
- Mandatory Courses will not carry any credits.

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

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

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

   a) A student pursues the course of study and completes it successfully in not less than four academic years and not more than eight academic years.
   b) A student has to register for all the 160 credits and secure all credits (with CGPA ≥ 5).
   c) A student must fulfill all the academic requirements for the award of the degree.

5. Courses to be offered

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

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

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

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

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

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

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

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

6. Attendance Requirements:

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

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

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

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

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

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

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

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

b) Distribution and Weightage of marks

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

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

Assessment Procedure:

S. No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Theory	40	Internal Examination & Continuous Evaluation	1) Two mid semester examination shall be conducted for 30 marks each for a duration of 120 minutes. Average of the two mid exams shall be considered **i) Subjective – 20 marks** **ii) Objective – 10 marks** 2) Continuous Evaluation is for each unit using **i) Assignment – 05 marks** **ii) Quiz/Subject Viva-voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject – 05 marks**
		60	Semester end examination	The semester-end examination is for a duration of 3 hours
2	Practical	40	Internal Examination & Continuous Evaluation	One internal lab examination towards the end of course for a duration of 90 minutes with a viva of 5 minutes. **i) Internal Exam-10 marks** **ii) Viva voce – 10 marks** **iii) Continuous Assessment- 10 marks** **iv) G-Lab on Board(G-LOB) (Case study inter threading of all experiments of lab)/ Laboratory Project/Prototype Presentation/App Development -10 marks**
		60	Semester end examination	The semester-end examination is for a duration of 3 hours. **i) write-up (algorithm/flowchart/procedure) as per the task/experiment/program - 10 marks** **ii) task/experiment/program-15 marks** **iii) evaluation of results -15 marks** **iv) write-up (algorithm/flowchart/procedure) for another task/experiment/program- 10 marks** **v) viva-voce on concerned laboratory course - 10 marks**

3	Graphics for Engineers	40	Internal Examination & Continuous Evaluation	1) Two mid semester examination shall be conducted for 15 marks each for a duration of 90 minutes. Average of the two mid exams shall be considered 2) Day-to-Day activity -15 marks 3) Continuous Evaluation using • **Assignment – 05 marks** • **Quiz/Subject Viva-voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject – 05 marks**
		60	Semester end examination	The semester-end examination is for a duration of 3 hours

d) Mini Project:

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

Note:

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

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

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

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

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

Note:

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

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

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

- A student is deemed to have satisfied the academic requirements and earned the credits allotted to **Project Stage-I** if the student secures not less than 40% of marks (40 marks out of 100 marks) in the evaluation of the same.
- A student is deemed to have failed if the student does not submit a report on work carried out during Project Stage-I or does not make a presentation of the same before the evaluation committee as per schedule or secures less than minimum marks in the evaluation.
- A student who has failed may reappear once for evaluation when it is scheduled again; if the student fails in the evaluation of 'one such reappearance', the student has to reappear for the same in the subsequent semester, as and when it is offered.
- A student is deemed to have satisfied the academic requirements and earned the credits allotted to **Project Stage-II** if the student secures not less than 35% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), not less than 35% (21 marks out of 60 marks) in the Semester End Examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject/ course.
- The student is deemed to have failed if the student does not submit a report on work carried out during Project Stage-II or does not make a presentation of the same before the evaluation committee as per schedule or secures less than minimum marks in either CIE or SEE or CIE+SEE taken together.
- A student who has failed may reappear once for the evaluation when it is scheduled again; if the student fails again in the evaluation of "once such reappearance", the student has to reappear for the same in the subsequent semester as and when the evaluation is scheduled.

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

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

  CIE is done for 50 marks as follows:

  - There shall be two mid-term examinations during the semester conducted for 40 marks consisting of two parts with a total duration of 2 hours: Part A for 20 marks and Part B for 20 marks.

- Part A is an objective paper or a quiz and shall consist of multiple-choice questions, fill-in-the blanks, match the following, etc. for a total of 20 marks.
- Part B is a descriptive paper and shall contain 6 questions out of which, the student needs to answer 4 questions each carrying 5 marks.
- While the first mid-term examination shall be conducted for the first 50% syllabus, the second mid-term examination shall be conducted for the remaining 50% of the syllabus. The average of the two mid-term examinations shall be taken as final marks.
- Two assignments are evaluated for 5 marks each. The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The assignments shall be given by the subject teachers. The average of the two assignments shall be taken as the final marks.
- The remaining 5 marks may be evaluated by conducting viva-voce in the subject or by evaluating the performance of the student in PPT/Poster/Case-Study presentation on a topic in the concerned subject before second mid-term examination**.**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

a) A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% (14 marks out of 40), not less than 35% (21 marks out of 60 marks) in the semester end examination, and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

The student is eligible to write Semester End Examination of the concerned subject/course if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.

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

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

S.No	Promotion	Conditions to be fulfilled
1	First year first semester toFirst year second semester	Regular course of study of First year first semester.
2	First year second semester toSecond year first semester	**(i)** Regular course of study of First year second semester. **(ii)** Must have secured at least 50% credits up to First year secondsemester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Second year first semester toSecond year second semester	Regular course of study of Second year firstsemester.
4	Second year second semester to Third year first semester	**(i)** Regular course of study of Second year second semester **(ii)** Must have secured at least 60% credits up to Second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to Third year second semester	Regular course of study of Third year first semester.
6	Third year second semesterto Fourth year first semester	**(i)** Regular course of study of Third year second semester. **(ii)** Must have secured at least 60% credits upto Third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Fourth year first semester toFourth year second semester	Regular course of study of Fourth year firstsemester.

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

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

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

Computation of SGPA and CGPA:

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

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

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

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

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

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

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

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

S. No	Class Awarded	CGPA Secured
1	First Class with Distinction	CGPA >= 8.00 with no F or below grade/detention anytime during the programme

2	First Class	CGPA >= 8.00 with rest of the clauses of S.No 1 not satisfied
3	First Class	CGPA ≥ 6.50 and CGPA < 8.00
4	Second Class	CGPA ≥ 5.50 and CGPA < 6.50
5	Pass Class	CGPA ≥ 5.00 and CGPA < 5.50

Equivalence of grade to marks

Marks % = (CGPA -0.5)*10

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

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

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

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

4. A student may be permitted to take one year break after completion of II Year II Semester or B.Tech III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

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

18. Transitory Regulations

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of GR22 Regulations due to lack of attendance, shall be permitted to join I year I Semester of GR24 Regulations and he is required to complete the study of B.Tech programme within the stipulated period of eight academic years from the date of first admission in I Year.
2. A student who has been detained in any semester of II, III and IV years of GR22 regulations for want of attendance, shall be permitted to join the corresponding semester of GR24 Regulations and is required to complete the study of B.Tech within the stipulated period of eight academic years from the date of first admission in I Year. The

GR24 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

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

C. For readmitted students in GR24 Regulations:

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

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

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

Note:

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

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

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

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

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

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

20. General Rules

a. The academic regulations should be read as a whole for the purpose of any interpretation.
b. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.
c. In case of any error in the above rules and regulations, the decision of the Academic Council is final.
d. The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

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

(Applicable for Batches Admitted from 2025-26)

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

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

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

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

2. Academic Requirements and Promotion Rules:

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

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

S. No.	Promotion	Conditions to be fulfilled
1	Second year first semester to Second year second semester.	Regular course of study of Second year first semester.
2	Second year second semester to Third year first semester.	(i) Regular course of study of Second year second semester. (ii) Must have secured at least 50% credits up to Second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester 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 Third year second semester. (ii) Must have secured at least 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to Fourth year second semester.	Regular course of study of Fourth year first semester.

3. **Award of Class:** After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of B.Tech Degree by JNTUH, he/she shall be placed in one of the following four classes based on CGPA secured from the 120 credits.

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

Academic Regulations for B.Tech with Minors Programme under GR24
(Applicable for Batches Admitted from 2024-25)

1. Objectives

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

4. Registration for the courses in Minor Programme

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

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

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

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

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

5. Minor courses and the offering departments

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 ENINEERING AND TECHNOLOGY
(Autonomous)
Bachupally, Kukatpally, Hyderabad–500090,India.(040)65864440

ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech(ECE)–GR24 Course Structure

I B. Tech (ECE) - I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext	Total Marks
1	Maths	BS	GR24A1001	Linear Algebra and Function Approximation	3	1	0	4	40	60	100
2	Chemistry	BS	GR24A1004	Engineering Chemistry	3	1	0	4	40	60	100
3	EEE	ES	GR24A1007	Fundamentals of Electrical Engineering	2	1	0	3	40	60	100
4	CSE	ES	GR24A1006	Programming for Problem Solving	2	0	0	2	40	60	100
5	Chemistry	BS	GR24A1019	Engineering Chemistry Lab	0	0	3	1.5	40	60	100
6	CSE	ES	GR24A1021	Programming for Problem Solving Lab	0	0	3	1.5	40	60	100
7	ME	ES	GR24A1025	Engineering Workshop	1	0	3	2.5	40	60	100
8	EEE	ES	GR24A1023	Fundamentals of Electrical Engineering Lab	0	0	2	1	40	60	100
9	ECE	ES	GR24A1013	Elements of Electronics and Communication Engineering Lab	0	0	2	1	50	--	50
TOTAL					**11**	**3**	**13**	**20.5**	**370**	**480**	**850**
10	Mgmt	MC	GR24A1028	Design Thinking	2	0	0	0	50	--	50

I B.Tech(ECE) - II Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int	Ext	Total Marks
1	Maths	BS	GR24A1002	Differential equations and Vector Calculus	3	1	0	4	40	60	100
2	Physics	BS	GR24A1003	Applied Physics	3	1	0	4	40	60	100
3	English	HS	GR24A1005	English	2	0	0	2	40	60	100
4	CSE	ES	GR24A1017	Data structures	2	0	0	2	40	60	100
5	ME	ES	GR24A1016	Graphics for Engineers	1	0	4	3	40	60	100
6	ECE	ES	GR24A1026	Fundamentals of Electronic Devices	1	0	0	1	50	--	50
7	English	HS	GR24A1020	English Language and Communication Skills Lab	0	0	2	1	40	60	100
8	Physics	BS	GR24A1018	Applied Physics Lab	0	0	3	1.5	40	60	100
9	CSE	ES	GR24A1024	Data Structures Lab	0	0	2	1	40	60	100
TOTAL					**12**	**2**	**11**	**19.5**	**370**	**480**	**850**

II B. Tech (ECE) - I Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Total	Int.	Ext	Total Marks
1	ECE	PC	GR24A2054	Analog Circuits-I	3	0	0	3	40	60	100
2	ECE	PC	GR24A2055	Digital Electronics	3	0	0	3	40	60	100
3	ECE	PC	GR24A2056	Signals and Systems	2	1	0	3	40	60	100
4	ECE	PC	GR24A2057	Probability Theory and Stochastic Processes	2	1	0	3	40	60	100
5	ECE	PC	GR24A2058	Network Analysis	2	1	0	3	40	60	100
6	ECE	PC	GR24A2059	Analog Circuits-I Lab	0	0	3	1.5	40	60	100
7	ECE	PC	GR24A2060	Digital Electronics Lab	0	0	3	1.5	40	60	100
8	ECE	PC	GR24A2061	Signals and Systems Lab	0	0	2	1	40	60	100
9	CSE	PC	GR24A2062	OOPS through Java Lab	0	0	2	1	40	60	100
		TOTAL			**12**	**3**	**10**	**20**	**360**	**540**	**900**
10	Mgmt	MC	GR24A2002	Value Ethics and Gender Culture	2	0	0	0	50	--	50

II B. Tech (ECE) - II Semester

S.No	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext	Total Marks
1	Maths	PC	GR24A2008	Computational Mathematics for Engineers	3	0	0	3	40	60	100
2	ECE	PC	GR24A2063	Microcontrollers	3	0	0	3	40	60	100
3	ECE	PC	GR24A2065	Analog Circuits-II	2	1	0	3	40	60	100
4	ECE	PC	GR24A2064	Integrated Circuits and Applications	3	0	0	3	40	60	100
5	ECE	PC	GR24A2066	Analog and Digital Communications	3	0	0	3	40	60	100
6	ECE	PC	GR24A2067	Microcontrollers Lab	0	0	2	1	40	60	100
7	ECE	PC	GR24A2068	Analog Circuits-II and ICA Lab	0	0	2	1	40	60	100
8	ECE	PC	GR24A2069	Analog and Digital Communications Lab	0	0	2	1	40	60	100
9	ECE	PW	GR24A2106	Real-time Research Project/ Societal Related Project	0	0	4	2	50	--	50
	TOTAL				**14**	**1**	**10**	**20**	**370**	**480**	**850**
10	CHEM	MC	GR24A2001	Environmental Science	2	0	0	0	50	--	50

III B.Tech (ECE) –I Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
1	ECE	PC		IOT Architectures and Protocols	3	0	0	3	40	60	100
2	ECE	PC		Electromagnetic Fields and Transmission Lines	3	1	0	4	40	60	100
3	ECE	PC		Digital Signal Processing	3	1	0	4	40	60	100
4		PE- I		Professional Elective-I	3	0	0	3	40	60	100
5		OE-1		Open Elective-1	3	0	0	3	40	60	100
6	ECE	PC		IOT Sensors Lab	0	0	3	1.5	40	60	100
7	ECE	PC		Digital Signal Processing Lab	0	0	3	1.5	40	60	100
8	English	MC		Effective Technical Communication	2	0	0	1	40	60	100
				TOTAL	**17**	**2**	**6**	**21**	**320**	**480**	**800**
9	Mgmt	MC		Constitution of India	2	0	0	0	50	--	50

PROFESSIONAL ELECTIVE–I			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Linear Control Systems
2	IT		Computer Organization and Operating Systems
3	ECE		Optical Communications
4	ECE		Digital System Design using Verilog HDL

OPEN ELECTIVE–I			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Principles of Communications

III B.Tech (ECE)-II Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
1	ECE	PC		VLSI Design	3	0	0	3	40	60	100
2	ECE	PC		Antennas and Wave Propagation	3	1	0	4	40	60	100
3	Mgmt	HS		Economics and Accounting for Engineers	3	0	0	3	40	60	100
4		PE-II		Professional Elective-II	3	0	0	3	40	60	100
5		OE-II		Open Elective-II	3	0	0	3	40	60	100
6	ECE	PC		VLSI Design Lab	0	0	3	1	40	60	100
7	ECE	PW		Mini Project	0	0	4	2	40	60	100
				TOTAL	**15**	**1**	**7**	**19**	**280**	**420**	**700**

PROFESSIONAL ELECTIVE–II			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		FPGA and CPLD Architectures
2	CSE(AIML)		Machine Learning
3	ECE		Cellular Mobile Communications
4	ECE		Embedded Systems Design

OPEN ELECTIVE–II			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Sensor Technology

IV B.Tech (ECE)-I Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
1	Mgmt	HS		Fundamentals of Management and Entrepreneurship	3	0	0	3	40	60	100
2	ECE	PC		Microwave Engineering	3	0	0	3	40	60	100
3		PE III		Professional Elective-III	3	0	0	3	40	60	100
4		PE IV		Professional Elective-IV	3	0	0	3	40	60	100
5		OE III		Open Elective-III	3	0	0	3	40	60	100
6	ECE	PC		Microwave Engineering Lab	0	0	4	2	40	60	100
7	ECE	PW		Project Work Phase I	0	0	6	3	40	60	100
				TOTAL	**15**	**0**	**10**	**20**	**280**	**420**	**700**

PROFESSIONAL ELECTIVE–III			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Analog IC Design
2	ECE		Computer Networks
3	ECE		RTOS and System Programming
4	ECE		Information theory and Coding

PROFESSIONAL ELECTIVE–IV			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Fundamentals of Low Power VLSI Design
2	ECE		Artificial Neural Networks
3	ECE		Network Security and Cryptography
4	ECE		System on Chip Architecture

OPEN ELECTIVE–III			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Communication Technologies

IV B.Tech (ECE)-II Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
1	CSE	PC		Digital Image Processing	3	0	0	3	40	60	100
2		PE V		Professional Elective-V	3	0	0	3	40	60	100
3		PE VI		Professional Elective-VI	3	0	0	3	40	60	100
4	ECE	PW		Project Work Phase II	0	0	22	11	40	60	100
		TOTAL			**9**	**0**	**22**	**20**	**160**	**240**	**400**

PROFESSIONAL ELECTIVE–V			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		VLSI Technology
2	ECE		5G and beyond Communication
3	ECE		Radar Systems
4	ECE		Digital Signal Processors and Architectures

PROFESSIONAL ELECTIVE–VI			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		ASIC Design
2	ECE		Wireless Sensor Networks
3	ECE		Satellite Communications
4	ECE		Autonomous Systems

I YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

LINEAR ALGEBRA AND FUNCTION APPROXIMATION
(COMMON TO CSE, ECE, EEE, CE, ME, CSE(DS), CSE(AIML))

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

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

Course Objectives

On completion of this Course, the student shall be able to:

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

Course Outcomes:

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

UNIT-1: Fundamentals of Vector and Matrix algebra

Operations on vectors and matrices- Orthogonal projection of vectors- Exact and generalized inverse of a matrix- Rank of a matrix- Linear independence of vectors- Structured square matrices (Symmetric, Hermitian, skew-symmetric, skew-Hermitian, orthogonal and unitary matrices)- Vector and matrix norms

Solution of a linear algebraic system of equations (homogeneous and non-homogeneous) using Gauss elimination

UNIT-II: Matrix eigenvalue problem and Quadratic forms

Determination of eigenvalues and eigenvectors of a matrix, properties of eigenvalues and eigenvectors (without proof)- Similarity of matrices- Diagonalization of a matrix- Orthogonal diagonalization of a symmetric matrix- Definiteness of a symmetric matrix

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

UNIT-III: Matrix decomposition and Least squares solution of algebraic systems

LU decomposition- Cholesky decomposition- Gram-Schmidt orthonormalization process- QR factorization- Eigen decomposition of a symmetric matrix- Singular value decomposition

Least squares solution of an over determined system of equations using QR factorization and the

generalized inverse- Estimation of the least squares error

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

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

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

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

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

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING CHEMISTRY

Course Code: GR24A1004 **L/T/P/C:3/1/0/4**
I Year I Semesters

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: Water and its Treatment: (8 Lectures)

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

Unit II: Battery Chemistry and Corrosion (8 Lectures)

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

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

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

Unit III: Polymers (8 Lectures)

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

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

Conducting Polymers: Characteristics and Classification with examples-mechanism of conduction in trans-polyacetylene and applications of conducting polymers.

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

Unit V: Energy Resources (8 Lectures)

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

UNIT - V: Engineering Materials (10 Lectures)

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

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

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

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF ELECTRICAL ENGINEERING

(CSE, CSE(AIML), CSE(DS) and ECE)

Course Code: GR24A1007 **L/T/P/C: 2/1/0/3**
I Year I Semester

Course Outcomes:

1. Summarize the basic fundamental laws of electric circuits.
2. Analyze electric circuits with suitable theorems.
3. Distinguish the single phase and three phase systems.
4. Interpret the working principle of Electrical machines.
5. Outline the protection principles using Switchgear components.

UNIT I
NETWORK ELEMENTS & LAWS
Charge, Current, Voltage, Power, Active elements, Independent and dependent sources. Passive elements - R, L and C, Energy stored in inductance and capacitance, Kirchhoff's laws, Source transformations, Star-delta transformations, Node voltage method, mesh current method.

UNIT II
NETWORK THEOREMS
Superposition theorem, Thevenin's theorem, Norton's theorems, Maximum power transfer theorem and Reciprocity theorem (DC Circuits).

UNIT III
AC CIRCUITS
Representation of sinusoidal waveforms, RMS and average values of periodic sinusoidal and non- sinusoidal waveforms, Phasor representation, Types of power, active power, Reactive power and Apparent power, Power factor. Impedance and Admittance, Analysis of series, parallel and series-parallel circuits, Introduction to three-phase circuits, types of connection. voltage and current relations in star and delta connections. Resonance: Series circuits, Bandwidth and Q-factor.

UNIT IV
BASICS OF ELECTRICAL MACHINES
Transformer: Mutual Induction, construction and working principle, Types of transformers, Ideal transformer, EMF Equation-simple Problems.
Construction and working principles of DC generator, DC motor, Synchronous generator, and Induction Motor – applications.

UNIT V
ELECTRICAL INSTALLATIONS
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, MCCB, Earthing – Plate and Pipe Earthing. Types of Batteries – Primary and Secondary, UPS (Uninterrupted power supply)-components, calculation of ratings for UPS-Components to a specific load, power

factor improvement methods.

TEXTBOOKS

1.“Basic Electrical Engineering”, D.P. Kothari and I.J. Nagrath, Third edition 2010, Tata McGraw Hill.
2.“Electrical Engineering Fundamentals”, Vincent Deltoro, Second Edition, Prentice Hall India, 1989.

REFERENCES

1. “A Textbook of Electrical Technology”,- BL Theraja volume-I, S.Chand Publications.
2. “Electrical Machinery”, P. S. Bimbhra, Khanna Publishers, 2011.
3. “Electrical and Electronics Technology”, E. Hughes, 10th Edition, Pearson, 2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING

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

Course Outcomes:

1. Design algorithms and flowcharts for problem solving and illustrate the fundamentals of C language.
2. Apply control structures and arrays to solve problems.
3. Discover the need for strings and functions in problem solving and apply it.
4. Analyze the need for pointers and structures in C and implement for solutions.
5. Demonstrate file handling mechanism, preprocessor directives and command line arguments in C.

UNIT I
Introduction to Programming:
Introduction to Algorithms: Representation of Algorithm, Flowchart, Pseudo code with examples, compiling and executing programs, syntax and logical errors.
Introduction to C Programming Language: Structure of C program, keywords, variables, constants, datatypes, operators, precedence and associativity, expression evaluation, implicit andexplicit type conversion, formatted and unformatted I/O.

UNIT II
Decision Making and Arrays:
Branching and Loops: Conditional branching with simple if, if-else, nested if else, else if ladder,switch-case, loops: for, while, do-while, jumping statements: goto, break, continue, exit.
Arrays: One and two dimensional arrays, creating, accessing and manipulating elements ofarrays. **Searching:** Introduction to searching, Linear search and Binary search.

UNIT III
Strings and Functions:
Functions: Introduction to structured programming, function declaration, signature of a function, parameters and return type of a function, categories of functions, parameter passing techniques, passing arrays and strings to functions, recursion, merits and demerits of recursive functions, storage classes.
Strings: Introduction to strings, operations on characters, basic string functions available in C - strlen, strcat, strcpy, strrev, strcmp, String operations without string handling functions, arrays of strings.

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

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

UNIT V

File handling and Preprocessor in C:

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

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

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

TEXT BOOKS

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

REFERENCE BOOKS

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Engineering Chemistry Lab

Course Code: GR24A1006 **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 studyof 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 inindustry. Determination of physical properties like adsorption and viscosity.

List of Experiments

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Programming For Problem Solving Lab

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

Course Outcomes:

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

TASK 1

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

TASK 2

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

TASK 3

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

TASK 4

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

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

(iii)

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

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

TASK 7

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

TASK 8

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

TASK 9

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

TASK 10

a. Write a C program to implement factorial of a given integer using recursive and non-recursive functions.
b. Write a C programto find the GCD (greatest common divisor) of two given integers usingrecursive and non-recursive functions.

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

TASK 11

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

TASK 12

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

TASK 13

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

TASK 15

a. Write a C program to find sum of 'n' numbers using command line arguments.
b. Write a C program to implement following pre-processor directives:
   i. define ii. undef iii. ifdef iv. ifndef.
c. Write a C program to create a user defined header file to find sum, product and greatestof 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, CengageLearning, (3rd Edition)

REFERENCE BOOKS

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Engineering Workshop

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

Course Outcomes

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

TRADES FOR EXERCISES: At least two tasks from each trade

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

b. Fitting - Demonstration and practice of fitting tools
   Task 3: Preparation of Straight Fit
   Task 4: Preparation of V-Fit

c. Tin-Smithy - Demonstration and practice of Tin Smithy tools
   Task 5: Preparation of Rectangular Tray
   Task 6: Preparation of Open Scoop

d. Welding : Demonstration and practice on Arc Welding tools
   Task 7: Preparation of Lap joint,
   Task 8: Preparation of Butt Joint

e. House-wiring: Demonstration and practice on House Wiring tools
   Task 9: Exercise on One way switch controlled two bulbs in series one bulb in Parallel.
   Task 10: Exercise on Stair Case connection.

f. Foundry : Demonstration and practice on Foundry tools
   Task 11: Preparation of Mould using Single Piece Pattern.
   Task 12: Preparation of Mould using Split Piece Pattern.

g. Black Smithy: Demonstration and practice on Black Smithy tools
   Task 13: Preparation of U-Hook
   Task 14: Preparation of S-Hook

h. **Preparation of a prototype model of any trade under G-LOBE activity**

Text Books

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Fundamentals of Electrical Engineering Lab

Course Code: GR24A1023 **L/T/P/C: 0/0/2/1**
I Year I Semester

COURSE OUTCOMES

1. Demonstrate the common electrical components and their ratings.
2. Summarize the basic fundamental laws of electric circuits.
3. Distinguish the measurement and relation between the basic electrical parameters
4. Examine the response of different types of electrical circuits with three phase excitation.
5. Outline the basic characteristics of Electrical machines.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Verification of Ohms Law, KVL and KCL.
2. Verification of Thevenin's & Norton's Theorems.
3. Verification of Superposition and Reciprocity Theorems.
4. Resonance in series RLC circuit.
5. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
6. Verification of Voltage and Current relations in Three Phase Circuits (Star-Delta)
7. Measurement of Active and Reactive Power in a balanced Three-phase circuit.
8. Torque – speed characteristics of a Separately Excited DC Shunt Motor.
9. Torque-Slip Characteristics of a Three-phase Induction Motor.
10. No-Load Characteristics of a Three-phase Alternator.
11. Verification of Maximum Power Transfer Theorem.
12. Power factor improvement by using capacitor bank in parallel with inductive load.

TEXTBOOKS

1. "Basic Electrical Engineering", D.P. Kothari and I.J. Nagrath, Third edition 2010, Tata McGraw Hill.
2. "Electrical Engineering Fundamentals", Vincent Deltoro, Second Edition, Prentice Hall India, 1989.

REFERENCES

1. "A Textbook of Electrical Technology",- BL Theraja volume-I, S.Chand Publications.
2. "Electrical Machinery", P. S. Bimbhra, Khanna Publishers, 2011.
3. "Electrical and Electronics Technology", E. Hughes, 10th Edition, Pearson, 2010

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
Elements of Electronics and Communication Engineering Lab

Course Code: GR24A1013 **L/T/P/C: 0/0/2/1**
I Year I Semester

COURSE OBJECTIVES:

1. Describe the basic functions and applications of common electronic components such as resistors, capacitors, diodes, and transistors.
2. Demonstrate the proper use of a digital Multimeter to accurately measure voltage, current, and resistance in electronic circuits
3. Explain the differences between analog and digital signals, including their characteristics and applications in communication systems

COURSE OUTCOMES:

The students will be able to:

1. Identify the different components used for electronics applications
2. Measure different parameters using various measuring instruments
3. Distinguish various signal used for analog and digital communications

List of Experiments:

1. Understand the significance of Electronics and communications subjects
2. Identify the different passive and active components
3. Color code of resistors, finding the types and values of capacitors
4. Measure the voltage and current using voltmeter and ammeter
5. Measure the voltage, current with Multimeter and study the other measurements using Multimeter
6. Study the CRO and measure the frequency and phase of given signal
7. Draw the various Lissajous figures using CRO
8. Study the function generator for various signal generations
9. Operate Regulated power supply for different supply voltages
10. Study the various gates module and write down the truth table of them
11. Analyze and evaluate the specifications and data sheets of electronic components for appropriate selection in applications.
12. Identify various Digital and Analog ICs
13. Observe the various types of modulated signals.
14. Know the available Softwares for Electronics and communication applications

Reference Books

1. "Practical Electronics for Inventors" by Paul Scherz and Simon Monk, McGraw-Hill Education
2. "Learning the Art of Electronics: A Hands-On Lab Course" by Thomas C. Hayes and Paul Horowitz, Cambridge University Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Design Thinking

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

COURSE OUTCOMES: After completion of the course, the student should be able to

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

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

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

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

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

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

TEXTBOOKS:

1. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, Vijay Kumar, John Wiley & Sons, ISBN: 978-1118083468, 2012

2. Living with Complexity, Donald A Norman, MIT Press, ISBN: 978-0262528948, 2016

3. Design Thinking for Entrepreneurs and Small Businesses: Putting the Power of Design to Work, Beverly Rudkin Ingle, A Press, ISBN: 978-1430261810, 2013

REFERENCE BOOKS:

1. Emotionally Durable Design: Objects, Experiences and Empathy, Jonathan Chapman, 2nd Edition, Routledge, ISBN: 978-0415732161, 2015

2. Innovation Design: How Any Organization Can Leverage Design Thinking to Produce Change, Drive New Ideas, and Deliver Meaningful Solutions, Thomas Lockwood, Edgar Papke, New Page Books, ISBN: 978-1632651167, 2017

3. Design Thinking Business Analysis: Business Concept Mapping Applied, Thomas Frisendal, Springer, ISBN: 978-3642434822, 2012

4. Chapter 1: A Simple Framework for Leading Innovation, The Three Box Solution, HBR Press, 2016

5. Design a Better Business: New Tools, Skills and Mindset for Strategy and Innovation, Patrick Van Der Pijl, Justin Lokitz, Lisa Kay Solomon, Erik van der Pluijm, Maarten van Lieshout, Wiley, ISBN: 978-8126565085, 2016

I YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Differential Equations And Vector Calculus

Course Code: GR24A1002 **L/T/P/C: 3/1/0/4**
I Year II Semester

Course Objectives: To provide the student with

1. Knowledge to solve engineering problems governed by differential equations
2. The skill of evaluating multiple integrals needed for applications in mechanics and electro-magnetic field theory
3. The knowledge to interpret the functions arising in vector field theory and utilize mathematical tools for some computations
4. The skill of evaluating work done by a field and flux across a surface
5. The skill of utilizing specialized theorems for fast evaluation of work and flux

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

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

UNIT-I: ORDINARY DIFFERENTIAL EQUATIONS OF THE FIRST ORDER

LDE of the first order: Solution of Exact, Linear and Bernoulli equations, modeling Newton's law of cooling, growth and decay models.

UNIT-II: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

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

UNIT-III: MULTIPLE INTEGRALS

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

UNIT-IV: VECTOR DIFFERENTIATION AND LINE INTEGRATION

Vector differentiation: Scalar and vector point functions, Concepts of gradient, divergence and curl of functions in cartesian framework, solenoidal field, irrotational field, scalar potential
Vector line integration: Evaluation of the line integral, concept of work done by a force field, Conservative fields

UNIT-V: SURFACE INTEGRATION AND VECTOR INTEGRAL THEOREMS

Surface integration: Evaluation of surface and volume integrals, flux across a surface

Vector integral theorems: Green's, Gauss and Stokes theorems (without proof) and their applications

TEXT BOOKS

1. R.K.Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa publishing house, Fourth edition 2014
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
4. . G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

REFERENCES:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Applied Physics

Course Code: GR24A1003 **L/T/P/C: 3/1/0/4**
I Year II Semester

Course Objectives:
1. Identify the dualistic nature of matter waves with experimental validation.
2. Outline the properties of semiconductor materials and optoelectronic devices for various applications.
3. Classify the properties of magnetic and superconducting materials for various applications.
4. Discuss the use of lasers as light sources in optical fiber applications.
5. Identify the importance of nanomaterials and various fabrication techniques.

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

UNIT I: Quantum Physics and Solids

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

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

UNIT II: Semiconductors and devices

Intrinsic and extrinsic semiconductors(qualitative) - Hall Effect and its applications, direct and indirect band gap semiconductors, Construction and principle of operation of p-n junction diode, I-V characteristics of p-n junction diode and Zener diode.

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

UNIT III: Magnetic materials and Superconductivity

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

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

UNIT IV: Lasers and Fiber Optics

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

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

UNIT V: Nanotechnology

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

Text books:

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

References:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

English

Course Code: GR24A1005 **L/T/P/C : 2/0/0/2**
I Year II Semester

Course Outcomes: Students will be able to
1. use English Language effectively in spoken and written forms.
2. comprehend the given texts and respond appropriately.
3. communicate confidently in various contexts and different cultures.
4. acquire proficiency in English including reading and listening comprehension, writing and speaking skills.
5. Convey complex ideas clearly and accurately in academic and professional settings

UNIT – I
Chapter entitled '***Toasted English*' by R.K.Narayan** from ***"English: Language, Context and Culture"*** published by Orient BlackSwan, Hyderabad.
Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms
Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.
Reading: Reading and Its Importance- Techniques for Effective Reading.
Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT – II
Chapter entitled **'Appro JRD' by Sudha Murthy** from ***"English: Language, Context and Culture" published*** by Orient BlackSwan, Hyderabad.
Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs
Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice
Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events– Classifying- Providing Examples or Evidence

UNIT – III
Chapter entitled **'Lessons from Online Learning' by F.Haider Alvi, Deborah Hurst et al** from ***"English: Language, Context and Culture"*** published by Orient BlackSwan, Hyderabad.
Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.
Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

UNIT – IV

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

UNIT - V

Chapter entitled **'Go, Kiss the World' by Subroto Bagchi** from ***"English: Language, Context and Culture"*** published by Orient BlackSwan, Hyderabad.
Vocabulary: Technical Vocabulary and their Usage
Grammar: Common Errors in English (*Covering all the other aspects of grammar which were not covered in the previous units*)
Reading: Reading Comprehension-Exercises for Practice
Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

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

Note: 1. As the syllabus of English given in AICTE *Model Curriculum-2018 for B.Tech First Year is* ***Open-ended***, besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.

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

TEXTBOOK:

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

REFERENCE BOOKS:

1. Effective Academic Writing by Liss and Davis (OUP)
2. Richards, Jack C. (2022) Interchange Series. Introduction, 1,2,3. Cambridge University Press
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
4. Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary. (2nd ed.,). Sage Publications India Pvt. Ltd.
5. (2019). Technical Communication. Wiley India Pvt. Ltd.
6. Vishwamohan, Aysha. (2013). English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd.
7. Swan, Michael. (2016). Practical English Usage. Oxford University Press. Fourth Edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES

Course Code: GR24A1017 **L/T/P/C:2/1/0/3**
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 on stack and queue and their applications.
3. Develop algorithms for various operations on linked lists and convert them to programs.
4. Interpret operations on non-linear data structure binary tree and BST.
5. Summarize the operations on graphs and apply graph traversals techniques and outline hashing techniques.

UNIT I

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

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

UNIT II

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

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

UNIT III

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

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

UNIT IV

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

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

UNIT V

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

Hashing - Introduction to hashing, hash function and types, hash table, implementation, collision

resolution techniques–separate chaining, linear probing, quadratic probing, double hashing (only examples – no implementation).

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

Graphics For Engineers

Course Code: GR24A1016 **L/T/P/C: 1/0/4/3**
I Year II Semester

Course Outcomes

1. Generate two dimensional drawings and apply AutoCAD commands.
2. Interpret projection methods and draw projections of line or point objects.
3. Imagine and generate multi-view projections of planes and solid objects in different positions
4. Construct and interpret sectional views and develop solid surfaces.
5. Create isometric drawings from given orthographic views and familiar with isometric to orthographic transformations.

UNIT I

Introduction to AutoCAD software: user interface, tool bar -draw, modify, dimension, layers, setting drawing area, status bar, print setup, generation of two-dimensional drawings. Construction of Engineering Curves- Ellipse, Parabola and Hyperbola -general method only.

UNIT II

Orthographic projection – Introduction, definition, and classification of projections; pictorial and multi-view, significance of first and third angle methods of projections; Projections of points -in all quadrants and straight lines -inclined to one reference plane only.

UNIT III

Projections of planes - definition and types of regular plane figures like triangle, square, pentagon, hexagon, and circle; projections of planes -inclined to one reference plane only.
Projections of solids - definition and types of right regular solids objects like prism, cylinder, pyramid, and cone; projections of solids -axis inclined to one reference plane only.

UNIT IV

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

UNIT V

Isometric views– isomeric views of lines, planes (polygons) and solids (prism, cylinder, pyramid, and cone); generation of Isometric line diagrams. World Coordinate System, User Coordinate System. Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

Text Books:

1. Engineering Drawing by N. D. Bhatt, Fiftieth Revised and Enlarged Edition:2011, Charotar Publishing House Pvt. Ltd.
2. Engineering Graphics by Basant Agrawal and C M Agrawal, fifth re-print 2011, Tata McGraw Hill Education Private Limited, New Delhi.

Reference Books:

1. Engineering Graphics with AutoCAD 2020 by James D. Bethune, Copyright © 2020 by Pearson Education, Inc. All rights reserved.
2. Engineering Graphics by M. B. Shah, B. C. Rana, S. N. Varma, Copyright © 2011 Dorling Kindersley (India) Pvt. Ltd, Licensees of Pearson Education in South Asia.
3. Engineering Drawing and Graphics by K Venu Gopal /New Age International Pvt. Ltd, Publishers, fifth edition, 2002.
4. Engineering Graphics by Koushik Kumar, Apurba Kumar Roy, Chikesh Ranjan, S Chand and Company limited, first edition 2019.
5. Engineering Drawing with Auto Cad by B. V. R. Gupta, M. Raja Roy, IK International Pub., 2009.

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GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
Fundamentals of Electronic Devices

Course Code: GR24A1026 **L/T/P/C: 2/0/0/1**
I Year II Semester

Course Objectives:
The objectives of this course for the student to

1. Understand and Analyze Semiconductor Devices:
2. Design and Evaluate Rectifier and Filter Circuits:
3. Implement Advanced Diode Applications:
4. Analyze and Apply BJT Configurations and Biasing Techniques:
5. Evaluate Characteristics and Applications of FETs

Course Outcomes: Students will be able to

1. Identify, describe, and explain the principles and characteristics of diodes, BJTs, JFETs, and MOSFETs.
2. Design, analyze, and evaluate rectifier and filter circuits, understanding their performance characteristics and ripple factors.
3. Implement and test voltage regulation circuits using Zener diodes, and design and analyze clippers and clampers.
4. Apply biasing techniques and analyze the input and output characteristics of BJTs, ensuring stabilization and proper operation in various configurations.
5. Analyze the characteristics of JFETs and MOSFETs, understanding their construction and working principles for use in practical electronic applications.

UNIT-1: PN Junction diode

Principle of working, VI characteristics, Diode current equation. Diode Resistance-Static and Dynamic, Diffusion and Transition Capacitance, Equivalent circuit of Diode.

UNIT-II: Bipolar Junction Transistor

Principle of Operation, CE, CB, CC configurations, Input and output characteristics of CE and CB.

UNIT-III

Field Effect Transistors (FET): FET- Construction and principle of working Drain and Transfer Characteristics, MOSFET- Construction and principle of working characteristics (Enhancement and depletion mode).

Text Books

1. "Basic Electronics" by B.P.Singh, Ajay Kumar and Prabhat Ranjan,New Age International Publishers
2. "Basic Electronics" by D.P.Kothari and I.J.Nagarath, Mc Graw Hill Education.

Reference Books

1. "The Art of Electronics" by Paul Horowitz and Winfield Hill, Cambridge University Press
2. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky, Pearson Education
3. "Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education
4. "Electronics for Dummies" by Cathleen Shamieh, For Dummies (Wiley)
5. "Introduction to Electric Circuits" by Richard C. Dorf and James A. Svoboda, Wiley

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

English Language and Communication Skills Lab

Course Code: GR24A1020 **L/T/P/C : 0/0/2/1**
I Year II Semester

Course Outcomes: Students will be able to

1. Interpret the role and importance of various forms of communication skills.
2. Demonstrate the skills needed to participate in a conversation that builds knowledge collaboratively by listening carefully and respect others point of view.
3. Utilize various media of verbal and non-verbal communication with reference to various professional contexts.
4. Recognize the need to work in teams with appropriate ethical, social and professional responsibilities.
5. Speak and pronounce English intelligibly

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

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

Exercise I
CALL Lab:
Understand: Introduction to Phonetics – Speech Sounds – Consonant and Vowel Sounds.
Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants.
ICS Lab:
Understand: Ice Breaking and JAM.
Practice: Ice-Breaking Activity and JAM Session. Introducing oneself and others

Exercise II
CALL Lab:
Understand: Structure of Syllables– Weak Forms and Strong Forms in Context– Word Stress and Rhythm.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.
ICS Lab:
Understand: Features of Good Conversation – Non-verbal Communication.
Practice: Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions- Telephone Etiquette, Rapid Round –Memory Games.

Exercise III
CALL Lab:
Understand: Intonation--Errors in Pronunciation-the Influence of Mother Tongue (MTI).
Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronunciation.
ICS Lab:
Understand: Public Speaking – Exposure to Structured Talks.
Practice: Making a Short Speech – Extempore.

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

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

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab
2. Interactive Communication Skills (ICS) Lab

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Applied Physics Lab

Course Code: GR24A1018 **L/T/P/C:0/0/3/1.5**
I Year II Semester

Course Objectives:
1. Outline the characteristics of various semiconducting devices.
2. Identify the behavioral aspects of magnetic fields.
3. Demonstrate the quantum nature of radiation through photoelectric effect.
4. Apply the theoretical concepts of Lasers and optical fibers in practical applications.
5. Experiment with resonance phenomena using mechanical source.

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

List of Experiments:

1. Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode.

2. Solar Cell: To study the V-I Characteristics of solar cell.

3. Light emitting diode: To study V-I characteristics of light emitting diode.

4. Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.

5. Hall effect: To determine Hall co-efficient of a given semiconductor.

6. Photoelectric effect: To determine work function of a given material and Planck's constant.

7. LASER: To study the V-I characteristics of LASER sources.

8. Optical fiber: To determine the bending losses of Optical fibers.

9. Optical fiber: To determine the Numerical Aperture of Optical fibers.

10. Melde's experiment: To determine the frequency of a tuning fork using Melde's arrangement.

Note: Any 8 experiments are to be performed.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Data Structures Lab

Course Code: GR24A1024 **L/T/P/C: 0/0/2/1**
I Year II Semester

Course Outcomes:

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

TASK 1

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

TASK 2

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

TASK 3

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

TASK 4

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

TASK 5

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

TASK 6

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

TASK 7

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

TEXT BOOKS

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

REFERENCE BOOKS

1. Data Structures with C, Seymour Lipschutz, TMH
2. Classic Data Structures, 2/e, Debasis, Samanta, PHI, 2009
3. Fundamentals of Data Structures in C, 2/e, Horowitz, Sahni, Anderson Freed, University Press

II YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALOG CIRCUITS-I

Course Code: GR24A2054 **L/T/P/C: 3/0/2/3**
II Year I Semester

Course Objectives:

1. Explain the basic principles, operation, and characteristics of various types of amplifiers.
2. Describe the principles and applications of feedback in amplifiers and the operation of different types of oscillators.
3. Understand the design, operation, and performance characteristics of multistage amplifier configurations.
4. Explain the operation and performance of large signal amplifiers, including their applications and limitations.
5. Design and analyze various types of multivibrator circuits and understand their applications in electronics.

Course Outcomes: Students will be able to

1. Explain the fundamental principles and analyze the characteristics of various types of amplifiers.
2. Apply the concepts of feedback to amplifiers and analyze the operation of different types of oscillators.
3. Design and evaluate the performance of multistage amplifiers, understanding their advantages and challenges.
4. Analyze the operation and performance of large signal amplifiers and understand their practical applications.
5. Design and implement various multivibrator circuits, understanding their operation and applications in electronic systems.

UNIT-I
Diode Circuits: Rectifiers-Half wave rectifier, Full wave rectifier and Bridge Rectifier, Harmonic Components in a rectifier circuit, Inductor filter, Capacitor filter, Clipper and Clamper circuits, Breakdown mechanisms in Diodes, Zener diode as a voltage regulator.

UNIT-II
Biasing and Stabilization: BJT biasing, DC Equivalent Model, Criteria for fixing operating point, Fixed bias, Collector to base bias, Self bias techniques for Stabilization , Stabilization factors, Compensation techniques, Compensation against variation in VBE and ICO, Thermal run away, Thermal Stability

UNIT-III
Amplifiers: Small Signal low frequency amplifier circuits, h-parameter representation of a transistor, Analysis of Single Stage transistor amplifier using h-parameters: voltage gain, current gain, Input and Output impedance, Comparison of transistor amplifier configurations.

UNIT-IV
FET- Biasing Techniques
FET Amplifiers: Analysis of CS, CD, CG JFET Amplifiers, comparison of performance with BJT Amplifiers, Basic Concepts of MOSFET Amplifiers, MOS Small signal model, Common source

amplifier with resistive, Diode connected and Current source loads, Source follower, Common Gate Stage, Cascode and Folded Cascode Amplifier – frequency response.

UNIT-V

Multistage Amplifiers: Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Cascade RC Coupled amplifiers, Cascode amplifier, Darlington pair.

Transistor at High Frequency: Hybrid -Π model of Common Emitter transistor model, fα, fβ and unity gain bandwidth, Gain-bandwidth product.

Text Books

1. Jacob Millman, Christos C Halkias -Integrated Electronics, Tata McGraw Hill Education.
2. Electronic Devices and Circuit Theory - Robert L.Boylestad, Louis Nashelsky, 9 ed., 2008PE.

Reference Books

1. Electronic Devices and Circuits, S Salivahanan and N Suresh kumar, McGraw Hill Education.
2. Electronic Circuit Analysis – K. Lal Kishore, 2004, BSP.
3. Electronic Devices and Circuits, David A. Bell – 5 ed., Oxford University Press.

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GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIGITAL ELECTRONICS

Course Code: GR24A2055 **L/T/P/C: 3/0/0/3**
II Year I Semester

Course Objectives:

1. To study the theory of Boolean algebra and to study representation of switching functions using Boolean expressions and their minimization techniques.
2. To study the combinational logic design of various logic and switching devices and their realization.
3. To study the sequential logic circuit design both in synchronous and Asynchronous modes for various complex logic and switching devices, their minimization techniques
4. To study the sequential elements like registers, counters and their usage in the real world.
5. To understand characteristics of memory and their classification, concept of Programmable devices, PLA, PAL and CPLD

Course Outcomes:

1. Aware of theory of Boolean algebra, Logic gates & the underlying features of various number systems.
2. Use the concepts of Boolean algebra for the analysis & design of various combinational logic circuits.
3. Use the concepts of Boolean algebra for the analysis & design of various sequential logic Circuits.
4. Apply the fundamental knowledge of analog and digital electronics to design different circuit elements like registers and counters which are very useful for real world with different changing circumstances.
5. Classify different semiconductor memories, Design various logic gates starting from simple ordinary gates to complex programmable logic devices & arrays.

UNIT-I

Boolean algebra & Logic Gates: Number systems, Number- Base Conversions, Signed Binary Numbers, Binary Codes, Axiomatic Definition of Boolean Algebra, Basic Theorems, Boolean Functions, Canonical and standard Forms. Logic Gates: Digital Logic Gates, NAND and NOR Implementation, Exclusive-OR Function, Integrated Circuits, Gate-level Minimization, The K- Map Method, Four- Variable Map, Don't-care Conditions.

UNIT-II

Combinational logic circuits: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations. Digital ICs: IC74138 3-8 Decoder, IC74151 Multiplexer, IC74155 Demultiplexer, 4-bit Parallel Binary Adder/Subtractor, IC7485 Comparator).

UNIT-III

Sequential Logic circuits: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from

one type of Flip-Flop to another. Digital ICs: IC7474 Flip- flops, IC7490 & IC74193.

UNIT-IV

Registers and Counters: Registers and Counters: Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters. Digital ICs: Counters, IC74194&195 Shift Registers

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UNIT-V

Memory and Programmable Logic: Types of Memories, Random-Access Memory, Read-Only Memory, Memory Operations, Timing waveform, Memory Decoding, Internal Construction, Address Multiplexing, PROM, Combinational PLDs, Programmable Logic Array, Programmable Array Logic.

Text Books:

1. M Morris Mano and Michael D.Ciletti, Digital Design, Pearson 6th ed2018.
2. Switching and Finite Automata Theory - Zvi Kohavi & Niraj K. Jha, 3rdEdition,Cambridge, 2010.
3. Charles H.Roth Jr.,Larry L. Kinney, Fundamentals of Logic Design, Cengaue learning6th edition, 2013

Reference Books:

1. Modern Digital Electronics – R. P. Jain, 3rd edition, 2007- Tata McGraw-Hill.
2. Reference Book: Designing of TTL Intergrated circuits Robert L Moris
3. Switching Theory and Logic Design – A Anand Kumar, PHI, 2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SIGNALS AND SYSTEMS

Course Code: GR24A2056 **L/T/P/C: 2/1/0/3**
II Year I Semester

Course Objectives:

1. To understand the basic concepts of Continuous Time Signals (CTS) and Discrete Time Signals (DTS) and their properties
2. To interpret the CTS as a sum of infinite orthogonal functions and analyse their working in time and frequency domains.
3. To employ the transformation techniques like Fourier, Laplace and Z-transforms
4. To represent the CT System in mathematical form and acquire knowledge of the properties and vital concepts of systems to work in application areas like filtering, communication and signal processing.
5. To apply the concepts of sampling process of analog signals and A/D and D/A conversions.

Course Outcomes:

1. Explain the fundamentals and detailed mathematical analysis of deterministic CTS and DTS and their spectra
2. Represent a deterministic CTS in terms of Fourier series and analyze its frequency spectra
3. Discriminate the application of Fourier, Laplace and Z-transforms appropriately on CTS and DTS
4. Analyze the effect of convolution on LTI systems and their working in time and frequency domains
5. Design basic filters for signal processing by applying the band-limited sampling theorem concepts.

UNIT-I

Introduction to Continuous-time Signals and Fourier series

Part-A: Representation of Continuous-time Signals: Introduction to typical signals; Time-domain operations; Continuous-time signal characteristics (periodicity, frequency, deterministic and random, symmetry, energy and power); Analogy between vectors and signals; Orthogonal signal space; Signal approximation using orthogonal functions; Mean squared error; Orthogonality in complex functions.

Part-B: Fourier Series: Representation of continuous-time periodic signals by Trigonometric and Exponential Fourier series; Dirichlet's conditions; Properties of Fourier series, Parseval's theorem; Complex Fourier spectrum, Power Spectrum.

UNIT-II

Fourier Transform, and Laplace Transform: Fourier transform via Fourier series; Convergence of Fourier transform; Fourier transforms of basic signals like impulse function, unit step, signum function and for various periodic and aperiodic signals; Properties of Fourier transforms, Parseval's theorem; Definition of two-& one-sided Laplace Transform (LT), Relation between LT and FT, Region of convergence (ROC) and Properties of LT.

UNIT-III

Signal Transmission through Linear Systems Continuous-time Linear Time-Invariant systems Representation by differential equations, Properties of continuous-time systems (linearity, time invariance, causality and stability); Impulse response, Convolution; Transfer function, frequency response; Ideal vs. realizable LPF, HPF and BPF characteristics; Signal bandwidth, system bandwidth, rise-time, gain-bandwidth; Distortion; Causality and Paley-Wiener criterion for physical realization.

UNIT-IV

Discrete Time signal characteristics (periodicity, frequency, deterministic, random, symmetry, energy and power), Discrete Time (DT) signal representation using complex exponential and sinusoidal components; z-Transform of a discrete sequence; Relationship between z-Transform and Discrete Time Fourier Transform; Transfer function of a LTI system (No difference equations); Region of convergence of z-Transform, Constraints on ROC for various classes of signals; Properties of z-Transform, Inverse z-Transform by Partial Fractions (simple poles only).

UNIT-V

Sampling: Sampling theorem – Graphical and analytical proof for Band Limited Signals; Impulse-train sampling; Reconstruction of signal from its samples; Undersampling and Aliasing; Natural and Flat-top sampling, Band pass sampling.

Text/Reference Books

1. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, "Signals and Systems", Second Edition, PHI Learning, New Delhi, 2007.
2.B. P. Lathi, Signals, Systems and Communications-B.S. Publications, 2003.
3. Simon Haykin and Barry Van Veen, "Signals and Systems", Edition, John Wiley and Sons, 2002.
4. Principles of Communication Systems by GoutamSaha,Herbert Taub& Donald Schilling, III Edition, Tata Mc graw Hill Education Private Limited
5. M J Roberts, "Signals and Systems",2e, TMH, 2012.
6. Hwei P. Hsu, "Signals and Systems", 3e, McGraw Hill Education,2014.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROBABILITY THEORY AND STOCHASTIC PROCESSES

Course Code: GR24A2057 **L/T/P/C: 2/1/0/3**
II Year I Semester

Prerequisites:

1. Set theory
2. Calculus
3. Signals and Systems

Course Objectives:

1. To study fundamentals of probability theory and random variables and study characteristics of basic random variables of communication engineering interest.
2. To study operations that are carried out on a single random variable.
3. To study operations that are carried out on a joint random variable.
4. To study random processes in time and frequency domain.
5. To study response of LTI systems fed with a random process and study noise performance of systems.

Course Outcomes:

1. The student should be able to model sample spaces and events for various real-world problems, find probability of various real-world events and apply characteristics of random variables like CDF and PDF.
2. The student should be able to find moments of a given random variable.
3. The student should be able to find joint moments of given random variables.
4. The student should be able to analyse whether given processes are uncorrelated, orthogonal and statistically independent.
5. The student should be able to evaluate statistics and power spectrum of response of an LTI system fed with a random process and evaluate various noise characteristics of a given system.

UNIT-I: INTRODUCTION TO PROBABILITY

Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Bayes Theorem, Independent Events, Random Variable, Functions of random variable, Discrete and Continuous, Mixed Random Variable, Distribution and Density functions, Binomial, Poisson, Uniform, Gaussian Distribution.

UNIT-II: OPERATIONS ON SINGLE VARIABLE – EXPECTATIONS

Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a

Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable.

UNIT-III: OPERATIONS ON MULTIPLE RANDOM VARIABLES – EXPECTATIONS

Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem (proof not included), Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Gaussian Random Variables.

UNIT-IV: RANDOM PROCESSES -TEMPORAL AND SPECTRAL CHARACTERISTICS

The Random process, classification, deterministic and non-deterministic processes, distribution and density Functions, stationarity and statistical independence, first-order stationary processes, second-order and wide-sense stationarity, auto correlation function and its properties, cross-correlation function and its properties, covariance functions, Gaussian random processes. Ergodicity.
The Power Spectrum: Properties, Relationship between Power Spectrum and Auto-correlation Function, Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

UNIT-V: RANDOM SIGNAL RESPONSE OF LINEAR SYSTEMS AND MODELLING OF NOISE

Temporal Characteristics of System Response: Random signal response of linear systems, auto-correlation and cross-correlation functions of input and output.
Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.
Types of Noise: Resistive (Thermal) Noise Source, Shot noise, Extra terrestrial Noise, Arbitrary Noise Sources,White Noise, Modeling of Noise Sources, Average Noise Bandwidth, Effective Noise Temperature, Average Noise Figures, Average Noise Figure of cascaded networks.

Text Books:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001
2. Probability, Random Variables and Stochastic Processes - Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.
3. Random Processes for Engineers-Bruce Hajck, Cambridge unipress,2015

Reference Books:

1. Probability, Statistics & Random Processes-K .Murugesan, P. Guruswamy, Anuradha Agencies, 3rd Edition, 2003.
2. Digital Modulations using Matlab: Build Simulation Models from Scratch- Mathuranathan Viswanathan-ebook, 2017

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

NETWORK ANALYSIS

Course Code: GR24A2058 **L/T/P/C: 3/1/0/4**
II Year I Semester

Course Objectives:
1. To distinguish basic concepts, techniques and applications of Electrical circuits
2. To describe various fundamental techniques for analysis of electrical circuits.
3. To apply the working principles of linear constant coefficient differential equations with the help of Laplace Transforms in electric circuits
4. To solve and compile the techniques like cut-set, tie-set, pole zero parameters and its stability
5. To compare the transient analysis with different network models

Course Outcomes:
1. Comprehend the mathematical expression for voltages and currents in RL, RC and RLC circuits to find the transient response of inductor and capacitor in dc circuits.
2. Analyze the concept with working principles of linear constant coefficient differential equations with the help of Laplace transforms.
3. Know the basic skills of an ac circuits with independent/dependent voltage current sources by drawing impedance/admittance diagrams or using various laws/techniques like source conversion.
4. Discriminate the concepts like cut-set, tie-set, pole zero parameters and stability analysis
5. Interpolate the two-port network parameters, conversion between parameters, interconnection of two port networks.

UNIT-I
Network Elements: Review of R, L,C circuits, Self and Mutual inductances, dotconvention, impedance, reactance concept, Impedance transformation and coupled circuits, co- efficient of coupling, Analysis of multi-winding coupled circuits.

UNIT-II
Steady State & Transient Analysis: Steady state and transient analysis of RC, RL and RLC Circuits, Circuits with switches, step response, 2nd order series and parallel RLC Circuits, damping factor, over damped, under damped, critically damped cases.

UNIT-III
S domain analysis of circuits: Review of Laplace Transform - Transformation of a circuit into S-domain - Transformed equivalent of inductance, capacitance and mutual inductance - Impedance and admittance in transform domain - Node analysis and Mesh analysis of the transformed circuit.

UNIT-IV
Network Topology: Network terminology - Graph of a network - Incidence and reduced incidence matrices – Cutsets - Fundamental cutsets - Cutset matrix – Tiesets, Network functions:

Poles and zeros of network functions, Restrictions on poles and zeros for driving point function and transfer function.

UNIT-V

Two Port Network Parameters: Open circuit impedance (Z) parameters - short circuit admittance(Y) parameters - transmission (ABCD) parameters and inverse transmission parameters - Hybrid (h) parameters and inverse hybrid parameters - Conversion between parameters, Standard T, Pi Sections, Image parameters, Lattice networks.

Text Books

1. William H. Hayt Jr. and Jack E. Kemmerly, 'Engineering Circuit Analysis', 6th Edition, McGraw Hill 2008.
2. Network Analysis – ME Van Valkenburg, Prentice Hall of India, 3 rd Edition, 2000.
3. Networks, Lines and Fields - JD Ryder, PHI, 2 nd Edition, 1999.

Reference Books

1. Electric Circuits – J. Edminister and M.Nahvi – Schaum's Outlines, MCGRAW HILL EDUCATION, 1999.
2. Network Theory – Sudhakar and Shyam Mohan, Mc-Graw Hill Education 2016

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALOG CIRCUITS-I LAB

Course Code: GR24A2059 **L/T/P/C: 0/0/3/1.5**
II Year I Semester

Course outcomes: Students will be able to

1. Understand and analyze the forward and reverse bias characteristics of PN junction diodes.
2. Design, construct, and evaluate the performance of full-wave rectifiers with and without filters.
3. Examine and interpret the characteristics of BJTs in Common Base (CB) and Common Emitter (CE) configurations.
4. Verify and comprehend the V-I characteristics of JFETs and MOSFETs.
5. Design and analyze various amplifier circuits, as well as different types of clipper and clamper circuits.

LIST OF EXPERIMENTS

Hardware for the first seven experiments and simulation of experiments 8, 9, 10, 11, and 12 using Multisim software.

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Full Wave Rectifier with & without filters
3. Characteristics of a BJT under CB Configuration
4. Characteristics of a BJT under CE Configuration
5. Verify Characteristics of a JFET under CS configuration.
6. Verify the V-I Characteristics of MOSFET.
7. Design a Self-bias Circuit and determine the Q-point of the Transistor.
8. Design a Common Emitter Amplifier
9. Design a two stage RC Coupled amplifier.
10. Verify Darlington pair Amplifier.
11. Types of Clipper circuits.
12. Types of Clamper circuits.

Lab Methodology: -
Lab experiments with Hardware and Software: Hardware: Analog Discovery;
Software: - Multisim 14.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIGITAL ELECTRONICS LAB

Course Code: GR24A2060 **L/T/P/C: 0/0/3/1.5**
II Year I Semester

Course Outcomes:

1. Explain theory of Boolean Algebra & the underlying features of various number systems.
2. Analyze the various coding schemes are the part of the digital circuit design.
3. Construct basic combinational circuits and verify their functionalities.
4. Apply the design procedures to design various sequential logic circuits.
5. Design of various circuits with the help of VERILOG Coding techniques.

LIST OF EXPERIMENTS

TASK-1 Realization of Logic GATEs

TASK-2 Adders

TASK-3 Magnitude comparator

TASK-4 Binary to Gray and Gray to Binary converter

TASK-5 Encoder & Decoder

TASK-6 Parity Checker

TASK-7 SR and JK flipflops

TASK-8 D and T Flip-Flops

TASK-9 Frequency Divider

TASK-10 Left and Right Shift Register

TASK-11 Serial to Parallel and Parallel to Serial converter

TASK-12 Binary Counter

TASK-13 Asynchronous BCD Up counter

TASK-14 Synchronous down counter

TASK-15 MOD 5 and MOD 10 counters

Lab Methodology: -
Lab experiments with suitable simulation Software.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SIGNALS AND SYSTEMS LAB

Course Code: GR24A2061 **L/T/P/C: 0/0/2/1**
II Year I Semester

Course Outcomes:

1. Understand basics of MATLAB syntax, functions and programming.
2. Generate and characterize various continuous and discrete time signals.
3. Design and analyze linear time-invariant (LTI) systems and compute its response.
4. Analyze the spectral characteristics of signals using Fourier analysis, Laplace transform and Z-transform.
5. Process continuous-time signals by first sampling and then processing the sampled signal in discrete-time and employ for signal processing applications.

LIST OF EXPERIMENTS

1. Perform Basic Matrix Operations with the help of Matlab program.
2. Illustrate the basic periodic and aperiodic signals/sequences with the help of Matlab Program.
3. Write a Matlab Program to perform the basic operations like Addition, Multiplication, Folding, Shifting, and Flipping, evaluating Energy and Power for various periodic and aperiodic signals.
4. Segregate with the help of Matlab program Even, Odd, Real and Imaginary parts of given signal/sequence.
5. Verify Gibb's phenomenon for the various periodic waveforms by Fourier series representation.
6. Find the Fourier Transform of (not limited to)
   a. A b. u(t) c. A.e-tu(t) d. Ate-tu(t) e. ACosωt
7. i.Find the Laplace transform of(not limited to)
   a.Sin(ωt) b. Sin(ω(t-1))
   ii. Find Inverse Laplace Transform of Y(s)= 24/s(s+8)
8. a.Prove that the given system y(t)=t*x(t) is linear in nature.
   b.Prove that the given system y(n)=n*x(n)+n2*x2(n) is Time Variant.
9. For any given LTI system, compute the Impulse Response.
10. Demonstrate Convolution of two continuous time signals and discrete time sequences with the help of Matlab program.
11. Evaluate the Z-Transform of
    a.n b. an c. n.an d. e(-a*n*t)
12. Locate the Poles and Zeros of a given Transfer function in S-Plane and Z-Plane respectively

a. $H(s)=\frac{s^2-2s+1}{s^3+6s^2+11s+6}$ b. $H(z)=\frac{-1+z^{-1}}{1+z^{-1}+0.16z^{-2}}$

13. Verify the Sampling Theorem for various conditions prevailing between Sampling Frequency (fs) and Message Frequency (fm)
    a.fs<2 fm b. fs=2 fm c.fs>2fm
14. Perform Auto Correlation and Cross Correlation on various sequences with the help of Matlab program.

Text/Reference Books

1. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, "Signals and Systems", Second Edition, PHI Learning, New Delhi, 2007.
2. B. P. Lathi, Signals, Systems and Communications-B.S. Publications, 2003.
3. Simon Haykin and Barry Van Veen, "Signals and Systems", Edition, John Wiley and Sons, 2002.
4. Principles of Communication Systems by GoutamSaha,Herbert Taub& Donald Schilling, III Edition, Tata Mc graw Hill Education Private Limited
5. M J Roberts, "Signals and Systems",2e, TMH, 2012.
6. Hwei P. Hsu, "Signals and Systems", 3e, McGraw Hill Education,2014.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING & TECHNOLOGY
OOPS THROUGH JAVA LAB

Course Code: GR24A2062 **L/T/P/C: 0/0/2/1**
II Year I Semester

Course Outcomes

1. Write basic Java programs, Identify classes, objects, members of a class and relationshipsamong them needed for a specific problem.
2. Write Java application programs using OOP principles and proper program structuring.
3. Demonstrate the concepts of polymorphism and inheritance.
4. Write JAVA programs to demonstrate method overloading, overriding.
5. Explain the benefits of JAVA's Exceptional handling mechanism compared to other Programming Language.

Task 1

Write a program to print the area of a rectangle by creating a class named 'Area' having two methods. First method named as 'setDim' takes length and breadth of rectangle as parameters and the second method named as 'getArea' returns the area of the rectangle. Length and breadth of rectangle are entered through keyboard

Task 2: Write java programs that implement the following

a) Constructor
b) Parameterized constructor
c) Method overloading
d) Constructor overloading.

Task 3

a) Write a Java program that checks whether a given string is a palindrome or not.
b) Write a Java program for sorting a given list of names in ascending order.
c) Write a Java program that reads a line of integers, and then displays each integer and the sum of all the integers (Use StringTokenizer class of java.util)

Task 4: Write java programs that uses the following keywords

a) this
b) super
c) static
d) final

Task 5

a) Write a java program to implement method overriding
b) Write a java program to implement dynamic method dispatch.
c) Write a Java program to implement multiple inheritance.
d) Write a java program that uses access specifiers.

Task 6

a) Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
b) Write a Java program that reads a file and displays the file on the screen, with a line
c) n umber before each line.
d) Write a Java program that displays the number of characters, lines and words in a text file

Task 7

a) Write a Java program for handling Checked Exceptions.
b) Write a Java program for handling Unchecked Exceptions.

Task 8

Write a Java program that creates three threads. First thread displays "Good Morning" one second, the second thread displays "Hello" every two second and the third thread displays "Welcome" every three seconds.

Task 9

a) Develop an applet that displays a simple message.
b) Develop an applet that receives an integer in one text field and computes its factorial value and returns it in another text field when the button named "Compute" is clicked

Task 10

Write a Java program that works as a simple calculator. Use a grid layout to arrange button for the digits and for the +, -,*, % operations. Add a text field to display the result.

Task 11

a) Write a Java program for handling mouse events.
b) Write a Java program for handling key events.

Task 12

Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields Num1 and Num 2. The division of Num1 and. Num2 is displayed in the Result field when the Divide button is clicked. If Num1or Num2 were not an integer, the program would throw Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception and display the exception in a message dialog box.

Task 13

a) Write a java program that simulates traffic light. The program lets the user select one of three lights: red, yellow or green. When a radio button is selected, the light is turned on, and only one light can be on at a time. No light is on when the program starts.
b) Write a Java program that allows the user to draw lines, rectangles and ovals.

Text Books:

1. Java; the complete reference, 7th editon, Herbert Schildt, TMH.
2. Introduction to Java programming, Sixth edition, Y.Daniel Liang, Pearson Education.

Reference Books:

1. Java: How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education.

Big Java, 2nd edition, Cay Horstmann, Wiley Student Edition, Wiley India Pvt Ltd.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

VALUE ETHICS AND GENDER CULTURE

Course Code: GR24A2002 **L/T/P/C: 2/0/0/0**
II Year I Semester

Course Outcomes: On completion of the course, the student will be able to

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, Michael J Rabins, 4e, Cengage learning, 2015.
4. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008

II YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTATIONAL MATHEMATICS FOR ENGINEERS

Course code:GR24A2008 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Outcomes

1. Apply well known techniques to find real roots of an equation and linear algebraic systems byiterative 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 heatconduction

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

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

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

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

UNIT-V: Numerical solution initial and boundary value problems in PDE
Solution of Laplace's equation by Jacobi, Gauss-Seidel method and Successive over relaxation(SOR) methods, Solution of Heat equation by the finite difference method.

TEXT BOOKS

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

Microcontrollers

Course Code: GR24A2063 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Outcomes:

1. Known the internal architecture, organization and assembly language programming of 8086 processors.
2. Known the internal architecture, organization and assembly language programming of 8051/controllers
3. Learn the interfacing techniques to 8086 and 8051 based systems.
4. Known the internal architecture of ARM processors and basic concepts of advanced ARM processors.
5. Design various programs to run several applications

UNIT-I

8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT-II

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

UNIT-III

I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

UNIT-IV

ARM Architecture: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT-V

Advanced ARM Processors: Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

TEXT BOOKS:

1. A. K. Ray and K. M. Bhurchandani -Advanced Microprocessors and Peripherals, TMH, 2nd Edition 2006.
2. Andrew N SLOSS, Dominic SYMES, Chris WRIGHT -ARM System Developers guide, Elsevier, 2012

REFERENCE BOOKS:

1. Kenneth. J. Ayala-The 8051 Microcontroller, Cengage Learning, 3rd Ed, 2004.
2. D. V. Hall -Microprocessors and Interfacing, TMGH, 2nd Edition, 2006.
3. K. Uma Rao, Andhe Pallavi-The 8051 Microcontrollers, Architecture and Programming and Applications, Pearson, 2009.
4. Donald Reay-Digital Signal Processing and Applications with the OMAP- L138 Experimenter, WILEY 2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ANALOG CIRCUITS-II

Course Code: GR24A2065 **L/T/P/C: 2/1/0/3**
II Year II Semester

Course Objectives:

1. Explain the concepts and classifications of feedback amplifiers, and analyze the effects of negative feedback on amplifier characteristics.
2. Understand the conditions for oscillations and analyze the design and stability of various RC and LC oscillators, including crystal oscillators.
3. Describe the operation, configurations, and efficiency of different classes of large signal amplifiers, including Class A, B, AB, C, and D.
4. Understand the principles and design of single and double-tuned amplifiers, and analyze their frequency response and Q-factor.
5. Design and analyze bistable, monostable, and astable multivibrators, as well as Schmitt triggers using transistors.

Course Outcomes: Students will be able to

1. Explain the concepts of feedback in amplifiers, classify different types of feedback amplifiers, and analyze the impact of feedback on amplifier performance through simple problems.
2. Design, implement, and analyze RC and LC oscillators, including Hartley, Colpitts, and crystal oscillators, and understand the conditions for stable oscillations.
3. Describe and evaluate the performance of Class A, B, AB, C, and D amplifiers, understanding their operation, configurations, and conversion efficiencies.
4. Design single and double-tuned amplifiers, analyze their frequency response and Q-factor, and understand the concepts of stagger tuning and synchronous tuning.
5. Design and analyze bistable, monostable, and astable multivibrators, as well as Schmitt triggers using transistors, for various practical applications.

UNIT-I

Feedback Amplifiers: Concepts of feedback – Classification of feedback amplifiers – General characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple Problems

UNIT-II

Oscillators: Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators, Crystal Oscillator.

UNIT-III

Large Signal Amplifiers: Class A Power Amplifier- Series fed and Transformer coupled, Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Principle of operation of Class AB and Class –C and D Amplifiers.

UNIT-IV

Tuned Amplifiers: Introduction, single Tuned Amplifiers – Q-factor, frequency response, Double Tuned Amplifiers – Q-factor, frequency response, Concept of stagger tuning and synchronous tuning.

UNIT-V

Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

TEXT BOOKS:

1. Jacob Millman, Christos C Halkias - Integrated Electronics, , McGraw Hill Education.
2. J. Millman, H. Taub and Mothiki S. PrakashRao - Pulse, Digital and Switching Waveforms – 2nd Ed., TMH, 2008,

REFERENCE BOOKS:

1. David A. Bell - Electronic Devices and Circuits, 5th Ed., Oxford.
2. Robert L. Boylestead, Louis Nashelsky - Electronic Devices and Circuits theory, 11th Ed., Pearson, 2009
3. David A. Bell - Pulse, Switching and Digital Circuits, 5th Ed., Oxford, 2015.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INTEGRATED CIRCUITS AND APPLICATIONS

Course Code: GR24A2064 **L/T/P/C: 3/0/0/3**

II Year II Semester

Course Objectives:

1. Explain the basic principles and characteristics of operational amplifiers (op-amps) and their ideal behavior.
2. Design and analyze various op-amp circuits such as amplifiers, comparators, integrators, and differentiators for different applications.
3. Design and analyze active filter circuits using op-amps, including low-pass, high-pass, band-pass, and band-stop filters.
4. Understand the operation and applications of the IC555 timer in monostable, astable, and bistable modes.
5. Explain the principles and operation of analog-to-digital (A/D) and digital-to-analog (D/A) converters, and analyze their performance characteristics.

Course Outcomes: Students will be able to

1. Explain the principles of op-amps and apply them to design basic circuits with desired characteristics.
2. Design and implement various op-amp circuits such as amplifiers, comparators, integrators, and differentiators for specific applications.
3. Design, simulate, and analyze active filter circuits and oscillators using op-amps for different frequency ranges and responses.
4. Implement and analyze circuits using the IC555 timer in different modes, understanding their timing characteristics and applications.
5. Analyze the principles of A/D and D/A converters, design basic converter circuits, and evaluate their performance in terms of accuracy and resolution.

UNIT– I Block diagram of Operational Amplifier (Op-Amp), Op-Amp DC and AC Characteristics, Op-Amp open loop and closed configurations, Modes of Operation – Inverting, Non-Inverting, and Differential. Classification of Integrated Circuits, Features of IC 741 and LM 324.

UNIT– II Op-Amp Applications- Waveform Generators, Instrumentation Amplifier, Sample and hold circuit, Differentiator, Integrator, Schmitt Trigger, Comparators, Voltage Controller Oscillator.

UNIT– III Active Filters and Oscillators- Types of Filters, Active Filters, First and Second order Filters, Butter worth Filters and Chebshev Filters-LPF, HPF, BPF, Notch Filter and All Pass Filters, RC Phase Shift Oscillator, Wein Bridge Oscillator.

UNIT– IV IC555 Timer – Functional Diagram, Monostable, and Astable Operations, Applications, Voltage Regulators, IC723 Regulator, Three Terminal Voltage Regulators IC 7805,7809 and 7912.

UNIT– V Basic DAC techniques, types of DACs-Weighted Resistor, R-2R ladder and Inverted R-2R DAC, ADCs – Flash type, ADC, Counter type ADC, Successive Approximation ADC and Dual Slope ADC.

Text Books

1. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003. 2. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005.
2. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2ndEd., 2003. 2. Operational Amplifiers with Linear Integrated Circuits by K.Lal Kishore – Pearson, 2009.

Reference Books

1. "Operational Amplifiers and Linear Integrated Circuits" by Robert F. Coughlin and Frederick F. Driscoll, Pearson Education
2. "Design with Operational Amplifiers and Analog Integrated Circuits" by Sergio Franco, McGraw-Hill Education
3. "Active Filter Design" by H.E. Newcomb, McGraw-Hill Education
4. "Timer, Op Amp, and Optoelectronic Circuits and Projects" by Forrest M. Mims III, Master Publishing, Inc.
5. "Analog-Digital Conversion" by Stuart Ball, Oxford University Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ANALOG AND DIGITAL COMMUNICATIONS

Course Code: GR24A2066 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Outcomes: Upon completing this course, the student will be able to

1. Design and analyze various Amplitude Modulation and Demodulation techniques for given specifications.
2. Design and analyze various Frequency Modulation and Demodulation techniques for given specifications.
3. Implement the Pulse Modulation techniques in various applications and apply the knowledge to design an optimal baseband communication system.
4. Design and analyze various Digital Modulation and Demodulation techniques for given specifications.
5. Apply the knowledge of Source coding algorithms while designing the Digital Communication system.

UNIT I

Amplitude Modulation and Demodulation: Introduction to Communication Systems and modulation, Amplitude Modulation: –Concepts and expressions of AMDSBSC, AMDSBFC, SSB modulation. Spectra of AMDSBSC, AMDSBFC, SSB modulation. System level generation and detection of AMDSBSC, AMDSBFC, SSB modulation. Noise performance analysis of AMDSBFC. Superheterodyne receiver, Intermediate frequency, Image frequency, FDM.

UNIT II

Angle Modulation: Concepts and expressions of, Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band and Wide band FM, Generation of FM Waves: Direct and Indirect Methods. Detection of FM Waves: Balanced Frequency discriminator, Phase locked loop. FM receiver, Noise performance analysis of FM, Pre-emphasis and De-emphasis.

UNIT III

Pulse modulation and Baseband Communication PAM, PWM, PPM, PCM, Quantization noise, DM, ADM, DPCM and TDM, Optimum Receiver, Matched filter, Intersymbol Interference and Nyquist criterion for distortion less binary baseband transmission

UNIT IV

Digital Modulation Techniques BASK, BFSK, BPSK, Differential PSK, QPSK, QAM signal models, Generation and Coherent Detection, Geometrical Representation, Spectrum, Error Probabilities of BASK, BPSK and BFSK.

UNIT V

Information Theory Discrete Memoryless source, Information, Entropy, Mutual Information, Discrete Memoryless channels, Binary Symmetric Channel, Channel Capacity: Shannon Hartley theorem, Source coding theorem: Shannon - Fano & Huffman codes.

Textbooks:

1. An introduction to analog and digital communications, Haykin, SimonS.Vol.1. NewYork:

Wiley,1989.
2. Analog and digital communications, Sanjay Sharma
3. Communication Systems-Simon Haykin, John Wiley,5thEd.2009
4. Principles of Communication Systems- Herbert Taub, DonaldL Schiling, GoutamSaha,3rd Edition, Mcgraw- Hill, 2008.

Reference Books:

1. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, 2009, PHI.
2. Electronic Communications – Dennis Roddy and John Coolean , 4th Edition , PEA, 2004
3. Electronics & Communication System – George Kennedy and Bernard Davis , TMH 2004
4. Analog and Digital Communication – K. Sam Shanmugam, Willey ,2005

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MICROCONTROLLERS LAB

Course Code: GR24A2067 **L/T/P/C: 0/0/2/1**
II Year II Semester

Course Outcomes:

1. Acquire the knowledge of 8051and Arduino Uno microcontroller architecture & its programming.
2. Work on Arduino Uno and 8051 microcontroller-based boards.
3. Interface different peripherals with Microcontroller.
4. Implement a wireless based Monitoring and appliance control System.
5. Define and design a project on the exposure with AVR/8051.

Task-1: 8051 Microcontroller Programming Using Keil IDE.

1.8051 Assembly Language Programs for Arithmetic and Logical Operations.
2.8051 Serial Data Communication.
3. 8051Timers programming in mode 0, mode 1 and mode 2
4.8051 I/O port programming
5.8051 Interrupt programming
6. 8051 programming with branch instructions

Task-2: Embedded C/Arduino Programming Using Arduino Uno Boards and Arduino IDE/Experiments to be carried out on Cortex-M3 development boards and using GNU tool chain

1. Blink an LED with software delay, delay generated using the SysTick timer.
2. System clock real time alteration using the PLL modules.
3. Control intensity of an LED using PWM implemented in software and hardware.
4. Control an LED using switch by polling method, by interrupt method and flash the LED once every five switch presses.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ANALOG CIRCUITS-II AND ICA LAB

Course Code: GR24A2068 **L/T/P/C: 0/0/3/1.5**
II Year II Semester

Course Outcomes: Students will be able to

1. Design, verify, and analyze various types of amplifiers, including voltage series feedback, current shunt feedback, and class B power amplifiers.
2. Design and verify the functionality of different oscillator circuits, such as RC phase shift, and Colpitt's, oscillators.
3. Understand and verify the characteristics and applications of Op-Amp inverting and non-inverting amplifiers, as well as adder and subtractor circuits.
4. Design and verify function generators, active filters (LPF & HPF), and IC 555 Timer circuits in monostable and astable modes.
5. Design and verify the operation of digital-to-analog converters using weighted and R-2R ladder techniques.

List of Experiments

Cycle-I

1. Design and verify Voltage Series Feedback amplifier
2. Design and verify current shunt feedback amplifier
3. Design and verify RC Phase shift Oscillator
4. Design and verify Colpitt's Oscillators
5. Design class B power amplifier and draw the input and output waveforms.
6. Design a single tuned voltage amplifier.

Cycle-II

1. Verify Op-Amp Inverting and Non-Inverting Amplifiers.
2. Verify Adder, Subtractor circuits with waveforms
3. Design and verify Function Generator.
4. Design and verify Active Filter LPF&HPF (first order)
5. Design and verify IC 555 Timer – Monostable and Astable Multivibrator
6. Oscillators-RC& Wein Bridge
7. DAC-Weighted and R-2R

Lab Methodology: -

Lab experiments with Hardware and Software: Hardware: Analog Discovery;
Software: - Multisim 14.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ANALOG AND DIGITAL COMMUNICATIONS LAB

Course Code: GR24A2069 **L/T/P/C: 0/0/3/1.5 II Year II Semester**

Course Outcomes: Upon completing this course, the student will be able to

1. Design and implement various Analog modulation and demodulation techniques and observe the time and frequency domain characteristics
2. Design and implement various Pulse modulation and demodulation techniques and observe the time and frequency domain characteristics.
3. Design and implement various Digital modulation and demodulation techniques and observe the waveforms of these modulated Signals practically.
4. Transmit and receive various types of signals using Frequency Division & Time Division Multiplexing & De multiplexing.
5. Analyze the effect of noise present in continuous wave and angle modulation techniques.

LIST OF THE EXPERIMENTS/TASKS

(All the experiments can be done either using hardware or using MATLAB)

TASK-1: (i) Amplitude Modulation and Demodulation (ii) Spectrum analysis of AM

TASK-2: (i) DSB-SC Modulator & Demodulator (ii) Spectrum Analysis of DSBSC

TASK-3: (i) SSB-SC Modulator & Demodulator (ii) Spectrum Analysis of SSBSC

TASK-4: (i) Frequency modulation and demodulation (ii) Spectrum analysis of FM (iii) Pre emphasis and De emphasis

TASK-5: Frequency Division Multiplexing & De multiplexing

TASK-6: Pulse Amplitude Modulation & Demodulation

TASK-7: Pulse Width Modulation & Demodulation

TASK-8: Pulse Position Modulation & Demodulation

TASK-9: PCM Generation and Detection

TASK-10: Delta Modulation

TASK-11: Non Uniform Quantization-(i) μ-Law (ii) A-law using Matlab

TASK-12: Amplitude Shift Keying: Generation and Detection

TASK-13: Frequency Shift Keying: Generation and Detection

TASK-14: Binary Phase Shift Keying: Generation and Detection

TASK-15: Generation and Detection (i) DPSK (ii) QPSK

TASK-16: Time Division Multiplexing

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

Course Code: GR24A2106 **L/T/P/C:0/0/4/2**
II Year II Semester

Course Outcomes:

At the end of this course, students will be able to:

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. Analyse 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.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING & TECHNOLOGY
ENVIRONMENTAL SCIENCE

Course Code: GR24A2001 **L/T/P/C: 2/0/0/0**
II Year I Semester

Course Pre-Requisites: Basic knowledge of environmental issues

Course Outcomes:

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

UNIT I: INTRODUCTION AND AWARENESS ACTIVITIES

Environmental Science: Introduction, Definition, scope and importance.
AWARENESS ACTIVITIES
Small group meetings about:

- Water management
- Waste water treatment
- Projects Vs Environment
- Zero waste management
- Circular economy
- Impact of Science & Technology on Environment
- E-waste management
- Biodiversity loss
- Renewable Energy

UNIT II: SLOGAN AND POSTER MAKING EVENT

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

UNIT III: EXPERT LECTURES ON ENVIRONMENTAL SCIENCE

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

UNIT IV: CLEANLINESS DRIVE

- Indoor air pollution

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

UNIT V: CASE STUDIES

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

TEXT BOOKS:

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

REFERENCES:

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