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 2022-23)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Bachupally, Kukatpally, Hyderabad- 500 090

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD

Academic Regulations for B.Tech. (Regular) under GR22

(Applicable for Batches Admitted from 2022-23)

Under Graduate Degree Programme in Engineering and Technology (UG)

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

S.No	Department	Programme Code	Programme
1	Civil Engineering	01	B.Tech. Civil Engineering
2	Electrical and Electronics Engineering	02	B.Tech. Electrical and Electronics Engineering
3	Mechanical Engineering	03	B.Tech. Mechanical Engineering
4	Electronics and Communication Engineering	04	B.Tech. Electronics and Communication Engineering
5	Computer Science and Engineering	05	B.Tech. Computer Science and Engineering
6	Information Technology	12	B.Tech. Information Technology
7	Computer Science and Business System	32	B.Tech. Computer Science & Business System
8	Computer Science and Engineering (AIML)	66	B.Tech. Computer Science and Engineering (AIML)
9	Computer Science and Engineering (Data Science)	67	B.Tech. Computer Science and Engineering (Data Science)

GR22 Regulations shall govern the above programmes offered by the Departments with effect from the students admitted to the programmes in 2022-23 academic year is given below.

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

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

3. **Programme Pattern:**

   a) Each Academic Year of study is divided into two semesters.
   b) Minimum number of instruction days in each semester is 90.
   c) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).
   d) The total credits for the Programme are 160.
   e) A student has a choice to register for all courses in a semester / one less or one additional course from other semesters provided the student satisfies prerequisites.
   f) All the registered credits except Mandatory and Value Added Courses will be considered for the calculation of final CGPA.
   g) Each semester has 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC, and course structure as suggested by AICTE are followed. The terms 'subject' and 'course' imply the same meaning.
   h) **Course Classification:** All courses offered for all undergraduate programmes in B.Tech. degree programmes are broadly classified as follows.

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

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

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

5. Attendance Requirements:

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

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

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

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

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

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

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

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

b) Distribution and Weightage of marks

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

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

Assessment Procedure:

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

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

d) Mini Project:

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

Note:

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

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

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

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

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

Note:

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

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

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

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

- I Year courses: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he/she (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.
- II Year II Semester *Real-Time/Field-based Research Project/Societal Related Project* course: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he/she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (ii) secures less than 40% marks in this course.

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

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

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

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

11. **Re-registration for mid examination:** A student shall be given one time chance to re-register for a maximum of two subjects in a semester:
    - If the internal marks secured by a student in Continuous Internal Evaluation marks for 40 (sum of average of 2 mid-term examinations, average of all assignments and Subject Viva-voce/ PPT/Poster Presentation/Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects

    A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork when the course is offered next, it could be semester for first years and a year for others.

In the event of the student taking this chance, his/her Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

12. Academic Requirements and Promotion Rules:

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

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

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

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

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

c) Provision of opting 2 OE courses through online mode.
d) Choice of placement-oriented value-added courses in every semester from II year till IV year
e) Students can take a year break after second or third year to work on R&D
f) Under Mandatory Courses
  i) Co-Curricular activities -- 0.5 credit for publishing paper, publishing patent, attend seminar, technical competition and taking part in hackathon
  ii) Extra-Curricular activities -- 0.5 credit for sports represent University or part or college winning team a medal or cup in outside recognized inter collegiate or above tournaments or NSS activities or donated blood two times or 2 green campus events

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

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

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

Computation of SGPA and CGPA:

The UGC recommends the following procedure to compute the Semester Grade Point Average

(SGPA) and Cumulative Grade Point Average (CGPA):

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

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

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**.

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

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

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

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

Equivalence of grade to marks

Marks % = (CGPA -0.5)*10

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

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

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

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

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

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

17. **Transitory Regulations**

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of GR20 Regulations due to lack of attendance, shall be permitted to join I year I Semester of GR22 Regulations and he is required to complete the study of B.Tech. programme within the stipulated period of eight academic years from the date of first admission in I Year.
2. A student who has been detained in any semester of II, III and IV years of GR20 regulations for want of attendance, shall be permitted to join the corresponding semester of GR22 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The GR22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

3. A student of GR20 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of GR22 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both GR20 & GR22 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The GR22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in GR22 Regulations:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including GR22 Regulations. **There is NO exemption of credits in any case**.
6. If a student is readmitted to GR22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in GR22 Regulations will be substituted by another subject to be suggested by the college academic administration.

Note:

If a student readmitted to GR22 Regulations and has not studied any courses/topics in his/her earlier regulations of study which is prerequisite for further subjects in GR22

Regulations, then the college shall conduct remedial classes to cover those courses/topics for the benefit of the students.

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

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

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

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

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

19. General Rules

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

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

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

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

Academic Regulations for B.Tech. (Lateral Entry) under GR22
(Applicable for Batches Admitted from 2023-24)

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

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

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

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

2. Academic Requirements and Promotion Rules:

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

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

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

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

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

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

(Applicable for Batches Admitted from 2022-23)

1. Objectives

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

4. Registration for the courses in Minor Programme

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

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

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

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

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

5. Minor courses and the offering departments

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

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

ELECTRONICS AND COMMUNICATION ENGINEERING
B.Tech(ECE)–GR22CourseStructure

I B. Tech (ECE) - I Semester

S. No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	BS	GR22A1001	Linear Algebra andFunction Approximation	3	1	0	4	3	1	0	4	40	60	100
2	Chemistry	BS	GR22A1005	Engineering Chemistry	3	1	0	4	3	1	0	4	40	60	100
3	EEE	ES	GR22A1008	Fundamentals of Electrical Engineering	2	1	0	3	2	1	0	3	40	60	100
4	CSE	ES	GR22A1007	Programming for Problem Solving	2	1	0	3	2	1	0	3	40	60	100
5	EEE	ES	GR22A1019	Fundamentals of Electrical Engineering Lab	0	0	1	1	0	0	2	2	40	60	100
6	Chemistry	BS	GR22A1015	Engineering Chemistry Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
7	CSE	ES	GR22A1017	Programming for Problem Solving Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
8	ME	ES	GR22A1021	Engineering Workshop	1	0	1.5	2.5	1	0	3	4	40	60	100
TOTAL					**11**	**4**	**5.5**	**20.5**	**11**	**4**	**11**	**26**	**320**	**480**	**800**
9	Mgmt	MC	GR22A1022	Design Thinking	0	**0**	0	0	**2**	**0**	0	2	40	60	100

I B.Tech(ECE) - II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	BS	GR22A1002	Differential equations and Vector Calculus	3	1	0	4	3	1	0	4	40	60	100
2	Physics	BS	GR22A1003	Applied Physics	3	1	0	4	3	1	0	4	40	60	100
3	English	HS	GR22A1006	English	2	0	0	2	2	0	0	2	40	60	100
4	CSE	ES	GR22A1012	Data structures	2	1	0	3	2	1	0	3	40	60	100
5	Physics	BS	GR22A1013	Applied Physics Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
6	ME	ES	GR22A1011	Graphics for Engineers	1	0	2	3	1	0	4	5	40	60	100
7	CSE	ES	GR22A1020	Data Structures Lab	0	0	1	1	0	0	2	2	40	60	100
8	English	HS	GR22A1016	English Language and Communication Skills Lab	0	0	1	1	0	0	2	2	40	60	100
TOTAL					**11**	**3**	**5.5**	**19.5**	**11**	**3**	**11**	**25**	**320**	**480**	**800**

II B. Tech (ECE) - I Semester

S.no	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	ECE	PC	GR22A2052	Electronic Devices and Circuits	3	0	0	3	3	0	0	3	40	60	100
2	ECE	PC	GR22A2053	Digital Electronics	3	0	0	3	3	0	0	3	40	60	100
3	ECE	PC	GR22A2054	Signals and Systems	2	1	0	3	2	1	0	3	40	60	100
4	ECE	PC	GR22A2055	Probability Theory and Stochastic Processes	2	1	0	3	2	1	0	3	40	60	100
5	ECE	PC	GR22A2056	Network Analysis	3	1	0	4	3	1	0	4	40	60	100
6	ECE	PC	GR22A2057	Electronic Devices and Circuits Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
7	ECE	PC	GR22A2058	Digital Electronics Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
8	ECE	PC	GR22A2059	Signals and Systems Lab	0	0	1	1	0	0	2	2	40	60	100
		TOTAL			**13**	**3**	**4**	**20**	**13**	**3**	**8**	**24**	**320**	**480**	**800**
9	CHEM	MC	GR22A2001	Environmental Science	0	0	0	0	2	0	0	2	40	60	100

II B. Tech (ECE) - II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	PC	GR22A2009	Computational Mathematics for Engineers	3	0	0	3	3	0	0	3	40	60	100
2	ECE	PC	GR22A2060	Microcontrollers	3	0	0	3	3	0	0	3	40	60	100
3	ECE	PC	GR22A2061	Electromagnetic Fields and Transmission Lines	3	1	0	4	3	1	0	4	40	60	100
4	ECE	PC	GR22A2062	Analog Electronics	3	0	0	3	3	0	0	3	40	60	100
5	ECE	PC	GR22A2063	Analog and Digital Communications	3	0	0	3	3	0	0	3	40	60	100
6	CSE	PC	GR22A2064	Microcontrollers Lab	0	0	1	1	0	0	2	2	40	60	100
7	ECE	PC	GR22A2065	Analog Electronics Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
8	ECE	PC	GR22A2066	Analog and Digital Communications Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
		TOTAL			**14**	**2**	**4**	**20**	**14**	**2**	**8**	**24**	**320**	**480**	**800**

III B.Tech (ECE) –I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	ECE	PC		Introduction to Computer Organization	3	0	0	3	3	0	0	3	40	60	100
2	ECE	PC		Control Systems	2	1	0	3	2	1	0	3	40	60	100
3	ECE	PC		Digital Signal Processing	3	1	0	4	3	1	0	4	40	60	100
4	ECE	PE- I		Professional Elective-I	3	0	0	3	3	0	0	3	40	60	100
5	ECE	OE-1		Open Elective-1	3	0	0	3	3	0	0	3	40	60	100
6	ECE	PC		IOT Sensors Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
7	ECE	PC		Digital Signal Processing Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
8	ECE	PC		Oops through Java Lab	0	0	1	1	0	0	2	2	40	60	100
		TOTAL			**14**	**2**	**4**	**20**	**15**	**2**	**8**	**24**	**320**	**480**	**800**
9	Mgmt	MC		Constitution of India	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**40**	**60**	**100**

PROFESSIONALELECTIVE–I			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		FPGA & CPLD Architectures
2	ECE		Soft Computing Techniques
3	ECE		Optical Communications
4	ECE		Actuators and Sensors

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

III B.Tech (ECE)-II Semester

Sl.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	ECE	PC		VLSI Design	3	0	0	3	3	0	0	3	40	60	100
2	ECE	PC		Antennas and Wave Propagation	3	1	0	4	3	1	0	4	40	60	100
3	Mgmt	PC		Economics and Accounting for Engineers	3	0	0	3	3	0	0	3	40	60	100
4	ECE	PC		Computer Networks	3	0	0	3	3	0	0	3	40	60	100
5	ECE	PE-II		Professional Elective-II	3	0	0	3	3	0	0	3	40	60	100
6	ECE	PC		Computer Networks Lab	0	0	1	1	0	0	2	2	40	60	100
7	ECE	PC		VLSI Design Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
8	ECE	PW		Mini project	0	0	1.5	1.5	0	0	3	3	40	60	100
		TOTAL			**15**	**1**	**4**	**20**	**15**	**1**	**8**	**24**	**320**	**480**	**800**
9	Mgmt	MC		Value Ethics and Gender Culture	0	0	0	0	2	0	0	2	40	60	100

PROFESSIONAL ELECTIVE–II			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Digital System Design using Verilog HDL
2	ECE		Machine Learning for Engineers
3	ECE		Wireless Communication Networks
4	ECE		Embedded Systems Design

IV B.Tech (ECE)-ISemester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext.	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Mgmt	HS		Fundamentals of Management and Entrepreneurship	3	0	0	3	3	0	0	3	40	60	100
2	ECE	PC		Microwave Engineering	3	0	0	3	3	0	0	3	40	60	100
3	ECE	PE III		Professional Elective-III	3	0	0	3	3	0	0	3	40	60	100
4	ECE	PE IV		Professional Elective-IV	3	0	0	3	3	0	0	3	40	60	100
5	ECE	OE III		Open Elective-II	3	0	0	3	3	0	0	3	40	60	100
6	ECE	PC		Microwave Engineering Lab	0	0	1	1	0	0	2	2	40	60	100
7	ECE	PW		Project Work Phase I	0	0	3	3	0	0	6	6	40	60	100
8	ECE	PW		Summer Internship & Seminar	0	0	2	1	0	0	2	1	40	60	100
		TOTAL			**15**	**1**	**4**	**20**	**15**	**1**	**8**	**24**	**320**	**480**	**800**

PROFESSIONAL ELECTIVE–III			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Analog IC Design
2	ECE		Digital Image Processing
3	ECE		Software Defined Radio
4	ECE		RTOS and System Programming
PROFESSIONAL ELECTIVE–IV			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE		Fundamentals of Low Power VLSI Design
2	ECE		Speech Signal Processing
3	ECE		Cellular Mobile Communications
4	ECE		Fundamentals and Applications of ARM processors

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

IV B.Tech (ECE)-II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	ECE	PE 5		Professional Elective-V	3	0	0	3	3	0	0	3	40	60	100
2	ECE	PE 6		Professional Elective-V	3	0	0	3	3	0	0	3	40	60	100
3	ECE	OE-III		Open Elective-III	3	0	0	3	3	0	0	3	40	60	100
4	ECE	PW		Project Work Phase II Including Seminar	0	0	11	11	0	0	22	22	40	60	100
		TOTAL			**9**	**0**	**11**	**20**	**9**	**0**	**22**	**29**	**160**	**240**	**400**

PROFESSIONALELECTIVE–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		Biomedical Signal Processing
3	ECE		Satellite Communications
4	ECE		Autonomous Systems

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

PROFESSIONALELECTIVES–4THREADS

Elective	VLSI	Signal Processing	Communications	Embedded Systems
3-1.	FPGA&CPLD Architectures	Soft Computing Techniques	Optical Communications	Actuators and Sensors
3-2.	Digital System Design using Verilog HDL	Machine Learning for Engineers	Wireless Communication Networks	Embedded Systems Design
4-1.	Analog IC Design	Digital Image Processing	Software Defined Radio	RTOS and System Programming
4-1.	Fundamentals of Low Power VLSI Design	Speech Signal Processing	Cellular Mobile Communications	Fundamentals and Applications of ARM processors
4-2.	VLSI Technology	5G and beyond Communication	Radar Systems	Digital Signal Processors and Architectures
4-2.	ASIC Design	Biomedical Signal Processing	Satellite Communications	Autonomous Systems

OPENELECTIVESFORGR22REGULATIONS:

THREAD 1	THREAD 2	OFFERED BY
1. Soft Skills and Interpersonal Communication 2. Human Resource Development and Organizational Behavior 3. Cyber Law and Ethics 4. Economic Policiesin India	1. Principles of E-Commerce	CSE
	2. Business Analytics	
	3. Augmented Reality and Virtual Reality	
	1. Internet of Things	CSE (AIML)
	2. Augmented Reality and Virtual Reality	
	3. Human Computer Interaction	
	1. Augmented Reality and Virtual Reality	CSE (DS)
	2. Internet of Things	
	3. Human Computer Interaction	
	1. Services Science and Service Operational Management IT Project Management	CSBS
	2. Marketing Research and Marketing Management	
	1. Artificial Intelligence	IT
	2. Introduction to Data Science	
	3. Human Computer Interaction	
	1. Non-Conventional Energy Sources	EEE
	2. Machine Learning	
	3. Artificial Intelligence Techniques	
	1. Principles of Communication	ECE
	2. Sensor Technology	
	3. Communication Technologies	
	1. Robotics	ME
	2. Composite Materials	
	3. Operations Research	
	1. Engineering Materials for Sustainability	CE
	2. Geographic Information Systems and Science	
	3. Environmental Impact Assessment and Life Cycle Analyses	

I YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

LINEAR ALGEBRA AND FUNCTION APPROXIMATION

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

Course Objectives:

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

Course Outcomes:

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

UNIT-I

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

UNIT-II

Matrix eigenvalue problem and Quadratic forms Determination of eigen values 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 matrixQuadratic Forms- Definiteness and nature of a quadratic form- Reduction of a quadratic form to the canonical form using an orthogonal transformation.

UNIT-III

Matrix decomposition and Least squares solution of algebraic systems LU decomposition- Cholesky decomposition- Gram-Schmidt orthonormalization process- QR factorization- Eigen decomposition of a symmetric matrix- Singular value decomposition Least squares solution of an over determined system of equations using QR factorization and the generalized inverse- Estimation of the least squares error.

UNIT-IV

Multivariable differential calculus and Function optimization Partial Differentiation- Chain rule- Total differentiation- Jacobian- Functional dependence Multivariable function Optimization- Taylor's heorem for multivariable functions- Unconstrained optimization of functions using the Hessian matrix- Constrained optimization using the Lagrange multiplier method

UNIT-V:

Function approximation tools in engineering Function approximation using Taylor's polynomials- Properties of Chebyshev polynomials- Uniform approximation using Chebyshev polynomials The principle of least squares- Function approximation using polynomial, exponential and power curves using matrix notation- Estimating the Mean squared error.

TEXT BOOKS:

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

REFERENCES:

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

GOKARAJURANGARAJUINSTITUTEOFENGINEERINGANDTECHNOLOGY

ENGINEERING CHEMISTRY

Course Code: GR22A1005 **L/T/P/C:3/1/0/4**
I Year I Semesters

Course Objectives:

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

Course Outcomes:

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

UNIT- I

Atomic and Molecular Structure Atomic and Molecular orbitals - Definition, examples and comparison, Molecular orbital theory- postulates and MO energy diagrams of N_2 and O_2.Theories of Metallic bonding – Free electron theory, Resonance theory, Molecular orbital theory, Valence Bond Theory – Postulates and Limitations, Bonding in $[Ni(CO)_4]$, $[Ni(Cl)_4]^{2-}$, $[Ni(CN)_4]^{2-}$, $[Co(NH_3)_6]^{3+}$, and $[CoF_6]^{3-}$. Crystal Field Theory, Crystal Field Splitting of transition metal ion d-orbitals in octahedral, tetrahedral and square planar geometries.

UNIT- II

Spectroscopic Techniques and Applications Regions of Electromagnetic spectrum. Molecular spectroscopy: Rotational Spectroscopy: Rotation of molecules, Rotational spectra of rigid diatomic molecules, Selection rules. Vibrational Spectroscopy: The vibrating diatomic molecule, Simple and anharmonic oscillators of a diatomic molecule, Selection rules, Applications of IR spectroscopy. NMR Spectroscopy: Criteria for NMR activity (Magnetic and non-magnetic nuclei), Basic concepts and Principle of ^1H NMR spectroscopy, Chemical shift- Shielding and Deshielding. Magnetic Resonance Imaging.

UNIT- III

Batteries and Corrosion Batteries: Primary and Secondary types, Lithium ion and Lead acid batteries. Fuel cells: Definition, Hydrogen-Oxygen fuel cell and Microbial Fuel cell – working principle and applications.Corrosion: Definition, causes and effects of corrosion, Theories of chemical and electro chemical corrosion with mechanism, Differential metal corrosion - Galvanic corrosion, Differential aeration corrosion - pitting corrosion, Factors affecting corrosion – Nature of metal (Position of metal, Relative areas, Purity and Passivity), Nature of Environment (pH, Temperature and Humidity), Corrosion control methods: Cathodic protection (sacrificial anodic and impressed current cathodic protection), Metallic coatings: Hot dipping- galvanization and tinning.

UNIT- IV

Engineering Materials and Water Technology Semiconductors: Si and Ge - preparation, purification and crystal growth by zone refining and Czochralski pulling methods, Doping – Epitaxy, Diffusion and Ion implantation.Plastics: Comparison between thermoplastics and thermosets, Fabrication of plastics - compression moulding and injection moulding. Conducting polymers – Definition, classification and applications. Water: Hardness - Causes, types and units. Boiler troubles-scales and sludges, caustic embrittlement. Water purification: Demineralization by Ion-exchange process, Desalination by reverse osmosis method.

UNIT- VStereochemistry and Energy Resources Stereochemistry: Elements of symmetry-plane of symmetry, centre of symmetry, alternating axis of symmetry. Chirality, Enantiomers – tartaric acid, Diastereomers- 2,3-dichloropentane, Conformational analysis of n-butane. Structure, synthesis and pharmaceutical applications of aspirin and ibuprofen.Energy sources: Fossil Fuels: Coal –types, analysis of coal- proximate and ultimate analysis and their significance, Petroleum-its composition, Cracking – Definition, Fluid bed catalytic cracking, Knocking and its mechanism in Internal Combustion engine, Octane rating, Hydrogen gas generation by Electrolysis process.

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FUNDAMENTALS OF ELECTRICAL ENGINEERING

Course Code: GR22A1008 **L/T/P/C: 2/1/0/3**
I Year I Semester

Course Objectives:

1. Introduce the fundamentals of Electrical Engineering.
2. Solve the problems in the applications of DC circuits
3. Implement the basic concepts in AC circuits
4. Provide foundation in theory and applications of Transformers, AC and DC machines
5. Understand the principles involved in Sensors

Course Outcomes:

1. Summarize Understand basic electric circuits.
2. Analyze electric circuits with suitable theorems.
3. Interpret the working principle of Electrical machines.
4. Solve single phase balanced sinusoidal systems.
5. Apply sensors for real time applications

UNIT -I
BASIC COMPONENTS AND ELECTRIC CIRCUITS
Charge, Current, Voltage, Power, Passive components, Voltage and Current sources, dependent and independent sources, fundamentals of circuit Laws, Source Transformation, Passive components in series and parallel, Delta – star conversion.

UNIT- II
NETWORK ANALYSIS
Nodal and Mesh Analysis, Linearity and Superposition, Thevenin's and Norton's theorems, Maximum power transfer theorem and Reciprocity theorem.

UNIT- III
A.C CIRCUITS
Representation of sinusoidal waveforms, average and rms values, phasor representation, real power, reactive power, apparent power, power factor, analysis of RL, RC and RLC circuits. Series and Parallel Circuits, Resonance.

UNIT- IV
BASICS OF ELECTRICAL MACHINES
Transformer: Mutual Induction, construction and working principle, Types of transformers, Ideal transformer, EMF Equation, Phasor diagram on No Load.Construction and working principles of DC generator, DC motor, Synchronous generator, and Induction Motor – applications.

UNIT V
MEASURING INSTRUMENTS AND SENSORS
Transducers, Sensors, and Actuators – Physical Principles and their working ,Temperature Sensors, Ultrasonic Sensor, Accelerometers Sensor and PIR Motion Detector.

Text Books:

1. D.P. Kothari and I.J. Nagrath, Basic Electrical Engineering -, Third edition 2010, Tata McGraw Hill.
2. Sensors and amp, Transducers – D. Patranabis, PHI Publications
3. Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice Hall India, 1989

Reference Books:

1. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education,2004.
2. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.
3. Circuit Theory (Analysis and Synthesis) by A.Chakrabarti-Dhanpat Rai & Co.
4. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
5. D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
6. Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROGRAMMING FOR PROBLEM SOLVING

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

Course Objectives:

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

Course Outcomes:

1. To design algorithms and flowcharts for problem solving and illustrate the fundamentals of C language.
2. To identify and apply control structures and arrays to solve problems.
3. To discover the need for strings and functions in problem solving and apply it.
4. To analyze the need for pointers and structures in C and implement for solutions.
5. To interpret working with files, preprocessor directives and command line arguments in C.

UNIT- I

Introduction to Programming: Introduction to Algorithms: Representation of Algorithm, Flowchart, Pseudo code with examples, compiling and executing programs, syntax and logical errors.

Introduction to C Programming Language: Structure of C program, keywords, variables, constants, datatypes, operators, precedence and associativity, expression evaluation, implicit and explicit type conversion, formatted and unformatted I/O.

UNIT- II

Decision Making and Arrays: Branching and Loops: Conditional branching with simple if, if-else, nested if else, else if ladder, switch-case, loops: for, while, do-while, jumping statements: goto, break, continue, exit.

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

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

UNIT- III

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

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

UNIT- IV

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

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

UNIT- V

File handling and Preprocessor in C:

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF ELECTRICAL ENGINEERING LAB

Course Code: GR22A1019 **L/T/P/C: 0/0/2/1**
I Year I Semester

Course Objectives:

1. Introduce the use of measuring instruments.
2. Analyze a given network by applying various electrical laws
3. Measure and know the relation between basic electrical parameters.
4. Understand the response of electrical circuits for different excitations
5. Summarize the performance characteristics of electrical machines.

Course Outcomes:

1. Get an exposure to common electrical components and their ratings.
2. Get an exposure to basic electrical laws.
3. Understandthemeasurementandrelationbetweenthebasicelectricalparameters
4. Understandtheresponseofdifferenttypesofelectricalcircuitstodifferentexcitations.
5. Compare the basic characteristics of Electrical machines.

List of Experiments:

TASK-1: Verification of Ohms Law, KVL and KCL

TASK-2: Verification of Thevenin's and Norton's Theorems

TASK-3: Verification of Superposition and Reciprocity Theorems.

TASK-4: Verification of Maximum Power Transfer Theorem

TASK-5: Resonance in series RLC circuit

TASK-6: Load Test on Single Phase Transformer (Calculate Efficiency and regulation)

TASK-7: Three Phase Transformer: Verification of Relationship between Voltages andCurrents(Star-Delta, Delta-Delta, Delta-star, Star-Star)

TASK-8: Measurement of Active and Reactive Power in a balanced Three-phase Circuit

TASK-9: Torque SpeedCharacteristicsofa SeparatelyExcited DCShuntMotor

TASK-10:Torque-SlipCharacteristicsofa Three-phaseInductionMotor

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING CHEMISTRY LAB

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

Course Objectives:

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

Course Outcomes:

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

List of Experiments:

1. Determination of Total Hardness of water by complexometric method using EDTA
2. Determination of Chloride content of water by Argentometry
3. Redox titration: Estimation of Ferrous ion using standard $KMnO_4$ by Permanganometry
4. Estimation of HCl by Conductometric titrations
5. Estimation of Ferrous ion by Potentiometry using dichromate
6. Determination of Rate constant of acid catalyzed reaction of methyl acetate
7. Adsorption of Acetic acid by charcoal
8. Determination of Surface tension of liquid by using Stalagmometer
9. Determination of Viscosity of liquid by using Ostwald's Viscometer
10. Determination of Partition Coefficient of Acetic acid between n-butanol and water
11. Synthesis of Aspirin
12. Synthesis of Paracetamol

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING LAB

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

Course Objectives:

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

Course Outcomes:

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

List of Experiments

TASK 1

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

TASK 2

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

TASK 3

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

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

TASK 4

a. Write a C program to find the roots of a quadratic equation using if-else.
b. Write a C program to input electricity unit charges and calculate total electricity bill according to the given condition:
   For first 50 units Rs. 0.50/unit
   For next 100 units Rs. 0.75/unit
   For next 100 units Rs. 1.20/unit
   For unit above 250 Rs. 1.50/unit
   An additional surcharge of 20% is added to the bill
c. Write a menu driven C program to implement a simple arithmetic calculator.
d. Write a C program to display number of days in month using switch case (The input is month number 1 -12).

TASK 5

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

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TASK 6

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

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

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

TASK 7

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

TASK 8

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

TASK 9

a. Write a C program to display binary equivalent of a given decimal number using functions.
b. Write a C program to implement transpose of a matrix using functions

c. Write a C program using functions that compares two strings to see whether they are identical or not. The function returns 1 if they are identical, 0 otherwise.

TASK 10

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

TASK 11

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

TASK 12

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

TASK 13

a. Define a structure Student, to store the following data about a student: rollno(int), name(string) and marks. Suppose that the class has 'n' students. Use array of type Student and create a function to read the students data into the array. Your program should be menu driven that contains the following options :
   (i) Print all student details (ii) Search student by roll no (iii) Print the names of the students having the highest test score
b. Write a C program that uses structures and functions to perform addition and product of two complex numbers? (use structures and functions)

TASK 14

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

TASK 15

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING WORKSHOP

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

Course objectives:

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

Course Outcomes:

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

TRADES FOR EXERCISES: At least two exercises from each trade

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

Text/ Reference Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN THINKING

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

Course Objectives:

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

Course Outcomes:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS

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

REFERENCE BOOKS

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

I YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

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

Course Objectives:

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

Course Outcomes:

1. Solve linear differential equations of higher order under various forcing functions
2. Evaluate double and triple integrals and apply them to some problems in geometry
3. Apply principles of vector differentiation and line integration for some field related problems
4. Apply classical vector integral theorems for fast evaluation of work done around closed curves and flux across closed surfaces

UNIT I
ORDINARY DIFFERENTIAL EQUATIONS OF THE FIRST ORDER
Linear Differential Equations of the first order: Solution of Exact, Linear and Bernoulli equations, modelling Newton's law of cooling, growth and decay models, modelling of R-L circuit

UNIT II
ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER
Solution of homogeneous and non-homogeneous linear differential equations with constant coefficients, complimentary functions, particular integrals and the method of variation of parameters Solution of Linear Differential Equations with variable coefficients: Cauchy's and Legendre's homogeneous equations

UNIT III:
MULTIPLE INTEGRALS Double integrals: Evaluation of Double Integrals, change of order of integration (only Cartesian form), change of variables (Cartesian and polar coordinates) Triple Integrals: Evaluation of triple integrals, Change of variables (Cartesian to Spherical and Cylindrical polar coordinates) Application of double integral to find the area of a lamina and volume of a solid, application of the triple integral to find the volume of a solid

UNIT IV
VECTOR DIFFERENTIATION AND LINE INTEGRATION
Vector differentiation: Scalar and vector point functions, Concepts of gradient, divergence and curl of functions in Cartesian framework, solenoidal field, irrotational field, scalar potential Vector line integration: Evaluation of the line integral, concept of work done by a force field, Conservative

fields

UNIT V

SURFACE INTEGRATION AND VECTOR INTEGRAL THEOREMS Surface integration: Evaluation of surface and volume integrals, flux across a surfaceVector 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.
4. Calculus Early Transcendental 9E by James Steward, Daniel Clegg, Saleem Watson, CENGAGE Publications

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

APPLIED PHYSICS

Course Code: GR22A1003 **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 for specific applications.
3. Develop basic understanding of optoelectronic devices.
4. Discuss the use of lasers as light sources in optical fiber applications.
5. Classify the properties of dielectric, magnetic and superconducting materials for various applications.

Course Outcomes:

1. Solve engineering problems involving quantum nature of radiation and matter waves.
2. Describe the characteristics of semiconductor devices such as transistors and diodes.
3. Illustrate the operation of optoelectronic devices and its applications.
4. Analyze the properties of Laser and its propagation in different types of optical fibers.
5. Identify dielectric, magnetic and superconducting materials based on their properties for specific applications.

UNIT I

Quantum Mechanics: Introduction, Black body radiation, Planck's law, Photoelectric effect-Einstein's Photoelectric equation, Compton effect, 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.

UNIT II

Semiconductor Physics: Intrinsic and extrinsic semiconductors, Estimation of carrier concentration in intrinsic and Extrinsic semiconductors, Dependence of Fermi level on carrier concentration and variation with temperature, Carrier transport: diffusion and drift, p-n junction diode: I-V Characteristics, Zener diode: I-V Characteristics, Hall Effect and its applications.

UNIT III

Optoelectronic Devices:Radiative transitions: Absorption, Spontaneous and Stimulated emissions, Non-radiative transitions: Auger recombination, Surface recombination and recombination at defects, Generation and recombination mechanism in semiconductors, Principle, Construction, Working, Characteristics and Applications: LED, PIN photo detector, Avalanche photo detector and Solar cell.

UNIT IV

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

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

UNIT V

Dielectric Materials: Introduction, Types of polarizations: Electronic, Ionic and Orientation, Calculation of Electronic and Ionic polarizability, Internal fields in solids, Clausius-Mossotti equation, Applications of dielectric materials.

Magnetic Materials: Introduction, Bohr magneton, classification of magnetic materials: Ferro, Para, Dia, Antiferro and Ferri, Hysteresis curve based on domain theory, Soft and hard magnetic materials, Applications of magnetic materials

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

Course Objectives:

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

Course Outcomes:

1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in various contexts and different cultures.
4. Acquire proficiency in English including reading and listening comprehension, writing and speaking skills.
5. Listen and respond appropriately.

UNIT I

Where the Mind is without Fear poem by Rabindranath Tagore
Vocabulary: The Concept of Word Formation-- The Use of Prefixes and Suffixes.
Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.
Reading: Reading and Its Importance- Techniques for Effective Reading
Writing: Sentence Structures -Use of Phrases and Clauses in Sentences-Importance of Proper Punctuation - Techniques for writing precisely - Paragraph writing - Do's and Don'ts of Paragraph Writing - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT II
The Last Leaf by O. Henry
Vocabulary: Synonyms and Antonyms.
Grammar: Modal Auxiliaries- Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
Reading: Sub-skills of Reading- Skimming and Scanning
Writing: PrécisWriting, DescribingObjects, Places and Events – Classifying - Providing Examples or Evidence

UNIT III

'Blue Jeans' from the prescribed textbook 'English for Engineers' published by Cambridge University Press. Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages in English to form Derivatives-Words from Foreign Languages and their Use in English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses. **Reading:** Improving Comprehension Skills – Techniques for Good Comprehension
Writing: Format of a Formal Letter-Writing Formal Letters E.g. Letter of Complaint, Letter of Requisition and Letter of permission, Use of phrases for formal and informal letter writing and Email etiquette

UNIT IV

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

UNIT V

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

Text Books:

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

References:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES

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

Course Objectives:

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

Course Outcomes:

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

UNIT- I

Algorithms and Complexities: Analysis of algorithms, Basic concept of order of complexity, Asymptotic Notations: Big Oh notation, Omega notation, Theta notation, little oh notation and little omega notation.**Sorting:** Bubble sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Radix Sort, Counting sort.

UNIT- II

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

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

UNIT- III

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

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

UNIT-IV

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

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

UNIT -V

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

APPLIED PHYSICS LAB

Course Code: GR22A1013 **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 and electric 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. Recall the basic concepts of LCR and RC circuits through hands on experience.

Course Outcomes:

1. Compare the behavior of p-n junction diode, Solar cells and LED.
2. Analyze the behavior of magnetic and electric fields with the help of graphs.
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 time constant of RC circuit and resonance phenomenon in LCR circuit.

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. R-C Circuit: To determine the time constant of R-C circuit.
10. LCR Circuit: To determine the resonant frequency and Quality factor of LCR Circuit in series and parallel.

Note: Any 8 experiments are to be performed.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

GRAPHICS FOR ENGINEERS

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

Course Objectives

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

Course Outcomes

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

UNIT I

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

UNIT II

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

UNIT III

Projections of planes - definition andtypes of plane figures (triangle, square, pentagon, hexagon, and circle); projections of plane (inclined toone reference plane only).

UNIT IV

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

UNIT V

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

TextBooks:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES LAB

Course Code: GR22A1020 **L/T/P/C: 0/0/3/1**
I Year II Semester

Course Objectives:

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

Course Outcomes:

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

TASK 1

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

TASK 2

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

TASK 3

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

TASK 4

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

TASK 5

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

TASK 6

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

TASK 7

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

TASK 8

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

TASK 9

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

TASK 10

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

TASK 11

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

TASK 12

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

TASK 13

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

TASK 14

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

TASK 15

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

Text Books:

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

References:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

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

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

Exercise IV
CALL Lab:
Understand: Presentation Skills – Elements of Presentation – Organizing Content – Use of Power Point – Slides Preparation
Practice: Presentation Skills

ICS Lab:
Understand: How to make informal and Formal Presentations
Practice: Collages / Poster Presentations-Power point presentations

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

Minimum Requirement of infrastructural facilities for ELCS Lab:

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

II YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ELECTRONIC DEVICES AND CIRCUITS

Course Code: GR22A2052 **L/T/P/C: 3/0/0/3**
II Year I Semester

Course Objectives:

1. To understand the Diodes and their applications
2. To know the switching characteristics and functionalities of diodes, BJTs and FETs
3. To classify and compare the functionalities of diodes, BJTs and FETs
4. To know the applications of components.
5. To understand the various types of circuits used in Engineering Field.

Course Outcomes:

1. Describe about different types of diodes, transistors and applying them for understanding various circuits.
2. Know the characteristics of various components.
3. Analyze the working principles of various components.
4. Ability to express functioning of diodes, BJT's, UJT's, FET's and SCR's.
5. Analyze and design various circuits for different applications in Engineering Field.

UNIT –I

Diode and Applications: Diode - Principle of working, VI characteristics, Diode Current equation, Half wave rectifier, Full wave rectifier and Bridge Rectifier, Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L-section filter, Π section filter and comparison of various filter circuits in terms of ripple factors, Zener diode as a voltage regulator, Clipper and Clamper circuits.

UNIT -II

Bipolar Junction Transistor: Transistor Construction, currents in a transistor, Input and output characteristics of transistor in common Base, Input and output characteristics of transistor in common Emitter and common collector configurations

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

UNIT –III

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 V_{BE} and $I_{CO,}$ Thermal run away, Thermal Stability.

UNIT –IV

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 configurations.

UNIT-V

Feedback Amplifiers and Oscillators: Concepts of feedback – Classification of feedback amplifiers – General characteristics– Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations. Condition for Oscillations, RC phase shift, Wein-bridge Oscillators, and LC type Oscillators, Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators.

Text Books

1. Electronic Devices and Circuit Theory - Robert L.Boylestad, Louis Nashelsky, 9 ed., 2008PE.
2. Integrated Electronics - Jacob Millman and Christos C Halkias, 1991 ed., 2008, TM
3. Electronic Devices and Circuits, S Salivahanan and N Suresh kumar, McGraw Hill Education.

Reference Books

1. Introductory Electronic Devices and Circuits– Robert T. Paynter, 7 ed., 2009, PEI.
2. Electronic Circuit Analysis – K. Lal Kishore, 2004, BSP.
3. Electronic Devices and Circuits, David A. Bell – 5 ed., Oxford University Press.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIGITAL ELECTRONICS

Course Code: GR22A2053 **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, verilog programming concepts.
3. To study the sequential logic circuit design both in synchronous and Asynchronous modes for various complex logic and switching devices, their minimization techniques and their realizations using verilog.
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 and implement digital system using verilog.

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, can able to write verilog program.
3. Use the concepts of Boolean algebra for the analysis & design of various sequential logic circuits, can able to write verilog program.
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 and and implement digital system using verilog.

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, Five-Variable Map, Don't-care Conditions.

UNIT-II

Combinational logic circuits: Introduction to Combinational circuits, Analysis Procedure, Design Procedure, Code conversion, Binary Adder-Subtractor, Carry Propagation, Half Subtractor, Full Subtractor, Binary Subtractor, Decimal Adder, BCD adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers with design examples. Introduction to verilog to implement combinational circuits. Digital ICs: IC74138 3-8 Decoder, IC74151 Multiplexer, IC74155 Demultiplexer, 4-bit Parallel Binary Adder/Subtractor, IC7485 Comparator).

UNIT-III

Sequential Logic circuits: Difference between combinational and sequential logic circuits, Flip-Flops, Triggering of Flip Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Flip-Flop Excitation Tables, Design Procedure, Fundamentals of Asynchronous Sequential Logic: Introduction, Analysis procedure, Circuits with Latches, Design Procedure. verilog code to implement sequential circuits. Digital ICs: IC7474 Flip-flops, IC7490 & IC74193.

UNIT-IV

Registers and Counters: Registers with parallel load, Shift registers, Serial Transfer, Serial Addition, Universal Shift Register, Ripple Counters, Binary Ripple Counter, BCD Ripple Counter, Synchronous Counters, Binary Counter, Up-Down Counter, BCD Counter, Binary Counter with Parallel Load, Counter with Unused States, Ring Counter, Johnson Counter, verilog to design Registers and 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, Combinational Circuit Implementation, 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. Charles H.Roth Jr.,Larry L. Kinney, Fundamentals of Logic Design, Cengaue learning 6th edition, 2013
3. J. Bhaskar, “A Verilog HDL Primer Hardcover”
4. Switching and Finite Automata Theory - Zvi Kohavi & Niraj K. Jha, 3rdEdition, Cambridge, 2010.

Reference Books:

1. Modern Digital Electronics – R. P. Jain, 3rd edition, 2007- Tata McGraw-Hill.
2. Introduction to Switching Theory and Logic Design – Fredric J. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & Sons Inc.
3. Switching Theory and Logic Design – A Anand Kumar, PHI, 2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SIGNALS AND SYSTEMS

Course Code: GR22A2054 **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 filtersfor signal processingby 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: GR22A2055 **L/T/P/C: 2/1/0/3**
II Year I Semester

Course Objectives:

1. To acquire the fundamental knowledge in probability concepts.
2. To manage situations involving more than one random variable and functions of random variables in engineering applications.
3. To analyze the various concepts like autocorrelation and cross correlation, power spectral density.
4. To understand the properties of random signals through time and frequency domain representation.
5. To compare the various noises involved in communication and their effects.

Course Outcomes:

1. Understand the axiomatic formulation of probability, model sample spaces and analyze random phenomena by constructing distribution function of random variables of various distribution functions.
2. Characterizing probability models and functions of random variables based on single and multiple random variables .
3. Evaluate and apply moments and characteristic functions and understand the concept of inequalities and probabilistic limits.
4. Understand the concept of random processes, determine time and spectral characteristics of stationary random processes, evaluate response of a linear system to random process.
5. Demonstrate and classify various noise related to specific applications and model the Noise figure of cascaded networks.

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, Baye's 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– 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..

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, random signal response of linear systems, autocorrelation and cross-correlation functions of input and output.

UNIT-V

RANDOM PROCESSES -SPECTRAL CHARACTERISTICS AND NOISE: The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

MODELLING OF NOISE:

Classification of Noise, types and sources of noises, Thermal Noise Source, Effective Noise Temperature, Average Noise Figures.

Text/Reference Books:

1. Probability, Random Variables and Stochastic Processes - Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.
2. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001
3. Random Processes for Engineers-Bruce Hajck, Cambridge unipress,2015
4. Probability, Statistics & Random Processes-K .Murugesan, P. Guruswamy, Anuradha Agencies, 3rd Edition, 2003.
5. Signals, Systems & Communications - B.P. Lathi, B.S. Publications, 2003.
6. Digital Modulations using Matlab: Build Simulation Models from Scratch-Mathuranathan Viswanathan-ebook, 2017.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

NETWORK ANALYSIS

Course Code: GR22A2056 **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 theconceptwithworkingprinciplesoflinearconstantcoefficientdifferentialequations with the help of Laplace transforms.
3. Know the basic skills of an ac circuits with independent/dependent voltage current sourcesbydrawingimpedance/admittancediagramsorusingvariouslaws/techniqueslike source conversion.
4. Discriminatetheconceptslikecut-set,tie-set,polezeroparametersandstabilityanalysis
5. Interpolate the two-port network parameters, conversion between parameters, interconnection of two port networks.

UNIT-I

Network Topology & Coupled Circuits: Review of R, L,C, RC, RL, RLC circuits, Network Topology, Terminology, Basic cutest and tie set matrices for planar networks, Illustrative Problems, Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits. Numerical Problems

UNIT-II

Steady State & Transient Analysis: Steady state and transient analysis of RC, RL and RLC Circuits, Circuits with switches, step response, 2^{nd} order series and parallel RLC Circuits, Root locus, damping factor, over damped, under damped, critically damped cases. Numerical Problems

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, Numerical Problems.

UNIT-IV

Network Topology: Network terminology - Graph of a network - Incidence and reduced incidence matrices – Cutsets - Fundamental cutsets - Cutset matrix – Tiesets, simple numerical problems.

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. Numerical Problems

UNIT-V

Filters Circuits: Standard T, π, L Sections, Characteristic impedance, image transfer constants, Design of Attenuators, impedance matching network, T and π Conversion, LC Networks. Numerical Problems.

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, 3rd Edition, 2000.
3. Networks, Lines and Fields - JD Ryder, PHI, 2nd 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

ELECTRONIC DEVICES AND CIRCUITS LAB

Course Code: GR22A2057 **L/T/P/C: 0/0/3/1.5**
II Year I Semester

Course Objectives:
1. To know the characteristics of various semiconductor devices.
2. To know the applications of Components.
3. To compare the functionalities of Diodes, BJTs and FETs.
4. To apply concepts for the design of voltage regulator.
5. To verify the theoretical concepts through laboratory and simulation experiments.

Course outcomes:
1. Analyze the characteristics of various semiconductor devices
2. Apply the knowledge of semiconductors
3. Design various circuits based on the characteristics of the components.
4. Apply concepts for the design of voltage regulator.
5. Verify the theoretical concepts through laboratory and simulation.

LIST OF EXPERIMENTS

Hardware of any 10 Experiments and Simulation of any 5 Experiments using Multisim Software.

1. Forward and Reverse Bias V-I Characteristics of PN junction Diode,
2. a. Zener Diode V-I Characteristics,
   b. Zener diode as Voltage Regulator
3. Half wave, Full Wave and Bridge Rectifiers without and with filters
4. Characteristics of a BJT under CB, CE Configuration
5. Measurement of h-parameters of transistor in CE configuration.
6. Verify Characteristics of a JFET under CS configuration.
7. Verify the V-I Characteristics of MOSFET.
8. Design and verify Voltage Series Feedback amplifier
9. Design and verify current shunt feedback amplifier
10. Design and verify RC Phase shift Oscillator
11. Design and verify Colpitt's Oscillators
12. Design and verify Wein Bridge Oscillator using Transistors

Text Books

1. Electronic Devices and Circuit Theory - Robert L.Boylestad, Louis Nashelsky, 9 ed., 2008PE.
2. Integrated Electronics - Jacob Millman and Christos C Halkias, 1991 ed., 2008, TM
3. Electronic Devices and Circuits, S Salivahanan and N Suresh kumar, McGraw Hill Education.

Reference Books

1. Introductory Electronic Devices and Circuits– Robert T. Paynter, 7 ed., 2009, PEI.
2. Electronic Circuit Analysis – K. Lal Kishore, 2004, BSP.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIGITAL ELECTRONICS LAB

Course Code: GR22A2058 **L/T/P/C: 0/0/3/1.5**
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 various coding schemes are the part of the digital circuit design.
3. To study the combinational logic design of various logic and switching devices and their realization.
4. To study the sequential logic circuits design both in synchronous and Asynchronous modes for various complex logic and switching devices, their minimization techniques and their realizations.
5. To Explain and analyze the VERILOG programming concepts for the design of digital circuits.

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: XILINX ISE QUICK Start Tutorial
TASK-2: Introduction to VERILOG Programming
Design and Simulation of Combinational Logic Circuits Using VERILOG
TASK-3 Realization of Logic GATEs
TASK-4 Half adder and Full adder circuits
TASK-5 Magnitude comparator
TASK-6 Binary to Gray and Gray to Binary converter
TASK-7 Encoder & Decoder
TASK-8 Parity Checker
Design and Simulation of sequential logic circuits using VERILOG
TASK-9 D and T Flip-Flops
TASK-10 SR and JK flipflops
TASK-11 Frequency Divider
TASK-12 Left and Right Shift Register
TASK-13 Serial to Parallel and Parallel to Serial converter
TASK-14 Binary Counter
TASK-15 Asynchronous BCD Up counter
TASK-16 Synchronous down counter
TASK-17 MOD 5 and MOD 10 counters

Text Books:

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

Reference Books:

1. Modern Digital Electronics – R. P. Jain, 3rd edition, 2007- Tata McGraw-Hill.
2. Introduction to Switching Theory and Logic Design – Fredric J. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & Sons Inc.
3. Switching Theory and Logic Design – A Anand Kumar, PHI, 2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SIGNALS AND SYSTEMS LAB

Course Code: GR22A2059 **L/T/P/C: 0/0/2/1**
II Year I Semester

Course Objectives:

1. To provide a thorough understanding and analysis of signals and systems using MATLAB platform
2. To generate and process various deterministic continuous and discrete-time signals.
3. To be aware of the underlying phenomenon of Fourier analysis thereby analyzing the signals and sequences transforming them into frequency domain
4. To demonstrate the system representation and characterize the properties of Linear Time-Invariant (LTI) systems
5. To process continuous-time signals by first sampling and then processing the sampled signal in discrete-time.

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 AND TECHNOLOGY

ENVIRONMENTAL SCIENCE

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

Course Objectives:
1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understanding the environmental policies and regulations
4. Integrate human ecology and science of environmental problems.
5. The effect of human activities on atmospheric pollution

Course Outcomes:
1. Understand the harmonious co-existence in between nature and human being
2. Recognize various problems related to environment degradation.
3. Develop relevant research questions for environmental investigation.
4. Generate ideas and solutions to solve environmental problems due to soil, air and water pollution.
5. Evaluate and develop technologies based on ecological principles and environmental regulations which in turn helps in sustainable development.

UNIT-I
Ecosystems: Definition, Scope, and Importance of ecosystem.Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, services and carrying capacity.

UNIT-II
Natural Resources: Classification of Resources: Living and Non-Living resources, natural capital & Resources water resources: use and over utilization of surface and ground water, conflicts over water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT-III
Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV
Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern

agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Waste water Treatment methods: Primary, secondary and Tertiary.

Global Environmental Issues and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS).Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. Anthropogenic activities, influence on the occurrence of COVID-19 Pandemic? How environment benefitted due to global lockdown arising out of corona outbreak.

UNIT-V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Resource exploitation, Crazy Consumerism, Environmental Education, Environmental Ethics, Concept of Green Building.

TEXT BOOKS:

1. Environmental Studies by Anubha Kaushik, 4th Edition, New Age International Publishers.
2. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.

REFERENCE BOOKS:

1. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications..
2. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
3. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela.2008 PHI Learning Pvt. Ltd.
4. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
5. Introduction to Environmental Science by Y. Anjaneyulu, BS Publications.
6. Environmental Studies by R. Rajagopalan, Oxford University Press.

II YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTATIONAL MATHEMATICS FOR ENGINEERS

Course code:GR22A2009 **L/T/P/C: 2/1/0/3**
II Year II Semester

Course Objectives

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

Course Outcomes

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

UNIT-I

Root finding and Numerical solution of linear algebraic systems

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

UNIT-II

Interpolation - Cubic spline- Differentiation

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

UNIT-III

Numerical integration and Curve approximations

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

UNIT-IV

Numerical solution of initial and boundary value problems in ODE

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

UNIT-V

Numerical solution initial and boundary value problems in PDE

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

TEXT BOOKS

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

REFERENCE BOOKS

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MICROCONTROLLERS

Course Code: GR22A2060 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Objectives:
1. To describe the basic concepts and structure of computers.
2. To compare features and internal components of microprocessors and microcontrollers
3. To describe the 8086 microprocessor architecture and 8051 microcontroller architecture
4. To analyse assembly language programming concepts
5. To create various programs to run several applications by interfacing

Course Outcomes:
1. Describe the internal structure of basics of computer organization and Microprocessors
2. Compare the architectures of microprocessors and microcontrollers
3. Analyze the functionality of 8051 microcontroller and 8086 microprocessor architectures
4. Write assembly language programs by using the instruction set
5. Design various programs to run several applications

UNIT-I
Introduction to Microprocessors: Overview of 8085 and it's Comparison with 8086
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.

UNIT-II
Introduction to Microcontrollers: Differences between microprocessors and microcontrollers, Overview of 8051 Microcontroller, Pin diagram of 8051,Architecture, Programming model, I/O Ports, Memory Organization of 8051,Special function Registers**,** PSW, SCON, TCON, TMOD, PCON etc.

UNIT-III
Arithmetic and logical operations of 8051: Addressing Modes of 8051:Immediate and register addressing modes, Accessing memory using various addressing modes, bit addresses for I/O and RAM Assembly language programming. Arithmetic, logical instructions and programs: Arithmetic instructions and operations, Logic and compare instructions, Rotate instructions and data serialization, BCD ASCII and other application programs

UNIT-IV
Jump, loop and call Operations of 8051: Loop and jump instructions, call instructions, I/O port programming: 8051 I/O Programming, I/O bit manipulation Programming,

Microcontroller design: Timer Programming: Programming 8051 timers ,Counter programming, Serial Port Programming: Basics of serial communication,8051 serial port programming in Assembly, Interrupts Programming:8051 Interrupts, Programming timer interrupts, Programming external hardware interrupts, Programming the serial interrupt, Interrupt priority in the 8051.

UNIT-V

Applications and Interfacing of 8051: LCD and keyboard interfacing, ADC interfacing, DAC interfacing: Generation of sine wave, square wave, triangular wave etc., Interfacing to External Memory: 8031/51 interfacing with external ROM, 8051 data memory space.

Text Books:

1. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.
2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed,2004.

Reference Books:

1. Morris Mano, "Computer System Architecture", Prentice-Hall of India, 2000.
2. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, TMH, 2ndEdition 2006.
3. The 8051 Microcontroller and Embedded Systems –Muhammad Ali Mazidi,Janice GillispieMazidi, Rolin D.McKinlay

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

Course Code: GR22A2061 **L/T/P/C: 3/1/0/4**
II Year II Semester

Course Objectives:
1. Carryout a study on various analytical methods of calculating electric field intensities and electric potentials
2. Carryout a study on various analytical methods of calculating magnetic field intensities and magnetic potentials
3. Carryout a study on time varying electrical and magnetic field intensities and consolidating important laws as Maxwell's Equations,
4. Carryout fundamentals of uniform plane waves in various media; calculation of power density and reflection
5. Carryout a study on transmission lines and usage of Smith Chart

Course Outcomes:
1. Apply Coulomb's law, Gauss's law equations for calculating electric field intensities and electric potentials in vacuum and materials due to various charge distributions
2. Apply Biot-Savart's law, Ampere's circuital law for calculating magnetic field intensities and potentials (scalar & vector) in vacuum and materials due to steady electric currents
3. Apply Faraday's law in generation of Electro Motive Force and modified Ampere's law to get finalized forms of Maxwell's equations
4. Apply fundamentals of uniform plane waves in various electromagnetic wave propagation problems
5. Apply filed theory, circuit theory and Smith chart knowledge to transmission lines

UNIT–I
Electrostatics: Coulomb's Law, Force on a discrete charge due to single charge and charge distributions, Electric Field Intensity – Fields due to Different Charge configurations, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V(Potential gradient), Maxwell's Equations for Electrostatic Fields(Divergence and curl of Electric field). Convection and Conduction Currents, Point form of Ohm's Law, Continuity Equation, Boundary conditions (only statements no derivation). Simulation of electrostatic fields using Matlab or CST Studio Suite.

UNIT–II
Magnetostatics: Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Equations for Magnetostatic Fields(Divergence and curl of Magnetic field), Magnetic Scalar Potentials, Force between current-carrying conductors, .Boundary conditions (only statements). Inductance fundamental. Simulation of magnetostatic fields using Matlab or CST Studio Suite.

UNIT–III
Time Varying Fields, Maxwell's Equations and Wave Equations: Faraday's Law -Transformer EMF and motional EMF, Concept of Displacement Current. Maxwell's Equations in final forms, Vector wave equation (Helmholtz Equation), Solution of one-dimensional wave equation. Uniform Plane wave characteristics. Simulation of Uniform plane waves using

Matlab or CST Studio Suite.

UNIT–IV

EM Wave Propagation in Different Media: – Loss tangent, Classification of materials into good conductors, good dielectrics and quasi conductors. Wave propagation in good conductors, good dielectrics and quasi conductors, Instantaneous and average Poynting vectors, Reflection, and Transmission coefficients of Normal incidence. Qualitative understanding of Oblique incidence with final expressions (no derivations).Simulation of wave movement in different media using Matlab or CST Studio Suite.

UNIT–V:

Transmission Lines: Transmission Line Parameters, Transmission Line Equations, Characteristic Impedance, Propagation characteristics, Lossless/ Low Loss Line Analysis, Conditions for Distortion less Transmission and Minimum Attenuation. Finite Transmission Line, Input Impedance, Short Circuit and Open Circuit Lines, Reflection Coefficient, VSWR. UHF Lines as Circuit Elements - λ/2, λ/4, λ/8 Lines. Impedance Transformations and Matching.**Smith Chart**– Theory and Applications, Single Stub Matching. Propagation between Parallel Plates, Modes, Cut-off Frequencies, Phase and Group Velocities, Wavelengths, Wave Impedances.

Text/Reference Books:

1. Principles of Electromagnetics – Matthew N.O. Sadiku and S.V. Kulkarni, 6th Ed., Oxford University Press, Aisan Edition, 2015.
2. EM waves and radiating systems by E C Jordan and Balmain.
3. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, 8th Ed., McGrawHill,2014

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ANALOG ELECTRONICS

Course Code: GR22A2062 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Objectives:

1. Learn the concepts of high frequency analysis of transistors.
2. To give understanding of various types of amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
3. To familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback
4. To construct various multivibrators using transistors and sweep circuits.
5. To apply and analyze various amplifiers and multivibrator circuits for various applications .

Course Outcomes:

1. Design the multistage amplifiers and understand the concepts of High Frequency Analysis of Transistors.
2. Utilize the Concepts of negative feedback to improve the stability of amplifiers and positive feedback to generate sustained oscillations
3. Design and realize different classes of Power Amplifiers and tuned amplifiers useable for audio and Radio applications.
4. Design multivibrators and sweep circuits for various applications.
5. Apply and analyze various amplifiers and multivibrator circuits for various applications

UNIT-I

Multistage Amplifiers: Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Cascade, Cascode amplifier, Darlington pair, Hybrid –π-model of Common Emitter transistor at high frequency.

UNIT-II

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 Amplifiers. **S**ingle Tuned Amplifiers – Q-factor, frequency response, Concept of stagger tuning.

UNIT-III

Multivibrators: Types of Triggering, Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors. Time Base Generators: General features of a Time base Signal, Methods of Generating Time Base Waveform, Miller and Bootstrap.

UNIT-IV

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation - Inverting, Non-

Inverting, Differential, Instrumentation Amplifier, , Differentiators and Integrators, Comparators, Schmitt Trigger Active Filters (LPF,HPF) .Classification of Integrated Circuits, LM 324.

UNIT-V

IC555 Timer – Functional Diagram, Monostable, and Astable Operations

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Different Types of ADCs: Flash type , Successive Approximation and Dual Slope, Counter type, Specifications of ADC and DAC.

Text/Reference Books: (only 6 books)

1. Integrated Electronics, Jacob Millman, Christos C Halkias, McGraw Hill Education, 2nd edition 2010
2. Electronic Devices and Circuits, David A. Bell – 5thEdition, Oxford, 1986.
3. Electronic Devices and Circuits theory– Robert L. Boylestead, Louis Nashelsky, 11th Edition, 2009, Pearson
4. Millman's Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. PrakashRao, 2 Ed., 2008, TMH.
5. Pulse, Switching and Digital Circuits – 5thEdition, David A. Bell, Oxford, 2015
6. Linear Integrated Circuits, D. Roy and Choudhury, Shail B. Jain, 4th Edition, New Age International (P) Limited, 2010.
7. Operational Amplifiers and Linear Integrated Circuit Theory and Applications, Denton J Dailey, McGraw-Hill, 1989.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ANALOG AND DIGITAL COMMUNICATIONS

Course Code: GR22A2063 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Objectives:
1. To study and understand concepts, mathematics, generation and detection of various amplitude modulations.
2. To study and understand concepts, mathematics, generation and detection of frequency modulation.
3. To study and understand concepts and mathematics of optimal baseband communication
4. To study and understand various waveform coding.
5. To study and understand concepts, mathematics, generation and detection of various digital modulations.

Course Outcomes
1. Apply the knowledge for design of AMDSBFC, AMDSBSC and SSB modulation and demodulation schemes forgiven specifications
2. Apply the knowledge for design of frequency modulation and demodulation scheme forgiven specifications
3. Apply the knowledge for design of optimal baseband communication system.
4. Apply the knowledge for design of various digital modulation schemes.
5. Apply the knowledge for calculating channel capacity for various scenarios.

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. Pre-envelope and complex envelope, 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, FM Threshold effect, Pre-emphasis and De-emphasis.

UNIT III
Waveform coding and Baseband Communication PAM, PCM, Quantisation noise, DM, DPCM and TDM, Different source codes. Matched filter, error rate in baseband communication, intersymbol interference and Nyquist criterion for distortionless binary baseband transmission

UNIT IV

Digital Modulation Techniques Geometric representation of signals. BPSK, QPSK, FSK: Signal model, Constellation diagram Generation and Detection. Error Probabilities of BPSK and QPSK. QAM-Signal model.

UNIT V

Information Theory Discrete Memoryless source, Information, Entropy, Mutual Information - Discrete Memoryless channels – Binary Symmetric Channel, Channel Capacity - Hartley - Shannon law - 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, SanjaySharma
3. CommunicationSystems-SimonHaykin,JohnWiley,5thEd.2009
4. PrinciplesofCommunicationSystems-HerbertTaub,DonaldLSchiling,GoutamSaha,3rd Edition, Mcgraw-Hill, 2008.

ReferenceBooks:

1. Electronics Communication Systems-Fundamentals throughAdvanced-WayneTomasi, 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 RANGARAJUINSTITUTE OF ENGINEERING AND TECHNOLOGY
MICROCONTROLLERS LAB

Course Code: GR22A2064 **L/T/P/C: 0/0/2/1**
II Year II Semester

Course Objectives

1. To impart the knowledge of 8051 and AVR Microcontrollers architecture & its programming
2. To extract the features of microcontroller and interfacing with different peripherals.
3. To know the working Environment on Arduino IDE and Keil IDE.
4. To understand the concept of Assembly, Embedded C and AVR programming.
5. To develop an application Using AVR/8051 microcontroller in Embedded C.

Course Outcomes:

1. Acquire the knowledge of 8051and AVR 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 Communication.

3. Time delay Generation Using Timers of 8051.

Task-2: Embedded C/Arduino Programming Using Arduino Uno Boards and Arduino IDE

1. LEDs and Switches
2. 2*16 LCD
3. Serial Communication
4. Reading sensors using Internal ADC
5. Device control
6. DC Motor control
7. Real Time Clock
8. Wireless Communication(Bluetooth/ Zigbee)
9. Interrupts

Task-3: AVR Programming Using Arduino Uno Boards and Arduino IDE.

1. AVR Program to interface a switch and a buzzer to two different pins of a Port such that the buzzershould sound as long as the switch is pressed.
2. AVR Program for Echo.
3. AVR Program to read the LDR sensor and control the appliances based on light intensity.

Note:

* Task1Programs have to be tested Using Keil IDE or Equivalent.
* Task 2 Programs have to be tested on Arduino Uno Boards (AVR Microcontroller Boards)orEquivalent Using Embedded C/Arduino Programming and Arduino IDE.
* Task 3 Programs have to be tested on Arduino Uno Boards (AVR Microcontroller Boards) orEquivalent Using AVR Programming and Arduino IDE.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALOG ELECTRONICS LAB

Course Code: GR22A2065 **L/T/P/C: 0/0/3/1.5**
II Year II Semester

Course Objectives:

1. Learn the concepts of high frequency analysis of transistors.
2. To give understanding of various types of amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
3. To familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback
4. To construct various multivibrators using transistors and sweep circuits.
5. To apply and analyze various amplifiers and multivibrator circuits for various applications.

Course outcomes:

1. Design the multistage amplifiers and understand the concepts of High Frequency Analysis of Transistors.
2. Utilize the Concepts of negative feedback to improve the stability of amplifiers and positive feedback to generate sustained oscillations
3. Design and realize different classes of Power Amplifiers and tuned amplifiers useable for audio and Radio applications.
4. Design multivibrators and sweep circuits for various applications.
5. Apply and analyze various amplifiers and multivibrator circuits for various applications

List of Experiments

1. Design and Verify Two Stage RC Coupled Amplifier
2. Design and verify the Darlington Pair Circuit
3. Design and verify Class A power amplifier
4. Design and verify Class B Complementary symmetry amplifier
5. Design and verify an Astable Multivibrator
6. Design and verify a Monostable Multivibrator
7. Design and verify Response of Schmitt Trigger circuit
8. Design and Verify Boot strap sweep circuit.
9. Verify Op-Amp Inverting and Non-Inverting Amplifiers.
10. Verify Adder, Subtractor circuits with waveforms
11. Design and verify Function Generator.
12. Design and verify Active Filter LPF&HPF (first order)
13. Design and verify IC 555 Timer – Monostable and Astable Multivibrator
14. 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:GR22A2066 **L/T/P/C: 0/0/3/1.5**
II Year II Semester

Course Objectives:

1. To develop an ability to design basic model of analog and digital communication systems.
2. To understand practically the generation, detection of various analog and digital modulation techniques using MATLAB.
3. To acquire practical knowledge of each block in AM, FM transmitters and receivers.
4. To discuss various security based transmission techniques.
5. To analyze the various modulation techniques in different environments and to verify its performance using MATLAB.

Course Outcomes:

1. Analyze the spectrum of various analog and digital modulation techniques.
2. Understand the effect of noise present in continuous wave and angle modulation techniques.
3. Attain the knowledge of design about analog and digital Transmitters and Receivers using components.
4. Apply and analyze the various Modulation techniques in different environments using MATLAB.
5. Explains spread spectrum systems to provide security to data using MATLAB.

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

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