Academic Regulations
Programme Structure
and
Detailed Syllabus

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

(Four Year Regular Programme)

(Applicable for Batches admitted from 2024-25)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Bachupally, Kukatpally, Hyderabad- 500 090

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD

Academic Regulations for B.Tech (Regular) under GR24

(Applicable for Batches Admitted from 2024-25)

Under Graduate Degree Programme in Engineering and Technology (UG)

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

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

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

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

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

3. **Programme Pattern:**

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

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

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

d) The total credits for the Programme are 160.

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

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

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

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

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

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

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

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

a) A student pursues the course of study and completes it successfully in not less than four academic years and not more than eight academic years.

b) A student has to register for all the 160 credits and secure all credits (with CGPA ≥ 5).

c) A student must fulfill all the academic requirements for the award of the degree.

5. Courses to be offered

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

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

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

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

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

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

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

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

6. Attendance Requirements:

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

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

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

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

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

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

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

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

b) Distribution and Weightage of marks

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

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

Assessment Procedure:

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

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

d) Mini Project:

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

Note:

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

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

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

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

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

Note:

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

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

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

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

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

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

  CIE is done for 50 marks as follows:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computation of SGPA and CGPA:

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

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

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

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

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

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

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

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

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

2	First Class	CGPA >= 8.00 with rest of the clauses of S.No 1 not satisfied
3	First Class	CGPA ≥ 7.00 and CGPA <8.00
4	Second Class	CGPA ≥ 6.00 and CGPA <7.00
5	Pass Class	CGPA ≥ 5.00 and CGPA <6.00

Equivalence of grade to marks

Marks % = (CGPA -0.5)*10

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

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

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

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

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

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

18. Transitory Regulations

A. For students detained due to shortage of attendance:

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

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

B. For students detained due to shortage of credits:

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

C. For readmitted students in GR24 Regulations:

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

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

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

Note:

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

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

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

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

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

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

20. General Rules

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

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

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

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

Academic Regulations for B.Tech (Lateral Entry) under GR24
(Applicable for Batches Admitted from 2025-26)

1. All regulations as applicable for B.Tech 4-year degree programme (Regular) will hold good for B.Tech (Lateral Entry Scheme) except for the following rules:
   a) Pursued programme of study for not less than three academic years and not more than six academic years.
   b) A student should register for all 120 credits and secure all credits. The marks obtained in all 120 credits shall be considered for the calculation of the final CGPA.
   c) Students who fail to fulfil all the academic requirements for the award of the degree within six academic years from the year of their admission, shall forfeit their seat in B.Tech programme.

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

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

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

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

S. No	Class Awarded	CGPA Secured
1	First Class with Distinction	CGPA >= 8.00 with no F or below grade/ detention anytime during the Programme
2	First Class	CGPA >= 8.00 with rest of the clauses of S.no 1 not satisfied
3	First Class	CGPA ≥ 7.00 and CGPA <8.00
4	Second Class	CGPA ≥ 6.00 and CGPA <7.00
5	Pass Class	CGPA ≥ 5.00 and CGPA <6.00

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

1. Objectives

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

4. Registration for the courses in Minor Programme

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

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

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

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

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

5. Minor courses and the offering departments

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

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

ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech(ECE)–GR24 Course Structure

I B. Tech (ECE) - I Semester

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

I B.Tech(ECE) - II Semester

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

II B. Tech (ECE) - I Semester

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

II B. Tech (ECE) - II Semester

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

III B.Tech (ECE) –I Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
1	ECE	PC	GR24A3069	IOT Architectures and Protocols	3	0	0	3	40	60	100
2	ECE	PC	GR24A3070	Electromagnetic Fields and Transmission Lines	3	1	0	4	40	60	100
3	ECE	PC	GR24A3071	Digital Signal Processing	3	1	0	4	40	60	100
4		PE- I		Professional Elective-I	3	0	0	3	40	60	100
5		OE-1		Open Elective-1	3	0	0	3	40	60	100
6	ECE	PC	GR24A3077	IOT Sensors Lab	0	0	2	1	40	60	100
7	ECE	PC	GR24A3078	Digital Signal Processing Lab	0	0	2	1	40	60	100
8	English	BS	GR24A3013	Advanced English communication Skills lab	2	0	0	1	40	60	100
				TOTAL	**17**	**2**	**6**	**20**	**320**	**480**	**800**
9	Mgmt	MC	GR24A2003	Constitution of India	2	0	0	0	40	60	100

PROFESSIONAL ELECTIVE–I			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE	GR24A3072	Linear Control Systems
2	ECE	GR24A3073	Introduction to Computer Organization
3	ECE	GR24A3074	Optical Communications
4	ECE	GR24A3075	Digital System Design using Verilog HDL

OPEN ELECTIVE–I			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE	GR24A3076	Digital Electronics for Engineering

III B.Tech (ECE)-II Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
1	ECE	PC	GR24A3079	VLSI Design	4	0	0	4	40	60	100
2	ECE	PC	GR24A3080	Antennas and Wave Propagation	3	1	0	4	40	60	100
3	Mgmt	HS	GR24A3041	Economics and Accounting for Engineers	3	0	0	3	40	60	100
4		PE-II		Professional Elective-II	3	0	0	3	40	60	100
5		OE-II		Open Elective-II	3	0	0	3	40	60	100
6	ECE	PC	GR24A3086	VLSI Design Lab	0	0	2	1	40	60	100
7	ECE	PW	GR24A3027	Mini Project with seminar	0	0	4	2	40	60	100
				TOTAL	**15**	**1**	**7**	**20**	**280**	**420**	**700**

PROFESSIONAL ELECTIVE–II			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE	GR24A3081	FPGA and CPLD Architectures
2	CSE(AIML)	GR24A3082	Machine Learning
3	ECE	GR24A3083	Mobile Communications and Networks
4	ECE	GR24A3084	Embedded Systems Design

OPEN ELECTIVE–II			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE	GR24A3085	Sensor Technology

IV B.Tech (ECE)-I Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
1	Mgmt	HS	GR24A4069	Fundamentals of Management and Entrepreneurship	3	0	0	3	40	60	100
2	ECE	PC	GR24A4070	Microwave Engineering	4	0	0	4	40	60	100
3		PE III		Professional Elective-III	3	0	0	3	40	60	100
4		PE IV		Professional Elective-IV	3	0	0	3	40	60	100
5		OE III		Open Elective-III	3	0	0	3	40	60	100
6	ECE	PC	GR24A4079	Microwave Engineering Lab	0	0	4	2	40	60	100
7	ECE	PW	GR24A4016	Project Work Phase I	0	0	12	6	40	60	100
				TOTAL	**16**	**0**	**16**	**24**	**280**	**420**	**700**

PROFESSIONAL ELECTIVE–III			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE	GR24A4071	System Verilog test benches using UVM
2	ECE	GR24A4072	RTOS and System Programming
3	ECE	GR24A4073	Information theory and Coding
4	CSE	GR24A3087	Computer Networks

PROFESSIONAL ELECTIVE–IV			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE	GR24A4074	Fundamentals of Low Power VLSI Design
2	ECE	GR24A4075	Artificial Neural Networks
3	ECE	GR24A4076	Network Security and Cryptography
4	ECE	GR24A4077	System on Chip Architecture

OPEN ELECTIVE–III			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE	GR24A4078	Communication Technologies

IV B.Tech (ECE)-II Semester

S.No.	BOS	Group	Course Code	Course Name	L	T	P	Credits	Int.	Ext.	Total Marks
1	ECE	PC	GR24A4080	Digital Image Processing	4	0	0	4	40	60	100
2		PE V		Professional Elective-V	3	0	0	3	40	60	100
3		PE VI		Professional Elective-VI	3	0	0	3	40	60	100
4	ECE	PW	GR24A4026	Project Work Phase II	0	0	12	6	40	60	100
		TOTAL			**9**	**0**	**22**	**16**	**160**	**240**	**400**

PROFESSIONAL ELECTIVE–V			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE	GR24A4081	Radar Systems
2	ECE	GR24A4082	5G and Beyond Communication
3	ECE	GR24A4083	Digital Signal Processors and Architectures
4	ECE	GR24A4084	Quantum Technologies

PROFESSIONAL ELECTIVE–VI			
S.No.	**BOS**	**COURSE CODE**	**COURSE**
1	ECE	GR24A4085	Satellite Communications
2	ECE	GR24A4086	Wireless Sensor Networks
3	ECE	GR24A4087	Global Navigation Satellite Systems
4	ECE	GR24A4088	Autonomous Systems

PROFESSIONAL ELECTIVES – 4 THREADS

S. No.	Thread 1: Communication, Networks & Security	Thread 2: VLSI, Embedded & Hardware Design	Thread 3: Signal Processing & Control Systems	Thread 4: AI, ML & Intelligent Systems
1	Optical Communications	Digital System Design using Verilog HDL	Linear Control Systems	Introduction to Computer Organization
2	Mobile Communications and Networks	FPGA and CPLD Architectures	Embedded Systems Design	Machine Learning
3	Computer Networks	System Verilog Test Benches using UVM	Information Theory and Coding	RTOS and System Programming
4	Network Security and Cryptography	System on Chip Architecture	Fundamentals of Low Power VLSI Design	Artificial Neural Networks
5	5G and Beyond Communication	Radar Systems	Digital Signal Processors and Architectures	Quantum Technologies
6	Satellite Communications	Wireless Sensor Networks	Global Navigation Satellite Systems	Autonomous Systems

OPEN ELECTIVES FOR GR24 REGULATIONS:

THREAD 1	THREAD 2	OFFERED BY
1. Human Resource Development and Organizational Behavior(GR24A3010) 2. Cyber Lawand Ethics(GR24A3024) 3. Economic Policies in India(GR24A4013) 4. Indian knowledge system(GR24A3023) 5. Personality Development through Life Enlightenment skills(GR24A4012)	1. Engineering Materials for Sustainability(GR24A3009)	**CE**
	2. Geographic Information Systems and Science(GR24A3022)	
	3. Plumbing (Water and Sanitation)(GR24A4011)	
	1. Non-Conventional Energy Sources(GR24A3035)	**EEE**
	2. Concepts of Control Systems(GR24A3046)	
	3. Artificial Neural Networks and Fuzzy Logic(GR24A4037)	
	1. Industrial Automation and Control(GR24A3056)	**ME**
	2. Operations Research(GR24A3034)	
	3. Composite Materials(GR24A3066)	
	1. Digital Electronics For Engineering(GR24A3076)	**ECE**
	2. Sensor Technology(GR24A3085)	
	3. Communication Technologies GR24A4078	
	1. Data Science for Engineers (GR24A3092)	**CSE**
	2. Data Analytics using open source tools (GR24A3103)	
	3. Augmented Reality and Virtual Reality GR24A4096)	
	1.Services Science and Service Operational Management(GR24A4115)	**CSBS**
	2. IT Project Management(GR24A4116)	
	3. Marketing Research and Marketing Management(GR24A4117)	
	1.Basics for java programming (GR24A3133)	**CSE (AIML)**
	2. Introduction to DBMS (GR24A3141)	
	3. Introduction to Data Mining (GR24A4124)	
	1. Introduction to Operating System (GR24A3143)	**CSE (DS)**
	2. Internet of Things (GR24A3145)	
	3. Scripting Languages (GR24A4134)	

I YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

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

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

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

Course Outcomes:

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

UNIT-1: Fundamentals of Vector and Matrix algebra
Operations on vectors and matrices- Orthogonal projection of vectors- Exact and generalized inverse of a matrix- Rank of a matrix- Linear independence of vectors- Structured square matrices (Symmetric, Hermitian, skew-symmetric, skew-Hermitian, orthogonal and unitary matrices)- Vector and matrix norms

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

UNIT-II: Matrix eigenvalue problem and Quadratic forms
Determination of eigenvalues and eigenvectors of a matrix, properties of eigenvalues and eigenvectors (without proof)- Similarity of matrices- Diagonalization of a matrix- Orthogonal diagonalization of a symmetric matrix- Definiteness of a symmetric matrix

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

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

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

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

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

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

TEXT BOOKS:

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

REFERENCES:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING CHEMISTRY

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

Course Outcomes:

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

Unit I: Water and its Treatment: **(8 Lectures)**

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

Unit II: Battery Chemistry and Corrosion **(8 Lectures)**

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

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

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

Unit III: Polymers **(8 Lectures)**

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

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

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

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

Unit V: Energy Resources (8 Lectures)

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

UNIT - V: Engineering Materials (10 Lectures)

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

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

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

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF ELECTRICAL ENGINEERING

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

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

Course Outcomes:

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

UNIT I

NETWORK ELEMENTS & LAWS

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

UNIT II

NETWORK THEOREMS

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

UNIT III

AC CIRCUITS

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

UNIT IV

BASICS OF ELECTRICAL MACHINES

Transformer: Mutual Induction, construction and working principle, Types of transformers, Ideal transformer, EMF Equation-simple Problems.

Construction and working principles of DC generator, DC motor, Synchronous generator, and Induction Motor – applications.

UNIT V

ELECTRICAL INSTALLATIONS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, MCCB, Earthing – Plate and Pipe Earthing. Types of Batteries – Primary and Secondary, UPS (Uninterrupted power supply)-

components, calculation of ratings for UPS-Components to a specific load, power

factor improvement methods.

TEXTBOOKS

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING

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

Course Outcomes:

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

UNIT I

Introduction to Programming:

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

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

UNIT II

Decision Making and Arrays:

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

Arrays: One and two dimensional arrays, creating, accessing and manipulating elements ofarrays. **Searching:** Introduction to searching, Linear search and Binary search.

UNIT III

Strings and Functions:

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

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

UNIT IV

Pointers and Structures:

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

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

UNIT V

File handling and Preprocessor in C:

Files: Text and binary files, creating, reading and writing text and binary files, random access tofiles, error handling in files.
Preprocessor: Commonly used preprocessor commands like include, define, undef, if, ifdef,ifndef, elif, command line arguments, enumeration data type.

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

TEXT BOOKS

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

REFERENCE BOOKS

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Engineering Chemistry Lab

Course Code: GR24A1006 **L/T/P/C: 0/0/3/1.5**
I Year I Semester

Course Outcomes:

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

List of Experiments

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
Programming For Problem Solving Lab

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

Course Outcomes:

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

TASK 1

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

TASK 2

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

TASK 3

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

TASK 4

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

d. Write a C program to display number of days in month using switch case (The input is month number 1 -12).

TASK 5

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

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TASK 6

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

(i)

```
* * * *
*     *
*     *
* * * *
```

(ii)

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

(iii)

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

b. Write a C program to generate the prime numbers between x and y where x and y arestarting and ending values to be supplied by the user.
c. Write a C programto calculate the sumof 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 programto find sum, average and minimumand maximum in a list of numbers.
b. Write a C programto implement Linear search.
c. Write a C program to implement Binary search.

TASK 8

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

TASK 9

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

TASK 10

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

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

TASK 11

a. Write a C programto 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 programto 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 byrollno
   (iii) Print the names of the students having the highest test score
b. Write a C program that uses structures and functions to perform addition and product oftwo complex numbers? (use structures and functions)

TASK 14

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

TASK 15

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

TEXT BOOKS

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

REFERENCE BOOKS

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Engineering Workshop

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

Course Outcomes

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

TRADES FOR EXERCISES: At least two tasks from each trade

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

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

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

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

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

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

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

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

Text Books

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Fundamentals of Electrical Engineering Lab

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

COURSE OUTCOMES

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

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

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

TEXTBOOKS

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Elements of Electronics and Communication Engineering Lab

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

I Year I Semester

COURSE OUTCOMES:

The students will be able to:

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

List of Experiments:

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Design Thinking

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

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

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

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

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

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

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

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

TEXTBOOKS:

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

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

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

REFERENCE BOOKS:

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

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

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

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

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

I YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Differential Equations And Vector Calculus

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

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

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

UNIT-I: ORDINARY DIFFERENTIAL EQUATIONS OF THE FIRST ORDER

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

UNIT-II: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

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

UNIT-III: MULTIPLE INTEGRALS

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

UNIT-IV: VECTOR DIFFERENTIATION AND LINE INTEGRATION

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

UNIT-V: SURFACE INTEGRATION AND VECTOR INTEGRAL THEOREMS

Surface integration: Evaluation of surface and volume integrals, flux across a surface
Vector integral theorems: Green's, Gauss and Stokes theorems (without proof) and their applications

TEXT BOOKS

1. R.K.Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa publishing house, Fourth edition 2014
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
4. . G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

REFERENCES:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
Applied Physics

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

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

UNIT I: Quantum Physics and Solids

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

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

UNIT II: Semiconductors and devices

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

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

UNIT III: Magnetic materials and Superconductivity

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

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

UNIT IV: Lasers and Fiber Optics

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

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

UNIT V: Nanotechnology

Introduction, Quantum confinement, Surface to volume ratio, Classification of Nanomaterials,

Synthesis methods: Top-Down Technique: Ball milling method, Bottom-Up technique: Sol-Gel method, Characterization techniques: SEM, TEM and EDAX.

Text books:

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

References:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

English

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

Course Outcomes: Students will be able to

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

UNIT – I

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

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT - V

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

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

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

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

TEXTBOOK:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES

Course Code: GR24A1017 **L/T/P/C:2/1/0/3**
I Year II Semester

Course Outcomes:

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

UNIT I

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

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

UNIT II

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

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

UNIT III

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

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

UNIT IV

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

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

UNIT V

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

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

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

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

TEXT BOOKS

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

REFERENCE BOOKS

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Graphics For Engineers

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

Course Outcomes

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books:

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

Reference Books:

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

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GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Fundamentals of Electronic Devices

Course Code: GR24A1026 **L/T/P/C: 2/0/0/1**

I Year II Semester

Course Outcomes: Students will be able to

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

UNIT-I: Semiconductor Materials

Intrinsic and Extrinsic semiconductor, Mass action law, Energy band diagram of insulators, semiconductors and metals, Fermi-level in intrinsic and extrinsic semiconductor, Diffusion and Drift current

UNIT-II: PN Junction diode

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

UNIT-III: Bipolar Junction Transistor

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

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

UNIT-V: Transistor Biasing and Stabilization of operating point

Biasing of a transistor, Selection of operating point, Need for biasing, Requirements of a biasing circuits, Stabilization factors, Different biasing circuits-Fixed bias, Collector to base bias and Self-bias circuits

Text Books

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

Reference Books

1. "The Art of Electronics" by Paul Horowitz and Winfield Hill, Cambridge University Press
2. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky, Pearson Education
3. "Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education

4. "Electronics for Dummies" by Cathleen Shamieh, For Dummies (Wiley)
5. "Introduction to Electric Circuits" by Richard C. Dorf and James A. Svoboda, Wiley

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

English Language and Communication Skills Lab

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

Course Outcomes: Students will be able to

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

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

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

Exercise I CALL
Lab:

Understand: Introduction to Phonetics – Speech Sounds – Consonant and Vowel Sounds.
Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants.

ICS Lab:

Understand: Ice Breaking and JAM.
Practice: Ice-Breaking Activity and JAM Session. Introducing oneself and others

Exercise II CALL
Lab:

Understand: Structure of Syllables– Weak Forms and Strong Forms in Context– Word Stress and Rhythm.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.

ICS Lab:

Understand: Features of Good Conversation – Non-verbal Communication.
Practice: Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions- Telephone Etiquette, Rapid Round –Memory Games.

Exercise III CALL
Lab:

Understand: Intonation--Errors in Pronunciation-the Influence of Mother Tongue (MTI).
Practice: Common Indian Variants in Pronunciation – Differences in British and American

Pronunciation.

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks.
Practice: Making a Short Speech – Extempore.

Exercise IV CALL

Lab:

Understand: Presentation Skills – Elements of Presentation – Organizing Content – Use of Power Point Slides Preparation

Practice: Presentation Skills

ICS Lab:

Understand: How to make informal and Formal Presentations

Practice: Collages / Poster Presentations-Power point presentations

Exercise V CALL

Lab:

Understand: Listening Skills and its importance-– Purpose- Process- Types- Barriers of Listening - Listening for General/Specific Details.

Practice: Listening Comprehension Tests.

ICS Lab:

Understand: Mind map - Story Telling - Narrating a story using mind maps

Practice: Weaving Stories

Minimum Requirement of infrastructural facilities for ELCS Lab:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
Applied Physics Lab

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

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

List of Experiments:

1. Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode.
2. Solar Cell: To study the V-I Characteristics of solar cell.
3. Light emitting diode: To study V-I characteristics of light emitting diode.
4. Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.
5. Hall effect: To determine Hall co-efficient of a given semiconductor.
6. Photoelectric effect: To determine work function of a given material and Planck's constant.
7. LASER: To study the V-I characteristics of LASER sources.
8. Optical fiber: To determine the bending losses of Optical fibers.
9. Optical fiber: To determine the Numerical Aperture of Optical fibers.
10. Melde's experiment: To determine the frequency of a tuning fork using Melde's arrangement.

Note: Any 8 experiments are to be performed.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Data Structures Lab

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

I Year II Semester

Course Outcomes:

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

TASK 1

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

TASK 2

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

TASK 3

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

TASK 4

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

TASK 5

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

TASK 6

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

TASK 7

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

TASK 8

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

TASK 9

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

TASK 10

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

TASK 11

a. Implement the following operations on Binary Search Tree
   i. count-nodes
   ii. height
   i. 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
   i delete
   i search
   iv. display

TEXT BOOKS

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

REFERENCE BOOKS

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

II YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALOG CIRCUITS-I

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

Course Outcomes: Students will be able to

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

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

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

UNIT-III
FET- Biasing Techniques
FET Amplifiers: Analysis of CS, CD, CG JFET Amplifiers, comparison of performance with BJT Amplifiers, Basic Concepts of MOSFET Amplifiers, MOS Small signal model, Common source amplifier with resistive, Diode connected and Current source loads, Source follower, Common Gate Stage, Cascode and Folded Cascode Amplifier – frequency response.

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

UNIT-V
Transistor at High Frequency: Hybrid -Π model of Common Emitter transistor model, $f\alpha$, $f\beta$ and unity gain bandwidth, Gain-bandwidth product.

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

Reference Books

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

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GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIGITAL ELECTRONICS

Course Code: GR24A2055 **L/T/P/C: 3/0/0/3**

II Year I Semester

Course Outcomes:

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

UNIT-I

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

UNIT-II

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

UNIT-III

Sequential Logic circuits: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another. Digital ICs: IC7474 Flip- flops, IC7490 & IC74193.

UNIT-IV

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

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UNIT-V

Memory and Programmable Logic: Types of Memories, Random-Access Memory, Read-

Only Memory, Memory Operations, Timing waveform, Memory Decoding, Internal

Construction, Address Multiplexing, PROM, Combinational PLDs, Programmable Logic Array, Programmable Array Logic.

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SIGNALS AND SYSTEMS

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

Course Outcomes:

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

UNIT-I

Introduction to Continuous-time Signals and Fourier series

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

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

UNIT-II

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

UNIT-III

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

UNIT-IV

Discrete Time signal characteristics (periodicity, frequency, deterministic, random, symmetry, energy and power), Discrete Time (DT) signal representation using complex

exponential and sinusoidal components; z-Transform of a discrete sequence; Relationship between z-Transform and Discrete Time Fourier Transform; Transfer function of a LTI system (No difference equations); Region of convergence of z-Transform, Constraints on ROC for various classes of signals; Properties of z-Transform, Inverse z-Transform by Partial Fractions (simple poles only).

UNIT-V

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

Text/Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROBABILITY THEORY AND STOCHASTIC PROCESSES

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

Course Outcomes:

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

UNIT-I: INTRODUCTION TO PROBABILITY

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

UNIT-II: OPERATIONS ON SINGLE VARIABLE – EXPECTATIONS

Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable.

UNIT-III: OPERATIONS ON MULTIPLE RANDOM VARIABLES – EXPECTATIONS

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

UNIT-IV: RANDOM PROCESSES -TEMPORAL AND SPECTRAL CHARACTERISTICS

The Random process, classification, deterministic and non-deterministic processes, distribution and density Functions, stationarity and statistical independence, first-order stationary processes,

second-order and wide-sense stationarity, auto correlation function and its properties, cross-correlation function and its properties, covariance functions, Gaussian random processes. Ergodicity.

The Power Spectrum: Properties, Relationship between Power Spectrum and Auto-correlation Function, Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

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

Temporal Characteristics of System Response: Random signal response of linear systems, auto-correlation and cross-correlation functions of input and output.

Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

Types of Noise: Resistive (Thermal) Noise Source, Shot noise, Extra terrestrial Noise, Arbitrary Noise Sources,White Noise, Modeling of Noise Sources, Average Noise Bandwidth, Effective Noise Temperature, Average Noise Figures, Average Noise Figure of cascaded networks.

Text Books:

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

NETWORK ANALYSIS

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

Course Outcomes:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

Network Topology: Network terminology - Graph of a network - Incidence and reduced incidence matrices – Cutsets - Fundamental cutsets - Cutset matrix – Tiesets, Network functions: Poles and zeros of network functions, Restrictions on poles and zeros for driving point function and transfer function.

UNIT-V

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

Text Books

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALOG CIRCUITS-I LAB

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

Course outcomes: Students will be able to

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

LIST OF EXPERIMENTS

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

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

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIGITAL ELECTRONICS LAB

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

Course Outcomes:

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

LIST OF EXPERIMENTS

TASK-1 Realization of Logic GATEs

TASK-2 Adders

TASK-3 Magnitude comparator

TASK-4 Binary to Gray and Gray to Binary converter

TASK-5 Encoder & Decoder

TASK-6 Parity Checker

TASK-7 SR and JK flipflops

TASK-8 D and T Flip-Flops

TASK-9 Frequency Divider

TASK-10 Left and Right Shift Register

TASK-11 Serial to Parallel and Parallel to Serial converter

TASK-12 Binary Counter

TASK-13 Asynchronous BCD Up counter

TASK-14 Synchronous down counter

TASK-15 MOD 5 and MOD 10 counters

Lab Methodology: -
Lab experiments with suitable simulation Software.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SIGNALS AND SYSTEMS LAB

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

Course Outcomes:

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

LIST OF EXPERIMENTS

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

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

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

Text/Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING & TECHNOLOGY
OOPS THROUGH JAVA LAB

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

Course Outcomes

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

Task 1

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

Task 2: Write java programs that implement the following

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

Task 3

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

Task 4: Write java programs that uses the following keywords

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

Task 5

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

Task 6

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

Task 7

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

Task 8

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

Task 9

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

Task 10

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

Task 11

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

Task 12

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

Task 13

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

Text Books:

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

Reference Books:

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

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

VALUE ETHICS AND GENDER CULTURE

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

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

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

UNIT –I

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

- A Case study on values and self-development

UNIT -II

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

- A Case study on Personality

UNIT –III

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

- A Case study on professional ethics

UNIT –IV

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

- A Case study/ video discussion on attitudes towards gender

UNIT-V

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

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

Text Books:

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

Reference Books:

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

II YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTATIONAL MATHEMATICS FOR ENGINEERS

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

Course Outcomes

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

UNIT-I: Root finding and Numerical solution of linear algebraic systems

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

UNIT-II: Interpolation - Cubic spline- Differentiation

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

UNIT-III: Numerical integration and Curve approximations

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

UNIT-IV: Numerical solution of initial and boundary value problems in ODE

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

UNIT-V: Numerical solution initial and boundary value problems in PDE

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

TEXT BOOKS

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

REFERENCE BOOKS

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Microcontrollers

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

Course Outcomes:

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

UNIT-I

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

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

UNIT-II

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

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

UNIT-III

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

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ANALOG CIRCUITS-II

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

Course Outcomes: Students will be able to

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INTEGRATED CIRCUITS AND APPLICATIONS

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

II Year II Semester

Course Outcomes: Students will be able to

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

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

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

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

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

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

Text Books

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ANALOG AND DIGITAL COMMUNICATIONS

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

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

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Textbooks:

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

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

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MICROCONTROLLERS LAB

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

Course Outcomes:

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

Task-1: 8051 Microcontroller Programming Using Keil IDE.

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

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

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALOG CIRCUITS-II AND ICA LAB

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

Course Outcomes: Students will be able to

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

List of Experiments

Cycle-I

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

Cycle-II

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

Lab Methodology: -

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

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

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

II Year II Semester

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

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

LIST OF THE EXPERIMENTS/TASKS
(All the experiments can be done either using hardware or using MATLAB)

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

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

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

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

TASK-5: Frequency Division Multiplexing & De multiplexing

TASK-6: Pulse Amplitude Modulation & Demodulation

TASK-7: Pulse Width Modulation & Demodulation

TASK-8: Pulse Position Modulation & Demodulation

TASK-9: PCM Generation and Detection

TASK-10: Delta Modulation

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

TASK-12: Amplitude Shift Keying: Generation and Detection

TASK-13: Frequency Shift Keying: Generation and Detection

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

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

TASK-16: Time Division Multiplexing

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

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

Course Outcomes:

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

1. Predict the Field domain in the specialized area under Engineering discipline.
2. Evaluate and Obtained the category of the solution with help of Real time studies
3. Analyse and Discuss the field problems using software tools /Modes/simulations and experimental investigations.
4. Implementing the solution of problem statement.
5. Prioritize the reports and deliver the final work with presentation.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING & TECHNOLOGY
ENVIRONMENTAL SCIENCE

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

Course Pre-Requisites: Basic knowledge of environmental issues

Course Outcomes:

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

UNIT I: INTRODUCTION AND AWARENESS ACTIVITIES

Environmental Science: Introduction, Definition, scope and importance. AWARENESS ACTIVITIES

Small group meetings about:

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

UNIT II: SLOGAN AND POSTER MAKING EVENT

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

UNIT III: EXPERT LECTURES ON ENVIRONMENTAL SCIENCE

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

UNIT IV: CLEANLINESS DRIVE

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

UNIT V: CASE STUDIES

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

TEXT BOOKS:

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

REFERENCES:

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

III YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
IOT ARCHITECTURE AND PROTOCOLS

Course Code: GR24A3069 **L/T/P/C: 3/0/0/3**
III Year I Semester

Course Outcomes:

1. Explore the Evolution of IoT, its Growth and Applications.
2. Compare different IoT architectures and identify the role of various IoT components.
3. Demonstrate knowledge of IoT data management and processing approaches.
4. Analyze IoT protocols across data link, network, transport, and session layers.
5. Evaluate service layer protocols and security mechanisms to design secure IoT applications.

UNIT-I: IOT introduction:
Introduction and definition of IoT, Evolution of IoT, IoT growth, Application areas of IoT, Characteristics of IoT, IoT stack, Enabling technologies, IoT levels, IoT sensing and actuation, Sensing types, Actuator types.

UNIT-II: IOT and M2M:
M2M to IoT – A Basic Perspective– Introduction, Differences and similarities between M2M and IoT, SDN and NFV for IoT,M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, international driven global value chain and global information monopolies. IOT Architecture: IoT Architecture components, Comparing IoT Architectures, A simplified IoT Architecture, core IoT functional stack, IoT data management and compute stack

UNIT-III: **IOT Data link layer and Network layer protocols:**
Data Link / PHY-MAC: IEEE 802.15.4, Bluetooth Low Energy (BLE), Zigbee, IEEE 802.11 (Wi-Fi). **Network Layer:** IPv6, 6LoWPAN, RPL (Routing Protocol for Low-Power and Lossy Networks).

UNIT-IV: **Transport and Session layer protocols:**
Transport Layer: TCP, UDP, TLS/DTLS. **Session/Application Layer:** HTTP, CoAP (Constrained Application Protocol), MQTT (Message Queue Telemetry Transport), AMQP (optional, overview only).

UNIT-V: Service layer protocols and Security:
Service Layer Frameworks: oneM2M, OMA Lightweight M2M (LwM2M). **Security in IoT Protocols:** Security considerations in IEEE 802.15.4, 6LoWPAN, RPL, and Application Layer protocols (CoAP, MQTT).

TEXT BOOKS:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy -Introduction to IOT, Cambridge University Press.
2. David Hanes, Gonzalo salgueiro, Patrick Grossetete, Rob barton, Jerome henry-IoT Fundamentals Networking Technologies, Protocols and Usecases for IoT", Cisco Press.

REFERENCE BOOKS:

1. Cunopfister-Getting started with the internet of things, O Reilly Media, 2011
2. Francis daCosta,-Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications.
3. Arshdeep Bahga, Vijay Madisetti -Internet of Things A Hands-on approach, Universities Press
4. Shriram K Vasudevan, RMD Sundaram, Abhishek S Nagarajan-Internet of things, John Wiley and Sons.
5. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

Course Code: GR24A3070 **L/T/P/C: 3/1/0/4**
III Year I Semester

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

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. Analyze field 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, Poisson's and Laplace's Equations, Capacitance fundamental.

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, Inductance fundamental.

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. Conditions at a Boundary Surface - Dielectric-Dielectric and Dielectric-Conductor Interfaces.

UNIT-IV: EM Wave Propagation in Different Media:
Loss tangent, Classification of materials into good conductors, good dielectrics. Wave propagation in good conductors, good dielectrics, Surface Impedance, Instantaneous and average Poynting vectors, Reflection, and Transmission coefficients of Normal incidence. Qualitative understanding of Oblique incidence with final expressions (no derivations).

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 - $\lambda/2$, $\lambda/4$, $\lambda/8$ Lines. Impedance Transformations and

Matching. Overview of Waveguides, Smith Chart– Theory and Applications, Single Stub Matching.

TEXT BOOKS:

1. Principles of Electromagnetics – Matthew N.O. Sadiku and S.V. Kulkarni, 6th Ed., Oxford University Press, Aisan Edition, 2015.
2. Electromagnetic Waves & Radiating Systems by Edward C. Jordan and Keith G. Balmain, Pearson India, 2015

REFERENCE BOOKS:

1. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, 8th Ed.,McGrawHill, 2014.
2. Umesh Sinha, Satya Prakashan -Transmission Lines and Networks, (Tech. India Publications), New Delhi, 2001.
3. JD Ryder -Networks, Lines and Fields, 2nd Ed., PHI, 1999

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIGITAL SIGNAL PROCESSING

Course Code: GR24A3071 **L/T/P/C: 3/1/0/4**
III Year I Semester

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

1. Understand the fundamental concepts of discrete-time signals and systems, including stability, causality, and frequency domain representation.
2. Apply Discrete Fourier Series (DFS) and Discrete Fourier Transform (DFT) techniques, including FFT algorithms, to analyse and compute frequency spectra of discrete signals.
3. Analyse the structure and behavior of digital filters using Z-transforms and difference equations and evaluate their stability and frequency response.
4. Design Infinite Impulse Response (IIR) digital filters using analog filter approximations and transformation techniques such as impulse invariant and bilinear methods.
5. Design and compare Finite Impulse Response (FIR) filters using window and frequency sampling techniques and explore the applications of multi-rate signal processing.

UNIT-I: Introduction to Digital Signal Processing
Discrete Time Signals and Sequences, Linear Shift Invariant Systems, Stability, and Causality, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems.

UNIT-II: Discrete Fourier Series
DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT, Relation between DTFT, DFS, DFT and Z_Transform. Fast Fourier Transforms: Fast Fourier Transforms (FFT)-Radix-2, Decimation-in-Time, and Decimation-in-Frequency FFT Algorithms, Inverse FFT, and FFT with General Radix N.

UNIT-III: Realization of Digital Filters
Applications of Z-Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters - Direct, Canonical, Cascade and Parallel Forms.

UNIT-IV: IIR Digital Filters
Analog filter approximations - Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Impulse Invariant Techniques, Bi-linear Transformation Method.

UNIT-V: FIR Digital Filters
Characteristics of FIR Digital Filters, Frequency Response, Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, and Comparison of IIR and FIR filters. Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow.

TEXT BOOKS:

1. Discrete Time Signal Processing - A.V. Oppenheim and R.W. Schafer, PHI, 2009
2. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis Dimitris G. Manolakis, Pearson Education/PHI, 2007.

REFERENCE BOOKS:

1. Digital Signal Processing in Modern Communication Systems (Edition 2) – Andreas Schwarzinger.
2. Herbert Bernstein, Measuring Electronics & Sensors: Basics of Measurement, Technology, Sensors, Analog, and Digital Signal Processing.
3. Ludeman, Lonnie C. *Digital Signal Processing*. Addison-Wesley Longman Publishing Co., Inc., 1986.
4. Vaidyanathan, P. P. *Signals, Systems and Signal Processing*. Cambridge University Press, 2024.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
LINEAR CONTROL SYSTEMS
(PROFESSIONAL ELECTIVE-I)

Course Code: GR24A3072 **L/T/P/C: 3/0/0/3**
III Year I Semester

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

1. Determine the Transfer function using block diagram reduction technique and signal flow graphs.
2. Evaluate steady state errors from Transfer function.
3. Apply Routh criterion/ Root locus to determine the stability of LTI systems.
4. Evaluate Bode, Polar, inverse and Nyquist plots.
5. Apply state space analysis to control systems

UNIT I: **Introduction to control systems:**
Classification, open-loop and closed-loop systems, Transfer function of SISO and MIMO, Block Diagram of a closed-loop system, procedure for drawing a block diagram, transfer function of block diagrams, construction of Signal Flow Graphs (SFG), Signal Flow Graph analysis.

UNIT II: **Time response of control system**:
Standard test signals, Time response of first-order and second-order systems, steady state errors and error constrains, Bounded Input and Bounded Output(BIBO), Necessary conditions for stability, Routh stability criterion, applications of the Routh stability criterion, relative stability analysis.

UNIT III: Root locus & Polar Plot:
Root locus concepts, construction of root loci, rules for the construction of the root locus, Correlation between time and frequency response, Polar plots and inverse polar plots.

UNIT IV: Bode Plot & Nyquist Plot:
Basic factors of G(jw)H(jw), general procedure for constructing Bode plots, computation of Gain Margin and Phase margin, Nyquist plots, principle of argument, Nyquist stability criterion.

UNIT V: **State Space Analysis:**
Concepts of state, state variables and state models, state-space representation, state transition matrix and state transition equation.

TEXT BOOKS:

1. A.Anand Kumar, "Control Systems", Seventh printing, PHI Learning New Delhi, 2012
2. J. Nagrath, M. Gopal,"Control Systems Engineering",Fifth Edition, NewAge International, New Delhi, 2007.

REFERENCE BOOKS:

1. Katsuhiko Ogata, "Discrete Time Control Systems", Second Edition, PHI Learning New Delhi, 2006.
2. R. Ananda natarajan, P. Ramesh Babu, "Control Systems Engineering", Second edition, Sci Tech Publications Pvt. (India) Ltd, 2008

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INTRODUCTION TO COMPUTER ORGANIZATION
(PROFESSIONAL ELECTIVE-I)

Course Code: GR24A3073 **L/T/P/C: 3/0/0/3**
III Year I Semester

Course Outcomes:

1. Understand the theory and architecture of the central processing unit.
2. Design a simple CPU with applying the theory concepts.
3. Use appropriate tools to design, verify and test the CPU architecture.
4. Learn the concepts of parallel processing, pipelining and inter processor communication.
5. Exemplify in a better way the I/O and memory organization.

UNIT-I: Fundamentals of Computer Organization

Computing and Computers, Evolution of Computers, VLSI Era, System Design; Register Level, Processor Level, CPU Organization, Data Representation, Fixed Point Numbers, Floating Point Numbers, Instruction Formats, Instruction Types, addressing modes.

UNIT-II: Data Path Design

Fixed Point Arithmetic, Addition, Subtraction, Multiplication and Division, Combinational and Sequential ALUs, Carry look ahead adder, Robertson algorithm, booth's algorithm, non- restoring division algorithm, Floating Point Arithmetic, Co-processor, Pipeline Processing, Pipeline design, Modified booth's Algorithm..

UNIT-III: Control Design

Hardwired Control, Micro programmed Control, Multiplier Control Unit, CPU Control Unit, Pipeline Control Instruction Pipelines, Pipeline Performance, Super-scalar Processing, Nano Programming.

UNIT-IV: Memory Organization

Random Access Memories, Serial Access Memories, RAM Interfaces, Magnetic Surface Recording, Optical Memories, multilevel memories, Cache & Virtual Memory, Memory Allocation, Associative Memory..

UNIT-V: System Organization

Communication methods, Buses, Bus Control, Bus Interfacing, Bus arbitration, IO and system control, IO interface circuits, Hand shaking, DMA and interrupts, vectored interrupts, PCI interrupts, pipeline interrupts, IOP organization, operation systems, multiprocessors, fault tolerance, RISC and CISC processors, Super scalar, and vector processor.

TEXT BOOKS:

1. Computer Architecture: A quantitative approach David A Patterson and John L. Hennessy
2. Computer organization and Architecture, Designing for Performance William Stallings
3. Essentials of Computer organization and Architecture Linda Null

REFERENCE BOOKS:

1. Morris Mano, "Computer System Architecture", Prentice-Hall of India, 2000.
2. Paraami, "Computer Architecture", BEH R002, Oxford Press.
3. P. Pal Chaudhuri, "Computer organization and design", 2nd Ed., Prentice Hall of India,2007.
4. G. Kane & J. Heinrich, "MIPS RISC Architecture", Englewood cliffs, New Jersey, PrenticeHall, 1992.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
OPTICAL COMMUNICATIONS
(PROFESSIONAL ELECTIVE-I)

Course Code: GR24A3074 **L/T/P/C: 3/0/0/3**
III Year I Semester

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

1. Identify the basic elements of optical fiber transmission link, fibre modes configurations.
2. Explain transmission characteristics like attenuation, losses, dispersion, and polarization.
3. Differentiate different types of optical sources that includes lasers and LEDs.
4. Analyze the fiber optical network components, variety of networking aspects, detection, and reception of optics.
5. To design efficient optical communication systems, including considerations for component selection, multiplexing techniques, link budget calculations, and managing fiber dispersion

UNIT-I: Introduction:
Historical development, The general system, Advantages of optical fiber communications. Optical fiber waveguides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays. Cylindrical fibers- Modes, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index.

UNIT-II: Transmission characteristics of Optical fibers:
Introduction, Attenuation, Material absorption losses- Intrinsic absorption, extrinsic absorption, Scattering losses- Linearand nonlinear, Fiber bend loss, Dispersion- Intramodal dispersion, Intermodal dispersion, Polarization.

UNIT-III: Optical sources:
Laser- Optical emission from semiconductors, Injection laser structuresGain-guided lasers, Index-guided lasers, Quantum well lasers, Injection laser characteristics- Threshold current temperature dependence, dynamic response, Noise, Mode hopping. LED- LED power and efficiency, LED structures- surface emitter LEDs, edgeemitter LEDs, LED characteristics- optical output power, modulation bandwidth, reliability

UNIT-IV: Photodetectors:
Physical principles of photodiodes, Photodetector Noise, Comparisons of photodetectors. Optical receiver operation- Fundamental receiver operation, Digital receiver performance, Burst-Mode receivers, Analog receivers.

UNIT-V: Optical system design:
Considerations, Component choice, multiplexing. Point-to- point links, System considerations, Link power budget with examples. Overall fiber dispersion in Multi-mode and Single mode fibers, Rise time budget with examples.

TEXT BOOKS:

1. Optical Fiber Communications – John M. Senior, PHI, 2 nd Edition, 2002. 2. Optical Fiber Communications – Gerd Keiser, McGraw-Hill Education, 5 th Edition, 2000.

REFERENCE BOOKS:

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005.
2. Text Book on Optical Fibre Communication and its Applications – S.C.Gupta, PHI, 2005.

3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3 rd Edition, 2004.
4. Fiber Optic Communications – Joseph C. Palais, 4 th Edition, Pearson Education, 2004.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIGITAL SYSTEM DESIGN USING VERILOG HDL

(PROFESSIONAL ELECTIVE-I)

Course Code: GR24A3075 **L/T/P/C: 3/0/0/3**

III Year I Semester

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

1. Apply language constructs of Verilog hardware description languages (HDL) in design description.
2. Distinguish between gate level and data flow models of design description.
3. Describe behavioral models of design description.
4. Model designs at switch level & System level Functions
5. Verify the functioning of designs by writing test benches.

UNIT-I: Introduction to Verilog HDL:

Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Programming Language Interface, Module. Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Data Types, Scalars and Vectors, Operators.

UNIT-II: Gate Level Modeling:

Introduction, & Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Gate Delay, Strengths and Contention Resolution, Net Types. Modeling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vector, Operators.

UNIT-III: Behavioral Modeling:

Introduction, Operations and Assignments, 'Initial' Construct, always construct, Assignments with Delays, 'Wait ‘Construct, Design at Behavioral Level, Blocking and Non-Blocking Assignments, The 'C ase' Statement, 'If' and 'if-Else' Constructs, 'Assign- Deassign' Constructs,'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, sequential and Parallel Blocks.

UNIT-IV: Switch Level Modelling:

Basic Transistor Switches, CMOS Switch, Bi – directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Trireg Nets.

System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters, System Tasks and Functions, File – Based Tasks and Functions, Compiler Directives, Hierarchical Access, User-defined Primitives (UDP).

UNIT-V: Sequential Circuit Description:

Sequential Models – Feedback Model, Capacitive Model, Implicit Model, Basic Memory Components, Functional Register, Static Machine Coding, Sequential Synthesis

Component Test and Verification: Test bench – Combinational Circuit Testing, Sequential Circuit Testing, Test bench Techniques, Design Verification, Assertion Verification

TEXT BOOKS:

1. T.R. Padmanabhan, B Bala Tripura Sundari, Design Through Verilog HDL, Wiley 2009
2. Verilog HDL - Samir Palnitkar, 2nd Edition, Pearson Education, 2009.

REFERENCE BOOKS:

1. Fundamentals of Digital Logic with Verilog Design - Stephen Brown, Zvonkoc Vranesic, TMH, 2nd Edition.
2. Zainalabdien Navabi, Verilog Digital System Design, TMH, 2nd Edition.
3. Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA - Sunggu Lee, Cengage Learning, 2012.
4. Advanced Digital Design with Verilog HDL - Michel D. Ciletti, PHI, 2009.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
IOT SENSORS LAB

Course Code: GR24A3077 **L/T/P/C: 0/0/2/1**
III Year I Semester

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

1. Understand the different blocks involved in an IOT ecosystem and
2. Understand interfacing techniques to connect different sensors to a microcontroller.
3. Understand how a gateway module works as a bridge between two networks.
4. Understand different communication protocols used in IOT such as HTTP and web sockets.
5. Understand the programming of mobile applications to push and pull data from the cloud. and apply the concepts to implement a complete IOT ecosystem with different data flow scenarios.

Task-1: Microcontroller – sensor/ actuator Interfacing

Programming a Generic Sensor Board to interface the following sensors/actuators.

1. Blinking of LED
2. Buzzer Tone
3. Relay control for switching applications.
4. Ultrasonic sensor module
5. Soil Moisture Sensor Module
6. MEMS Sensor Module (INMP 441)
7. PIR Sensor Module
8. Gesture Sensor Module
9. Bluetooth Module
10. Environment Monitoring Module (BMP 280)
11. Heart Rate Monitoring Module
12. Multi-Axis Accelerometer Sensor Module
13. Magnetic switch
14. OLED Display interface
15. IR sensor Interface

Task-2: Mobile App development

Mobile app development using MIT's App Inventor and Kodular platforms to

1. Develop apps with simple UI
2. Mobile apps to push pull data from the cloud database.
3. Mobile apps to push actuator commands to the cloud database.

Task-3: IOT projects

Integrating different blocks to do the following IOT projects.

1. Home Security System with IOT interface
2. Smart Garden with IOT interface
3. IR Remote based motor Control with IOT Interface
4. IoT based Remote Range Meter
5. Fall Detection using IOT
6. Gesture Recognition using IOT
7. Heart Rate Monitoring using IOT
8. Wake Sound Detection and Alarm Notification using IOT
9. IoT based Real Time Appliance Control
10. Environment Monitoring using IOT

Text/ Reference Books:

1. Building Arduino Projects for the Internet of Things by Adeel Javed, Apress**,** 2016

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIGITAL SIGNAL PROCESSING LAB

Course Code: GR24A3078 **L/T/P/C: 0/0/2/1**
III Year 1 Semester

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

1. Implement and analyse discrete-time signals and systems using recursive difference equations and convolution.
2. Compute and interpret the Discrete Fourier Transform (DFT), Inverse DFT, and Fast Fourier Transform (FFT) for signal analysis
3. Determine the frequency response of analog and digital systems described by transfer functions or differential equations.
4. Design and implement Finite Impulse Response (FIR) filters and Infinite Impulse Response (IIR) filters for LPF and HPF to analyse their time and frequency domain characteristics.
5. Simulate advanced DSP techniques like decimation, interpolation, variable sampling rate conversion, and signal recovery through filtering.

LIST OF EXPERIMENTS

Experiments Based on PYTHON/ MATLAB/ LabView/ C Programming Equivalent/ Equivalent DSP processors**.**

1. **TASK-1** Generation of Sinusoidal waveform/signal based on recursive difference equations
2. **TASK-2** Linear and circular convolutions using DFT
3. **TASK-3** Frequency response of a given system given in (Transfer Function/ Differential equation form) (Frequency response of analog Butterworth filter)
4. **TASK-4** Implementation of DFT, inverse DFT and FFT of a given sequence
5. **TASK-5** Determination of Power Spectrum of a given signal
6. **TASK-6** Implementation of LP IIR filter for a given sequence (First order IIR filter (LP): Frequency-response and time-domain simulation)
7. **TASK-7** Implementation of HP IIR filter for a given sequence First order IIR filter (HP): Frequency response and time-domain simulation
8. **TASK-8** Implementation of LP FIR filter for a given sequence (Frequency response and time-domain simulation of FIR filter)
9. **TASK-9** Implementation of HP FIR filter for a given sequence
10. **TASK-10** Generation (Recovery) of Sinusoidal signal through filtering
11. **TASK-11** Generation of DTMF signals
12. **TASK-12** Implementation of I/D sampling rate converters
13. **TASK-13** Impulse Response of First order and Second Order Systems.
14. **TASK-14** Generation of Narrow Band Signal through Filtering

Lab Methodology: - The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Python Equivalent) and Hardware (Using Equivalent DSP processors/Arduino/Raspberry pi).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ADVANCED ENGLISH COMMUNICATION SKILLS LAB

Course Code: GR24A3013 **L/T/P/C: 0/0/2/1**
III Year I Semester
Course Outcomes: On completion of the course, the student will be able to

1. Demonstrate effective listening and reading strategies to comprehend, analyze, and evaluate texts.
2. Produce well-structured written documents for academic, professional, and digital platforms.
3. Deliver effective oral presentations using appropriate language, structure, and non-verbal cues.
4. Participate confidently in group discussions using logical reasoning, fluency, and teamwork.
5. Apply interview strategies to perform successfully in face-to-face and virtual interviews.

Activities on Listening and Reading Comprehension: Active Listening – Development of Listening Skills Through Audio clips - Benefits of Reading – Methods and Techniques of Reading – Basic Steps to Effective Reading – Common Obstacles – Discourse Markers or Linkers - Sub- skills of reading - Reading for facts, negative facts and Specific Details- Guessing Meanings from Context, Inferring Meaning - Critical Reading – – Reading Comprehension – Exercises for Practice.

Activities on Writing Skills: Vocabulary for Competitive Examinations - Planning for Writing – Improving Writing Skills - Structure and presentation of different types of writing – Free Writing and Structured Writing - Letter Writing –Writing a Letter of Application –Resume vs. Curriculum Vitae – Writing a Résumé **–** Styles of Résumé - e-Correspondence – Emails – Blog Writing - (N)etiquette– Report Writing – Importance of Reports – Types and Formats of Reports– Technical Report Writing– Exercises for Practice.

Activities on Presentation Skills - Starting a conversation – responding appropriately and relevantly – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions- PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation – Dealing with Glossophobia or Stage Fear – Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation.

Activities on Group Discussion (GD): Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas **–** Do's and Don'ts - GD Strategies – Exercises for Practice.

Interview Skills: Concept and Process - Interview Preparation Techniques - Types of Interview Questions – Pre-interview Planning, Opening Strategies, Answering Strategies - Interview Through Tele-conference & Video-conference - Mock Interviews.

Minimum Requirement:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system

- One PC with latest configuration for the teacher
- T. V, a digital stereo & Camcorder
- Headphones of High quality

Suggested Software: The software consisting of the prescribed topics elaborated above should be procured and used.

- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- Oxford Advanced Learner's Dictionary, 10th Edition
- Cambridge Advanced Learner's Dictionary
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dreamtech

BOOKS RECOMMENDED:

1. Rizvi, M. Ashraf (2018). *Effective Technical Communication*. (2nd ed.). McGraw Hill Education (India) Pvt. Ltd.
2. Suresh Kumar, E. (2015). *Engineering English.* Orient BlackSwan Pvt. Ltd.
3. Bailey, Stephen. (2018). Academic *Writing: A Handbook for International Students.* (5th Edition). Routledge.
4. Koneru, Aruna. (2016). *Professional Communication*. McGraw Hill Education (India) Pvt. Ltd.
5. Raman, Meenakshi & Sharma, Sangeeta. (2022). *Technical Communication, Principles and Practice.* (4TH Edition) Oxford University Press.
6. Anderson, Paul V. (2007). *Technical Communication***.** Cengage Learning Pvt. Ltd. New Delhi.
7. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart. (2017). *English Vocabulary in Use* Series. Cambridge University Press
8. Sen, Leela. (2009). *Communication Skills.* PHI Learning Pvt Ltd., New Delhi.
9. Elbow, Peter. (1998). *Writing with Power.* Oxford University Press.
10. Goleman, Daniel. (2013). *Emotional Intelligence*: *Why it can matter more than IQ.* Bloomsbury Publishing.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONSTITUTION OF INDIA

Course Code: GR24A2003 **L/T/P/C: 2/0/0/0**
III Year I Semester
Course Outcomes: On completion of the course, the student will be able to

1. Know the importance of Constitution and Government
2. Become Good Citizens and know their fundamental rights, duties and principles.
3. Learn about the role of PM, President, Council of Ministers etc and it will help students learn about Local Administration.
4. Understand the importance of Election Commission and the Students will become aware of how a Country and State are run in Democracy.
5. Know about Secularism, Federalism, Democracy, Liberty, Freedom of Expression, Special Status of States etc.,

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

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

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

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

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

BOOKS RECOMMENDED:

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

III YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
VLSI DESIGN

Course Code: GR24A3079 **L/T/P/C: 4/0/0/4**
III Year II Semester

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

1. Visualize the fabrication process of IC technology.
2. Analyze the electrical properties of MOS circuits.
3. Draw the stick diagrams and layouts for CMOS circuits.
4. Analyze and design CMOS data path subsystems.
5. Implement VLSI design using PLD's and understand various IC testing schemes.

UNIT-I: Introduction to IC Technology:
Introduction to IC Technology–MOS transistors, NMOS, CMOS & BiCMOS fabrication processes, Integrated Resistors and Capacitors

UNIT-II: Basic Electrical Properties:
Basic Electrical Properties of MOS and Bi-CMOS Circuits: I_{ds} Versus V_{ds} relationships, MOS transistor threshold Voltage Vt, gm, gds, Figure of merit ωo, Pass transistor, Analysis of NMOS Inverter, Various pull ups, CMOS Inverter, Bi-CMOS Inverters.

UNIT-III: VLSI Circuit Design Processes:
VLSI Circuit Design Processes, Gate Level Design: VLSI Design Flow, Stick Diagrams, Layout, Lambda based Design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Design using Pass transistors and transmission gates, Dynamic CMOS Logic and Domino CMOS Logic.

UNIT-IV: Data path Subsystems:
Data path Subsystems, Array Subsystems: Subsystem Design, Shifters, Adders- Ripple Carry, Carry Look ahead Adder, Carry Select Adder, Arithmetic Logic Unit(ALU), Multipliers – Array Type, Booth, Wallace tree, Parity generators, Comparators,Zero/One Detectors, SRAM, DRAM, ROM

UNIT-V: Semi Custom Integrated Circuit Design, IC Testing:
PLAs, Programmable Array Logic, FPGAs, CPLDs, Standard cells design approach, Need for Testing, Test Principles, Design Strategies for Test, Chip Level Test Techniques, System- Level Test Techniques.

TEXT BOOKS:

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Douglas A.Pucknell, Sholeh Eshraghian, PHI,2011.
2. CMOS VLSI Design–A circuits and systems perspective, Neil H.E Weste, David Harris, Fourth Edition, Addison Wesley, 2011.
3. VLSI Design, K. Lal Kishore and V. S. V. Prabhakar, 1 st Edition, I.K. International, 2009.

REFERENCE BOOKS:

1. CMOS logic circuit Design- John. P. Uyemura, Springer, 2013.
2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rdEdition, 1997.
3. VLSI Design–A. Albert Raj, Latha, PHI, 2008
4. Introduction to VLSI–Mead & Convey, BS Publications, 2010

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ANTENNAS WAVE PROPAGATION

Course Code: GR24A3080 **L/T/P/C: 3/1/0/4**
III Year II Semester

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

1. Apply basic characteristics in analyzing and designing antennas and wave propagation problems.
2. Analyze wire antenna problems and design an array.
3. Design various basic popular antennas for a given application.
4. Use modern antennas as required and apply measurement concepts in a given measurement setup.
5. Select right propagation method for a given frequency.

UNIT-I: Antenna Basics:

Introduction: Radiation Mechanism, Different Regions of Fields, Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Beamwidth, Directivity, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance, Antenna Radiation Efficiency, Antenna Vector Effective Length and Effective Areas, Friis Transmission Equation, Relation between Maximum Directivity and Maximum Effective Area, Antenna Temperature. Antenna Measurements: Ranges, Pattern Measurement Outdoor/Indoor and gain measurement

UNIT-II: Hertzian dipole, Linear antennas, and Basics of Arrays:

Current Distribution on a Thin Wire Antenna, Fields, Power, and Impedance of - Infinitesimal Dipole (Hertzian Dipole), Half-Wavelength Dipole, Monopole. Arrays: Concept of point source, Principle of pattern Multiplication, Two Sources of Any Phase and amplitude, uniform linear array-Derivation of field, Angles of Main lob maxima, angles of minor lobe maxima, angles of null, Classification of array-broadside array, endfire array. binomial array and Dolph-Chebyshev arrays.

UNIT-III: VHF, UHF and Microwave Antennas - I:

Horn Antenna, Slot Antenna, Log Periodic Dipole Antenna (LPDA), Yagi-Uda antenna, Helical Antenna, Flat-Sheet/corner reflectors, Parabolic Reflectors, Microstrip Patch Antenna. Fractal antenna and applications.

UNIT-IV: VHF, UHF and Microwave Antennas - II:

Reconfigurable Antennas-classification, Techniques and Applications, UWB antennas-Fundamentals, Different UWB antennas and applications. Metamaterials Based Antennas: Fundamentals, Classification, applications.

UNIT-V: Wave Propagation:

Ground Wave Propagation-Plane earth reflection, Space and Surface Waves, elevated dipole antenna above plane earth, Wave tilt of surface wave, Spherical earth. propagation. Tropospheric waves: Normal refraction, abnormal refraction and reflection, modified index curves and duct propagation, tropospheric scatter. Sky Wave Propagation: Structure and Layers of Ionosphere, Electrical Properties of Ionosphere, Refraction and Reflection by Ionosphere, Critical Frequency, MUF. LUF, Skip Distance, Maximum Single- hop Distance, Virtual Height.

TEXT BOOKS:

1. Antenna Theory-Analysis and Design-C.A. Balanis, John Wiley& Sons, 3rd ed. 2005.
2. Antennas and Wave Propagation-J.D.Kraus, RJ.Marhefka and Ahmad S.Khan. TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.
3. Electromagnetic Waves & Radiating Systems-E.C.Jordan and K.G.Balmain. PHI, 2nd ed.,2000.
4. Frontiers in Antennas: Next Generation Design & Engineering, Frank G Gross 1st Edition, 2011

REFERENCE BOOKS:

1. Antenna and Wave Propagation–Harish and Sachidananda M, Oxford University Press, 2007
2. Antenna Theory and Design-Warren L.Stutzman, GaryA. Thiele, John Wiley & Sons, 3rd edition. 2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ECONOMICS AND ACCOUNTING FOR ENGINEERS
(PROFESSIONAL ELECTIVE-II)

Course Code: GR24A3041 **L/T/P/C: 3/0/0/3**
III Year II Semester

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

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

UNIT -I: INTRODUCTION & DEMAND ANALYSIS: DEFINITION AND SCOPE

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

UNIT -II: PRODUCTION & COST ANALYSIS: PRODUCTION FUNCTION

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

UNIT-III: MARKETS AND FORMS OF BUSINESS ORGANIZATIONS

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

UNIT-IV: INTRODUCTION TO FINANCIAL ACCOUNTING: ACCOUNTING CONCEPTS AND CONVENTIONS

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

UNIT -V: CAPITAL BUDGETING

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

TEXT BOOKS:

1. Managerial Economics – International Edition, 2019, by Christopher Thomas (Author), S. Charles Maurice (Author), McGraw-Hill Education
2. Managerial Economics & Business Strategy, Michael R. Baye, Jeffrey T. Princ, McGraw-Hill

Education, 2021 (10th Edition)
3. Managerial Economics, Mark Hirschey, Cengage Learning, 2016 (13th Edition)
4. Managerial Economics: Analysis, Problems and Cases - P. L. Mehta, Edition, 13. Publisher, Sultan Chand, 2016.
5. Managerial Accounting, Carl S. Warren, James M. Reeve, Jonathan Ducha, Cengage Learning, 2021
6. Managerial Accounting: Tools for Business Decision Making (9th Edition), Jerry J. Weygandt, Paul D. Kimmel, Donald E. Kieso, Wiley, 2021
7. Managerial Economics Aryasri: Managerial Economics and Financial Analysis, TMH, 2009.

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FPGA AND CPLD ARCHITECTURES
(PROFESSIONAL ELECTIVE-II)

Course Code: GR24A3081 **L/T/P/C: 3/0/0/3**
III Year II Semester

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

1. Classify programmable logic devices
2. Select suitable programmable logic devices for the designs
3. Study different architectures of CPLD and FPGA.
4. Compare different programming technologies in FPGAs
5. Demonstrate various applications of FPGAs

UNIT-I: Introduction to programmable logic devices:
Introduction, Programmable Logic Devices/Generic Array Logic; Complex Programmable Logic Devices – Architecture of Xilinx Cool Runner XCR3064XL CPLD, CPLD Implementation of a Parallel Adder with Accumulation.

UNIT-II: Field programmable gate arrays:
Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications of FPGAs.

UNIT-III: SRAM Programmable FPGAs:
Introduction, Programming Technology, Device Architecture, The Xilinx XC2000, XC3000 and XC4000 Architectures.

UNIT –IV: ANTI-FUSE Programmed FPGAs:
Introduction, Programming Technology, Device Architecture, The Actel ACT1, ACT2 and ACT3 Architectures.

UNIT-V: Design Applications:
General Design Issues, Counter Examples, A Position Tracker for a Robot Manipulator, Designing Counters with ACT devices, Designing Adders and Accumulators with the ACT Architecture.

TEXT BOOKS:

1. Field Programmable Gate Array Technology - Stephen M. Trimberger, Springer International Edition. 2013
2. Digital Systems Design - Charles H. Roth Jr, Lizy Kurian John, Cengage Learning.

REFERENCE BOOKS:

1. Field Programmable Gate Arrays - John V. Oldfield, Richard C. Dorf, Wiley India.
2. Digital Design Using Field Programmable Gate Arrays - Pak K. Chan/Samiha Mourad, Pearson Low Price Edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MACHINE LEARNING
(PROFESSIONAL ELECTIVE-II)

Course Code: GR24A3082 **L/T/P/C: 3/0/0/3**
III Year II Semester

Prerequisites:
1. Mastery of introduction-level algebra, statistics, and probability theory
2. Fundamental knowledge on data modeling and evaluation

Course Outcomes: Upon completing this course, the student will be able to
1. Explain the concepts machine learning models and be able to perform feature engineering techniques.
2. Identify and apply appropriate supervised learning models.
3. Design neural network models for the given data.
4. Perform evaluation on machine learning algorithms and model selection techniques.
5. Devise un-supervised and reinforcement learning models.

UNIT -I:
Introduction: Introduction to machine learning, Supervised learning, Unsupervised learning, Semi-supervised learning, Reinforcement learning, Deep learning.
Concept learning and General to Specific Ordering: A Concept Learning Task, Concept Learning as Search, Find-S Finding a Maximally Specific Hypothesis.
Feature Engineering: Feature Selection using Filter, Wrapper, Embedded methods, and Feature normalization using min-max normalization, z-score normalization, and constant factor normalization,
Introduction to Dimensionality Reduction: Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) techniques.

UNIT -II:
Supervised Learning – I (Regression and Classification)
Regression models: Simple linear regression, Multiple linear regression. Cost Function, Gradient Descent, Performance Metrics: Mean Absolute Error (MAE), Mean Squared Error (MSE), R-Squared error, Adjusted R Square. Classification models: Decision Trees-ID3, CART, Naive Bayes, K-Nearest-Neighbours (KNN), Logistic regression, Multinomial logistic regression, Support Vector Machines (SVM).

UNIT-III:
Supervised Learning – II (Classification with Neural Networks)
Neural Network Representation: Introduction to Artificial Neural Networks (ANN), Activation Functions, Perceptron and Back Propagation algorithms.
Convolutional Neural Networks-Convolution and Pooling layers, Recurrent Neural Networks (RNN).
Classification Metrics: Confusion matrix, Precision, Recall, Accuracy, F-Score, ROC curves

UNIT-IV:
Model Validation in Classification: Cross Validation - Holdout Method, K-Fold, Stratified K-Fold, Leave-One-Out Cross Validation (LOOC-V). Bias-Variance tradeoff, Regularization, Overfitting, Underfitting.
Ensemble Methods: Boosting, Bagging, Random Forest classifier.
.
UNIT -V:
Unsupervised Learning: K-means, K-Modes, K-Prototypes, Gaussian Mixture Model clustering algorithms, Expectation-Maximization, BIRCH clustering algorithms.
Reinforcement Learning: Exploration and exploitation trade-offs, non-associative learning, Markov decision processes, Q-learning.

TEXT BOOKS:

1. Data Mining–Concepts and Techniques -Jiawei Han and Micheline Kamber, Morgan Kaufmann (2nd Edition).
2. Machine Learning – Tom M. Mitchell, TMGH.
3. Introduction to Data Mining - Michael Steinbach, Pang-Ning Tan, and Vipin Kumar (Second Edition).

REFERENCE BOOKS:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
2. R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press,1998.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009.
4. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
5. Machine Learning Yearning, Andrew Ng.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MOBILE COMMUNICATIONS AND NETWORKS
(PROFESSIONAL ELECTIVE-II)

Course Code: GR24A3083 **L/T/P/C: 3/0/0/3**
III Year II Semester

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

1. Quantify interference with regard to cellular communication
2. Quantify signal strength under various propagation conditions
3. Apply GSM fundamental concepts while working in the GSM system.
4. Apply CDMA, WCDMA and IS-95 fundamental concepts while working in CDMA, WDMA and IS-95 systems
5. Apply 4G fundamental concepts. while working in 4G system

UNIT -I: Introduction to Cellular Communications:
The History of Wireless Communications and the Birth of a Cellular System, Concepts of a Cellular System, Concepts of Duplexing and Multiple Access, Types of Interference, Evolution of Cellular Standards, Ecosystem of Cellular Systems, Phases of a Cellular System, Performance of Cellular Systems

UNIT -II: Radio Frequency Propagation:
Radio Frequency Waves, Free-Space Propagation, Cellular Propagation Mechanisms, Prediction of Received Signal Strength

UNIT-III: GSM, GPRS & EDGE:
Overview of GSM: Introduction, GSM System Architecture, Air-Interface Protocol Stack between MS and BSS, Radio Interface: Frame Structure and Channels, Network Acquisition, Voice Call Setup, Mobility Management in Idle Mode, Mobility Management in Active or Connected Mode, Power Control, Deployment Considerations
GPRS and EDGE: Introduction, System Architecture, MS-BSS Air-Interface Communications, Radio Interface: Frame Structure and Channels

UNIT-IV: Fundamentals of CDMA, WCDMA, and IS-95:
A Brief Introduction to CDMA, WCDMA, and IS-95, Characteristics of CDMA, IS-95 System Architecture, IS-95 MS-Radio-Network Communications: An Overview, IS-95 Call Setup, IS-95 Mobility Management, IS-95 Power Control, A Brief Overview of CDMA2000, CDMA2000 lx Network Architecture, Mobility Management, Power Control.

UNIT -V: Fourth-Generation Technologies:
Essential Elements of 4G Technologies, Fundamentals of OFDM and OFDMA, Multiple Antenna Techniques, WiMAX Overview, Overview of LTE

TEXT BOOKS:

1. Cellular Communications A Comprehensive and Practical Guide, Nishith D. Tripathi, Jeffrey H. Reed, John Wiley &Sons Inc.
2. T. S. Rappaport, "Wireless communication principles and practice," New Jersey: Prentice Hall, 1996

REFERENCE BOOKS:

1. Wireless and Cellular Communications, Thomas Schwengler, Lulu.com; First Edition (October 29, 2018)
2. Cellular Mobile Systems Engineering, Saleh Faruque, Artech House; 0 Edition (January 1, 1997)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
EMBEDDED SYSTEMS DESIGN
(PROFESSIONAL ELECTIVE-II)

Course Code: GR24A3084 **L/T/P/C: 3/0/0/3**
III Year II Semester

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

1. Understand basic concepts of embedded systems.
2. Apply and analyze the applications in various processors and domains of embedded systems.
3. Analyze and develop embedded hardware and software development cycles and tools.
4. Remember the fundamentals of RTOS-based embedded system design and synchronization techniques
5. Analyze various task communication and synchronization mechanisms in RTOS-based systems

UNIT-I: Introduction to Embedded Systems:
Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT-II: Typical Embedded System:
Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT-III: Embedded Firmware:
Reset Circuit, Brown-out Protection Circuit, Oscillator unit-, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT-IV: RTOS Based Embedded System Design:
Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT-V: Task Communication:
Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

TEXT BOOKS:

1. Introduction to Embedded Systems - Shibu K.V, McGraw Hill.
2. Embedded Systems - Raj Kamal, TMH.

REFERENCE BOOKS:

1. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

VLSI DESIGN LAB

Course Code: GR24A3086 **L/T/P/C: 0/0/2/1**

III Year II Semester

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

1. Design and analyze various combinational and sequential logic circuits.
2. Simulate and verify the design
3. Draw the layout of ICs.
4. Check design rules and compare layout with schematic
5. Extract the parasitic components

LIST OF EXPERIMENTS

1. **Task 1**: Introduction to Layout Design Rules
2. **Task 2**: Layout of CMOS Inverter
3. **Task 3**: Layout of CMOS NAND/NOR Gates
4. **Task 4**: CMOS AND/OR Gates
5. **Task 5**: CMOS XOR/XNOR Gates
6. **Task6**: Half adder
7. **Task 7**: CMOS 1-bit Full Adder
8. **Task 8**: Gray to binary code converter
9. **Task 9**: Multiplexer
10. **Task 10**: System Level Design using PLL
11. **Task 11**: Transmission Gate
12. **Task 12**: Dynamic RAM
13. **Task 13**: 6T Static RAM
14. **Task 14**: Characteristics of FET

Lab Methodology: Tasks based on Cadence University bundle/Xilinx

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MINI PROJECT WITH SEMINAR

Course Code: GR24A3027 **L/T/P/C: 0/0/4/2**
III Year II Semester

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

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

IV YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FUNDAMENTALS OF MANAGEMENT AND ENTREPRENEURSHIP

Course Code: GR24A4069 **L/T/P/C: 3/0/0/3**
IV Year I Semester

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

1. Gain knowledgeable about management thoughts, motivation theories and also capable of applying this knowledge in practical, real-world situations.
2. Understanding of the essential functions of management and equip them with the skills necessary to perform these functions effectively in career.
3. Explore the functional areas of management such as human resources, production and marketing management practices in their domain areas.
4. Exposed to the basic concepts of entrepreneurship and its development process and also lights on the financial agencies supporting entrepreneurship in India
5. Evaluate business ideas and attain hands on experience in designing and developing a business plan / model.

UNIT-I: Introduction to Management:
Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills; **Evolution of Management Thought**- Classical Approach- Scientific and Administrative Management; The Behavioural approach (Hawthorne Experiment); The Systems Approach; Contingency Approach.

UNIT-II: Planning and Organizing:
Planning – Planning Process, Types of Plans, Decision making and Steps in Decision Making; Organizing, Span of control, types of organizational Structures; Departmentalization, Delegation; Centralization, Decentralization. controlling – basic control process – control techniques.

UNIT-III: Human Resources and Marketing Management:
Concepts of HRM, HR planning, Recruitment & Selection methods, Training and Development methods, Performance Appraisal methods, Marketing concept, Marketing Mix, and Marketing Strategies based on Product Life Cycle.

UNIT-IV: Organization Behaviour:
Introduction to organization behaviour, Group Dynamics and team development, Motivation and theories of motivation, Leadership: Concept, Nature, Importance, Attributes of a leader, leadership styles and theories of leadership (Managerial grid)

UNIT-V: Entrepreneurship and business plan development: Characteristics and skills of an entrepreneur, Types of entrepreneurs, small business in Indian economy. Financial aspects: sources of rising capital, Procedure for setting up an enterprise, Schemes of Central level & State level - T Hub, Other institutional initiatives for entrepreneurial development. Risk Reduction strategies, Strategies for growth. Writing the business plan and functional plans.
Activity: Student need to submit their own business plan for the identified business area

TEXT BOOKS:

1. Fundamentals of management by Stephen P Robbins; Mary K Coulter; David A DiCenzo, Pearson 2019 (11th Edition)
2. Management: A Practical Introduction, Angelo Kinicki, Brian Williams, McGraw-Hill Education, 2018 (9th Edition)
3. Essentials of Management, Harold Koontz, Heinz Weihrich, Mark V. Cannice, McGraw-Hill Education,

2015 (10th Edition)
4. Fundamentals of Management, Ricky W. Griffin, Cengage Learning, 2020 (10th Edition)
5. Principles and Practice of Management, L. M. Prasad, Sultan Chand & Sons, 2012
6. Entrepreneurship- Robert D Hisrich, Michael P Peters, Dean A Shepherd, TMH.2009

REFERENCE BOOKS:

1. Essentials Of Management - An International Perspective: Harold Koontz, Heinz Weinrich
2. Tata McGraw Hill,2019
3. Essentials of Management, Koontz Kleihrich, Tata Mc – Graw Hill, 2019.
4. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
5. Entrepreneurship- Rajeev Roy, Oxford, 2011
6. Intellectual Property- Deborah E.Bouchoux, Cengage, 2012

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MICROWAVE ENGINEERING

Course Code: GR24A4070 **L/T/P/C: 3/0/0/3**
IV Year I Semester

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

1. Apply circuit theory to analyze and design microwave circuits.
2. Implement some impedance matching networks and design microwave filters.
3. Understand operating principles and application knowledge of microwave diodes, transistors, and tubes.
4. Design microwave amplifiers and oscillators.
5. Design up converters, down converters, and frequency multipliers.

UNIT-I: Microwave Network Analysis:
Overview of Rectangular and Circular waveguides and cavity resonators (Quantitative study without derivation). Equivalent voltages and currents, even and odd properties of driving point impedance and input reflection coefficient. Impedance and Admittance matrices for an N-Port network. Derivation of conditions for reciprocal and lossless networks in terms of impedance and admittance parameters and matrices. Scattering Parameters and Scattering matrix: Scattering matrix in terms of impedance matrix and vice-versa. Conditions for reciprocity and lossless in terms of S-Parameters and S-matrix. Shift in reference plane.

UNIT-II: Three-Port and Four-Port Networks:
S matrices of general three-port networks and four-port networks. Analysis of lossless power dividers and resistive dividers. Analysis of Wilkinson power dividers, Single-hole and double- hole directional couplers, analysis of Quadrature hybrid, analysis of 180º hybrid.

UNIT-III: Impedance Matching and Filter Implementation:
Networks-analytic and smith chart solutions: Matching With Lumped Elements. Filters: process of filter design and implementation, expressions for Chebyshev and Butterworth low- pass, high-pass, band pass and band-stop filters in terms of normalization filter component values. Filter design using Richards transformation, Kuroda's identities, stepped impedance low-pass filters.

UNIT-IV: Microwave diodes, Transistors and Tubes (Quantitative study without derivation):
Diodes: Operating principle and applications of Schottky diodes, PIN diodes, Varactor diodes, Gunn diodes, IMPATT diodes, Tunnel diodes and BARITT diodes Transistors: Operating principle and applications of bipolar junction transistors, hetero junction bipolar junction transistors, Tubes: Operating principle and applications of Klystrons: Two-cavity klystron, Reflex klystrons and TWTs and magnetrons.

UNIT-V: Microwave amplifiers, Oscillators, Mixers, and Frequency Multipliers:
Amplifiers: Two-port power gains, unconditional and conditional stabilities. Single -stage transistor amplifier design for maximum power. Microwave Oscillators: Transistor Oscillator, Frequency multipliers and Mixers: Reactive diode multipliers (include Manly-Rowe relations), up conversion and down conversion processes using mixers, single-ended diode mixer.

TEXT BOOKS:

1. "Microwave Engineering", David M Pozar, John Wiley & Sons, 4th ed., 2012
2. "Microwave Devices and Circuits", Samuel Y Liao, Pearson Education, 3rd ed., 1990
3. "RF Circuit Design", Christopher Bowick, Elsevier Inc, 2008.

REFERENCE BOOKS:

1. "RF Circuit Design- Theory and Applications". Reinhold Ludwig and Pavel Bretchko, Prentice Hall Inc., 2000
2. "Foundations for Microwave Engineering", RE Collin, John Wiley & Sons Inc, 2nd ed., 2002.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SYSTEM VERILOG TEST BENCHES USING UVM
(PROFESSIONAL ELECTIVE-III)

Course Code: GR24A4071 **L/T/P/C: 3/0/0/3**
IV Year I Semester

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

1. Build a foundational under Gain a fundamental understanding of analog electronic circuits, including passive and active components
2. Understand the applications of operational amplifiers in amplifier circuits, including inverting and non-inverting amplifier configurations.
3. Understand and consider op-amp specifications and parameters when selecting and using operational amplifiers in circuit designs.
4. Understand the basic principles of digital signal processing and its advantages in signal filtering and manipulation.
5. Understand and evaluate advanced IC fabrication processes and their impact on analog IC performance.

UNIT-I: UNIT – I
Verification Basics: Introduction, Verification need, Test bench components, Directed versus random stimulus, Code coverage versus functional coverage, Types of code coverage, Verification plan and test plan.

UNIT - II
System Verilog – I: Introduction, Constructs, Interface and object-oriented programming concepts.

UNIT – III
System Verilog – II: Randomization, Functional coverage and system verilog assertions.

UNIT – IV
UVM Test Bench Architecture: Introduction, UVM components and UVM phases.

UNIT – V
UVM Methodology: UVM component configuration and factory, Modelling UVM transactions, UVM sequence, Virtual sequencer, Component communication and UVMreporting.

TEXT BOOKS:

1. Janic Bergeron, "Writing Testbenches: Functional Verification of HDL Models", 2nd Ed., Kluwer Academic Publishers, 2003.
2. Stuart Sutherland, Simon Davidmann and Peter Flake, "System Verilog for Design", 2nd Ed., Springer, 2006.

REFERENCE BOOKS:

1. Reference Verification Methodology User Guide, Version 8.5.11 – Synopsis

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
RTOS AND SYSTEM PROGRAMMING
(PROFESSIONAL ELECTIVE-III)

Course Code: GR24A4072 **L/T/P/C: 3/0/0/3**
IV Year I Semester

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

1. Operate on a Unix/Linux operating system for embedded system application code development
2. Perform some basic level system programming
3. Acquainted with the coding techniques to establish synchronization in embedded systems involving multiprocessing.
4. Recommend about an operating system/real time operating system for the decided embedded application.
5. Compare the different Real Time Operating Systems and can choose the best one for the underlined embedded application

UNIT-I: Introduction:
Introduction to UNIX/LINUX, Overview of Commands, File I/O(open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).

UNIT-II: Real Time Operating Systems:
Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, Task States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use

UNIT-III: Objects, Services, and I/O:
Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem.

UNIT-IV: Exceptions, Interrupts and Timers:
Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

UNIT-V: Case Studies of RTOS:
RT Linux, Micro C/OS-II, VxWorks, Embedded Linux, Tiny OS, and Basic Concepts of Android OS.

TEXT BOOKS:
1. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011
2. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH.

REFERENCE BOOKS:
1. Advanced UNIX Programming, Richard Stevens
2. Embedded Linux: Hardware, Software and Interfacing – Dr. Craig Hollabaugh

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INFORMATION THEORY AND CODING
(PROFESSIONAL ELECTIVE-III)

Course Code: GR24A4073 **L/T/P/C: 3/0/0/3**
IV Year I Semester

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

1. Apply information theory and linear algebra in source coding and channel coding
2. Calculate the information content of a random variable from its probability distribution
3. Relate the joint, conditional, and marginal entropies of variables in terms of their coupled probabilities
4. Analyze various error control encoding and decoding techniques
5. Design BCH & RS codes for Channel performance improvement against burst errors.

UNIT-I: Information Theory:
Definition of Information, Entropy, Mutual Information, Properties of Mutual Information, Fundamental Inequality, I.T. Inequality, Divergence, Properties of Divergence, Divergence Inequality, Relationship between entropy and mutual information, Chain Rules for entropy, relative entropy and mutual information.

UNIT-II: Channel Capacity:
Uniform Dispersive Channel, Uniform Focusing Channel, Strongly Symmetric Channel, Binary Symmetric Channel, Binary Erasure Channel. Channel Capacity of the all these channels, Channel Coding Theorem, Shannon-Hartley Theorem Data Compression: Kraft inequality, Huffman codes, Shannon-Fano coding, Arithmetic Coding

UNIT-III: Linear Block Codes:
Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the MacWilliams identities; Perfect codes. Cyclic Codes, BCH codes; Reed-Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes; Spectral properties of cyclic codes.

UNIT-IV: Decoding of BCH codes:
Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp – Massey algorithm

UNIT-V: Convolution codes:
Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm, Turbo Codes, Concatenated Codes, polar codes

TEXTBOOKS:

1. F.J. MacWilliams and N.J.A. Slone, The theory of error correcting codes,North Holland, 1977.
2. R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.

REFERENCE BOOKS:

1. Thomas M. Cover, Joy A. Thomas, "Elements of Information Theory", Wiley Publishers.
2. Ranjan Bose," Information Theory Coding, Cryptography", TMH Publication

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMPUTER NETWORKS
(PROFESSIONAL ELECTIVE III)

Course Code: GR24A3087 **L/T/P/C: 3/0/0/3**
IV Year II Semester

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

1. Articulate basic terminologies of Computer Networks and transmission media in building a network for an organization.
2. Interpret the error correction and detection techniques and MAC Protocols for specific networks.
3. Illustrate the purpose of routing algorithms in real time applications.
4. Mind map the protocols and mechanism used in transport layer.
5. Integrate the application layer protocols in Internet based Applications.

UNIT-I:

Computer Networks: Uses of Computer Networks, Network Hardware, Network Software,Types of networks, Network topologies, Layered architecture. Reference Models: OSI, TCP/IP, ARPANET, Internet, and ATM header, Reference model, QoS.

Physical Layer: Guided Transmission Media, Wireless Transmission Media, Communication Satellites. Switching and Multiplexing, Mobile Telephone Network, GSM.

UNIT-II:

Data link layer: Design Issues, Framing, Error Detection, Elementary Data Link Protocol, and Sliding Window Protocols.

Medium Access sub layer: Static vs. Dynamic, Multiple Access Protocols: ALOHA, CSMA and Collision Free Protocols. Ethernet (IEEE 802.3), wireless LANS (IEEE 802.11), Bluetooth (IEEE 802.15), The Network and internetwork devices.

UNIT-III:

Network Layer: Routing Algorithms, Flooding, Broadcasting and Multicasting. Congestion Control Algorithms: General Principles of Congestion Control, Prevention Policies, Congestion Control in Virtual and Datagram Subnets, QoS in the Internet.

The Network Layer in the Internet: IPv4 Addressing Scheme, Subnetting and Masking, CIDR, NAT, Intra and Inter domain routing protocols, Mobile IP, IPv6 Header Format and Transmission Methods.

UNIT-IV:

Transport Layer: Transport Services, Elements of Transport Protocols.

Transport Layer Protocols: TCP & UDP protocols, TCP Connection Establishment and Release, TCP Congestion Control, TCP Fast Retransmit and Recovery, Slow start Mechanism in TCP, Transaction Oriented TCP.

UNIT-V:

Application Layer: DNS, Electronic Mail, the World Wide Web, FTP, HTTP, TELNET.

Multi Media: Audio and video compression techniques, streaming audio and video, VOIP.

TEXT BOOKS:

1. Autonomous Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education/PHI
2. Data Communications and Networking-Behrouz A. Forouzan, Third Edition TMH.

REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks- 3rd Edition, W.A. Shay,Thomson
3. Computer Networking: A Top-down Approach, Jim Kurose and Keith W. Ross, Pearson Education

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FUNDAMENTALS OF LOW POWER VLSI DESIGN
(PROFESSIONAL ELECTIVE-IV)

Course Code: GR24A4074 **L/T/P/C: 3/0/0/3**
IV Year I Semester

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

1. Explain the fundamentals of low-power VLSI circuit design.
2. Apply various approaches to low-power VLSI design.
3. Distinguish between various low-power logic styles.
4. Analyze low-power adders and multipliers design techniques.
5. Analyze low-voltage low-power memories.

UNIT -I: Introduction to Low Power VLSI Design:
Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects – Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

UNIT -II: Low-Power Design Approaches:
Low-Power Design through Voltage Scaling – VT CMOS circuits, MT CMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures.

UNIT –III: Low-Voltage Low- Power Adders:
Introduction, CMOS Adders' Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low- Power Design Techniques –Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.

UNIT –IV: Low-Voltage Low- Power Multipliers:
Overview of Multiplication, Braun Multiplier, Baugh-Wooley Multiplier, Booth Multiplier, Wallace Tree Multiplier.

UNIT-V: Low-Voltage Low- Power Memories:
Basics of ROM, Low-Power ROM Technology, Future Trends , Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, SelfRefresh Circuit, Future Trend and Development of DRAM.

TEXT BOOKS:

1. CMOS Digital Integrated Circuits – Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 2011.
2. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2. Low Power CMOS Design – Anantha Chandrakasan, IEEE Press/Wiley International, 1998.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ARTIFICIAL NEURAL NETWORKS
(PROFESSIONAL ELECTIVE-IV)

Course Code: GR24A4075 **L/T/P/C: 3/0/0/3**
IV Year I Semester

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

1. Create different neural networks of various architectures both feed forward and feed backward.
2. Perform the training of neural networks using various learning rules.
3. Perform the testing of neural networks and do the perform analysis of these networks for various pattern recognition applications.
4. Develop various neural network maping models
5. Design and develop Hopfield neural networks.

UNIT-I: Introduction:
A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process.

UNIT-II: Single Layer Perceptions:
Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection.

UNIT-III: Back Propagation:
Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning.

UNIT-IV: Self-Organization Maps (SOM):
Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification.

UNIT-V: Neuro Dynamics:
Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models.

TEXT BOOKS:

1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.
2. Introduction to Neural Networks, Sivanandam, S Sumathi, S N Deepa; “,2nd ed.,TATA McGraw Hill : 2005

REFERENCE BOOKS:

1. Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India P Ltd 2005
2. Neural Networks in Computer Inteligance, Li Min Fu TATA McGraw Hill 2003
3. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
NETWORK SECUIRITY AND CRYPTOGRAPHY
(PROFESSIONAL ELECTIVE-IV)

Course Code: GR24A4076 **L/T/P/C: 3/0/0/3**
IV Year I Semester

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

1. Describe network security fundamental concepts and principles
2. Encrypt and decrypt messages using block ciphers and network security technology and protocols
3. Analyze key agreement algorithms to identify their weaknesses
4. Identify and assess different types of threats, malware, spyware, viruses, vulnerabilities

UNIT-I: Security Services:
Mechanisms and Attacks, A Model for Internetwork security, Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques. Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Block Cipher Design Principles.

UNIT-II: Encryption:
Triple DES, International Data Encryption algorithm, Blowfish, RC5, Characteristics of Advanced Symmetric block Ciphers. Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

UNIT-III: Public Key Cryptography:
Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography. Number Theory: Prime and relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

UNIT-IV: Message Authentication and Hash Functions:
Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs. Hash and Mac Algorithms: MD-5, Message digest Algorithm, Secure Hash Algorithm. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications: Kerberos, Electronic Mail Security: Pretty Good Privacy, SIME/MIME.

UNIT-V: IP Security:
Overview, Architecture, Authentication, Encapsulating Security Payload, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms: Intruders, Viruses and Related threats. Fire Walls: Fire wall Design Principles, Trusted systems.

TEXT BOOKS:

1. William Stallings-Cryptography and Network Security: Principles and Practice, Pearson Education.
2. Robert Bragg, Mark Rhodes -Network Security: The complete reference, TMH, 2004.

REFERENCE BOOKS:

1. William Stallings - Network Security Essentials (Applications and Standards), Pearson Education.
2. Eric Maiwald - Fundamentals of Network Security, Dreamtech press
3. Whitman - Principles of Information Security, Thomson.
4. Buchmann - Introduction to Cryptography, Springer.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SYSTEM ON CHIP ARCHITECTURE
(PROFESSIONAL ELECTIVE-IV)

Course Code: GR24A4077 **L/T/P/C: 3/0/0/3**
IV YEAR I Semester

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

1. Describe the system design approach with respect to the hardware and software.
2. Apply the techniques for reducing the delays in program execution
3. Categorize and compare different processor types for their selection into a System on Chip.
4. Compare different memory designs and their purposes
5. Interpret the architectures and applications of various buses.

UNIT-I: Introduction to the system approach:
System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity

UNIT-II: Processors:
Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT-III: Memory design for SOC:
Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation ,SOC Memory System, Models of Simple Processor – memory interaction.

UNIT-IV: Interconnect customization and configuration:
Interconnect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance-Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

UNIT-V: Application studies / case studies SOC:
Design approach, AES algorithms, Design and evaluation, Image compression – JPEG Compression.

TEXTBOOKS:

1. Computer System Design System-on-Chip - Michael J. Flynn and Wayne Luk, Wiely India Pvt. Ltd
2. ARM System on Chip Architecture – Steve Furber –2nd Ed., 2000, Addison Wesley Professional

REFERENCE BOOKS:

1. Design of System on a Chip: Devices and Components – Ricardo Reis, 1st Ed., 2004, Springer
2. Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newnes, BK and CDROM

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MICROWAVE ENGINEERING LAB

Course Code: GR24A4079 **L/T/P/C: 0/0/4/2**
IV Year I Semester

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

1. Apply working concepts of reflex klystron well and do practical experiment involving reflex klystron
2. Apply working concepts of directional coupler and circulator well and do practical experiment involving directional coupler and circulator
3. Apply working concepts of wave guide well and do practical experiment involving wave guide
4. Apply working concepts of wave guide power dividers well and do practical experiment involving wave guide power dividers
5. Apply antenna parameter concept well and measure radiation pattern of a given antenna

LIST OF EXPERIMENTS

TASK-1 Reflex Klystron Characteristics

TASK-2 Gunn Diode Characteristics.

TASK-3 Attenuation Measurement

TASK-4 Parameters of Directional Coupler

TASK-5 VSWR Measurement

TASK-6 Impedance and Frequency Measurement

TASK-7 Waveguide parameters measurement

TASK-8 Scattering parameters of Circulator.

TASK-9 Scattering matrices of Tees: E plane, H plane

TASK-10 Scattering parameters of Magic Tee.

TASK-11 Radiation patterns for basic microwave antennas

TASK-12 Study of various microwave antennas

TASK-13 Design of Halfwave Dipole Antenna

TASK-14 Design of Patch Antenna

Lab Methodology: - Using Equivalent Software / Hardware

IV YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIGITAL IMAGE PROCESSING

Course Code: GR24080 **L/T/P/C: 4/0/0/4**
IV Year II Semester

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

1. Understand the fundamental concepts of Digital Image Processing.
2. Apply the various filtering and image smoothing and sharpening techniques of filtering techniques.
3. Analyse image restoration, inverse filtering techniques
4. Evaluate various image compression models and methods
5. Apply and create the Image compression image techniques for source encoder and decoder, error free compression

UNIT-I: Digital Image Fundamentals:
Digital Image through Scanner, Digital Camera. Concept of Gray Levels. Gray Level to Binary Image Conversion. Sampling and Quantization. Relationship between Pixels. Imaging Geometry. 2D Transformations-DFT, DCT, KLT and SVD.

UNIT-II: Image Enhancement:
Image Enhancement in Spatial Domain Point Processing, Histogram Processing, Spatial Filtering, Enhancement in Frequency Domain, Image Smoothing, Image Sharpening.

UNIT-III: Image Restoration:
Image Restoration Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT-IV: Image Segmentation:
Image Segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation.

UNIT-V: Image Compression:
Image Compression Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Source Encoder and Decoder, Error Free Compression, Lossy Compression.

TEXT BOOKS:

1. Digital Image Processing: R.C. Gonzalez & R. E. Woods, Addison Wesley/ Pearson Education, 2 nd Ed, 2004.
2. Fundamentals of Digital Image Processing: A. K. Jain, PHI.2015.

REFERENCE BOOKS:

1. Digital Image Processing using MAT LAB: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins: Pearson Education India, 2004.
2. Digital Image Processing: William K. Pratt, John Wiley, 3rd Edition, 2004.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
RADAR SYSTEMS
(PROFESSIONAL ELECTIVE-V)

Course Code: GR24A4081 **L/T/P/C: 3/0/0/3**
IV Year II Semester

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

1. Apply Radar equations to calculate maximum Radar range
2. Use MTI principles and deal with range and velocity ambiguity while working with Radars
3. To analyze problems involving matched filters.
4. Select right kind of Radar for a given application
5. Understand systems involving tracking Radars.

UNIT- I: Radar Fundamentals:
Fundamental Radar principles, types of Radar systems, basic Radar block diagram and description, detection, range, velocity and target location measurements and signature reflectivity and imaging. Radar Equations and CW Radars: Radar equations: an introduction, the pulse Radar equation, the search Radar equation, the bistatic Radar equation, the Radar equation with pulse compression, the beacon Radar equation. CW Radars: Unmodulated continuous wave (CW) Radar, frequency modulated CW Radars

UNIT- II: MTI and Pulse Doppler Radars:
Introduction, single delay-line canceler, double delay-line canceler, MTI recursive filter, MTI non- recursive filter, pulse Doppler Radar, range and Doppler ambiguities.

UNIT- III: Pulse Compression Radar and Synthetic Aperture Radar:
The matched filter, the Radar ambiguity function, pulse compression in Radars, Synthetic aperture Radars (SAR), SAR general description, SAR signal processing, Radar equation of the SAR system.

UNIT- IV: Radar Receivers:
Block diagram of super heterodyne receiver- Detection of Radar signals in noise – Matched filter criterion-detection criterion – Extraction of information and waveform design. Special Purpose Radars: Height finder-3D Radars –Radar Beacons- Radar Jamming

UNIT- V: Tracking Radars, Range tracking, Angle Tracking:
Sequential lobing, conical-scan tracking, mono pulse tracking Radar, range tracking.

TEXT BOOKS:

1. Introduction to Radar Systems – Merrill I. Skolnik, 2nd Edition, McGraw-Hill,1981.
2. Introduction to Radar with Python and MAT LAB, Lee Andrew Harrison, Artech House, 2019

REFERENCE BOOKS:

1. Radar Handbook, Merrill I. Skolnik, McGraw-Hill Education 3rd edition 2008
2. Introduction to Synthetic Aperture Radar Concepts and Practice, E. David Jansing, McGraw Hill, 1st Edition, 2021.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
5G AND BEYOND COMMUNICATIONS
(PROFESSIONAL ELECTIVE-V)

Course Code: GR24A4082 **L/T/P/C: 3/0/0/3**
IV Year II Semester

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

1. Apply knowledge of 5G specifications.
2. Involve in 5G System Architecture related works.
3. Apply some signalling techniques of 5G.
4. Do elementary-level works in key enabling technologies.
5. Apply AI at elementary level to 5 G-and-beyond communication

UNIT-I: Introduction to 5G:
Evolution of mobile communication (1G to 5G),5G vision and requirements (ITU IMT-2020) Key performance indicators (KPIs), Use cases: eMBB, URLLC, mMTC, Overview of 3GPP 5G standards

UNIT-II: 5G System Architecture:
5G NR architecture: gNB, NG-RAN,Core network: 5GC vs. LTE EPC, Network slicing, Service-based architecture (SBA),Control and user plane separation (CUPS)

UNIT-III: Radio Access Technologies in 5G:
5G NR waveform and numerology (OFDM, CP-OFDM, DFT-s-OFDM), Frequency bands (FR1, FR2) Massive MIMO and Beamforming, mmWave communication, Channel coding: LDPC, Polar codes

UNIT-IV: Key Enabling Technologies:
SDN and NFV in 5G, Mobile edge computing (MEC), Device-to-device (D2D) communication, Cloud-RAN and Open RAN, IoT integration in 5G

UNIT-V: Beyond 5G and 6G:
Motivation and vision for 6G, Terahertz communication, Intelligent Reflecting Surfaces (IRS), AI/ML in wireless networks, Joint communication, and sensing, Green and sustainable 6G

TEXT BOOKS:

1. Jonathan Rodriguez, Fundamentals of 5G Mobile Networks, 2015, 1st Edition, Wiley Publications, United States.
2. Mohammed Abdul Matin , A Glimpse Beyond 5G in Wireless Networks
3. Bogucha, Hanna, Kliks, Adrian, Kryszkiewicz, Pawel, Advanced multi carrier technologies for future Radio communication:5G & beyond.

REFERENCE BOOKS:

1. R. Vannithamby and S. Talwar, Towards 5G: Applications, Requirements and Candidate Technologies., John Willey & Sons, West Sussex, 2017.
2. Manish, M., Devendra, G., Pattanayak, P., Ha, N., 5G and Beyond Wireless Systems PHY Layer Perspective, Springer Series in Wireless Technology.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES
(PROFESSIONAL ELECTIVE-V)

Course Code: GR24A4083 **L/T/P/C: 3/0/0/3**
IV Year II Semester

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

1. Introduce architectural features of programmable DSP Processors of TI and Analog Devices.
2. Understand digital transform techniques.
3. Apply practical examples of DSP Processor architectures for better understanding.
4. Analyse and develop the programming knowledge using Instruction set of DSP Processors.
5. Apply interfacing techniques to memory and I/O devices.

UNIT-I: Introduction to Digital Signal Processing:
Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time- invariant systems, Digital filters, Decimation, and interpolation.
Computational Accuracy in DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT-II: Architectures for Programmable DSP Devices:
Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT-III: Programmable Digital Signal Processors:
Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline operation of TMS320C54XX Processors.

UNIT-IV: Analog Devices Family of DSP Devices:
Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor. Introduction to Blackfin Processor - The Blackfin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit

UNIT-V: Interfacing Memory and I/O Peripherals to Programmable DSP Devices:
Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

TEXT BOOKS:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson

2. A Practical Approach to Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran,Ananthi. S, New Age International, 2006/2009
3. Embedded Signal Processing with the Micro Signal Architecture Publisher: Woon-Seng Gan,Sen M. Kuo, Wiley-IEEE Press, 2007

REFERENCE BOOKS:

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, TMH.
2. Digital Signal Processing – Jonatham Stein, 2005, John Wiley. 3.DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.
3. Digital Signal Processing Applications Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
QUANTUM TECHNOLOGIES
(PROFESSIONAL ELECTIVE-V)

Course Code: GR24A4084 **L/T/P/C: 3/0/0/3**
IV Year II Semester

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

1. Explain the principles of quantum information and qubits.
2. Apply the concepts of quantum gates and circuits to simple problems.
3. Understand the basics of quantum algorithms and their applications.
4. Describe quantum communication and cryptographic protocols.
5. Analyze the role of quantum technologies in modern ECE applications.

Unit-I: Introduction to Quantum Information:
Bits vs Qubits, Quantum Superposition and Entanglement, Quantum measurement and Bloch sphere representation, Dirac notation (introductory).

Unit-II: Quantum Gates & Circuits:
Quantum gates: Pauli-X, Y, Z, Hadamard, Phase, T, CNOT, Building simple quantum circuits, Bell states and entangled systems.

Unit-III: Quantum Algorithms:
Deutsch–Jozsa algorithm, Grover's search algorithm, Shor's factoring algorithm (conceptual overview).

Unit-IV: Quantum Communication:
Quantum teleportation, Superdense coding, Quantum key distribution (BB84, E91), Quantum cryptography applications.

Unit-V: Applications & Emerging Technologies:
Quantum sensors and metrology, Quantum computing in AI/ML and optimization, Hardware platforms: superconducting qubits, trapped ions, photonic qubits, Nitrogen-Vacancy centres, post-quantum cryptography and outlook.

TEXTBOOK:

1. Chris Bernhardt, *Quantum Computing for Everyone*, MIT Press, 2019.

REFERENCE BOOKS:

1. Michael A. Nielsen and Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge Univ. Press.
2. Eleanor Rieffel & Wolfgang Polak, *Quantum Computing: A Gentle Introduction*, MIT Press.
3. Phillip Kaye, Raymond Laflamme, and Michele Mosca, *An Introduction to Quantum Computing*, Oxford Univ. Press.

ONLINE RESOURCES:

- IBM Quantum Experience (Qiskit tutorials).
- Microsoft Quantum Development Kit (Q#).
- MIT OpenCourseWare: *Quantum Computation*.

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

Course Code: GR24A4085 **L/T/P/C: 3/0/0/3**
IV Year II Semester

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

1. Explore the basic concepts and frequency allocations for satellite communication, orbital mechanics
2. Apply the concepts of orbital mechanics and determine parameters of launchers
3. Analyze various satellite subsystems and its functionality
4. Analyze satellite links design for specified C/N
5. Choose appropriate multiple access technique for a given satellite communication application and work with earth stations

UNIT-I: Introduction:
Origin of satellite communications, basic concepts of satellite communications, frequency allocations for satellite services, applications. Low Earth Orbit and Geo-stationary Satellite Systems: Orbit consideration, coverage and frequency considerations, delay and throughput considerations, system considerations, operational NGSO constellation designs.

UNIT-II: Orbital Mechanics, Launchers:
Orbital Mechanics look angle determination, orbital perturbations, orbit determination, launches and launch vehicles, orbital effects in communication systems performance.

UNIT-III: Satellite Subsystems:
Attitude and orbital control system, Telemetry, Tracking, command and monitoring, power systems, communication subsystems, satellite antenna equipment reliability and space qualification.

UNIT-IV: Satellite Link Design:
Basic transmission theory, system noise temperature and G/T ratio, design of down links, uplink design, design of satellite links for specified C/N, Link budget.

UNIT-V: Earth Station Technology:
Introduction, transmitters, receivers, Antennas, tracking systems, terrestrial interface, primary power test methods, VSAT, TVRO. International and National Satellites: Intelsat, landsat, Inmarsat, Apple, Gsat, Insat, IRS.

TEXT BOOKS:

1. Satellite communications-Timothi Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. Satellite communications Engineering-Wilbur L.Prichard, Robert A. Nelson & Henry G. Suyderhoud, 2nd Edition, Pearson Publications, 2003.
3. Satellite Communications - D. C. Agarwal, Khanna Publishers, 1996

REFERENCE BOOKS:

1. Satellite communications: Design Principles-M. Richharia, BS publications, 2nd Edition, 2003.
2. Fundamentals of Satellite communications K.N.Rajarao, PHI, 2004.

3. Satellite Communications-Dennis Roddy, McGraw Hill, 4th Edition, McGraw Hill, 2009

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
WIRELESS SENSOR NETOWORKS
(PROFESSIONAL ELECTIVE-VI)

Course Code: GR24A4086 **L/T/P/C: 3/0/0/3**
IV Year II Semester

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

1. Understand the challenges, constraints, and advantages of wireless sensor networks for various applications.
2. Discuss various architecture of MANETs
3. Design, Simulate and Compare the performance of various routing and MAC protocol
4. Analyze and compare various data gathering and data dissemination methods.
5. Apply various routing protocols and methods in internet WSN communication.

UNIT – I

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

UNIT – II

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

UNIT – III

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee

UNIT – IV

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

UNIT – V

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

TEXT BOOKS:

1. Ad-Hoc Wireless Sensor Networks- C. Siva Ram Murthy, B. S. Manoj, Pearson education
2. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE

REFERENCE BOOKS:

1. Wireless Digital Communications – Kamilo Feher, 1999, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.
4. Wireless Communication and Networking – William Stallings, 2003, PHI.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GLOBAL NAVIGATION SATELLITE SYSTEMS
(PROFESSIONAL ELECTIVE VI)

Course Code: GR24A4087 **L/T/P/C: 3/0/0/3**
IV Year II Semester

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

1. Demonstrate the fundamental concepts of communications in understanding of GPS architecture, operation and signal structure.
2. Apply the principles of orbital mechanics, time references, coordinate systems and range measurements in estimating user position.
3. Examine the effect of various error sources and satellite geometry on position estimates and analyze the suitability of a given data format.
4. Compare the architecture and working of other GNSS systems and make use of GNSS systems in a variety of civilian and defense applications.
5. Relate the knowledge of DGPS techniques in understanding augmentation systems.

UNIT-I: GPS fundamentals:
GPS System Segments: space, control and user segments, Principle of operation, Current status of GPS satellite constellation. Orbital Mechanics: GPS ephemeris data, algorithm for computation of satellite's position from ephemeris data. Time References: solar and sidereal days, UTC time, GPS time.

UNIT-II: GPS Signals:
Legacy GPS signals: Signal structure, Operating frequencies, C/A and P-Code, Navigation message, Modernized GPS signals: list of signals and their significance. Range measurements: code and carrier measurements, User position estimation with PRN codes. Coordinate systems: Earth Centered Earth Fixed (ECEF) coordinate system, Earth Centered Inertial (ECI) coordinate system, Geodetic coordinate system, Ellipsoid and Geoid, Regional and Global Datum, World Geodetic System (WGS-84).

UNIT-III: GPS error sources:
Satellite clock error, ephemeris error, Receiver clock errors, satellite and receiver instrumental bias, Multipath error, receiver measurement noise, ionospheric error and tropospheric error, Klobuchar model, ionospheric delay estimation using dual frequency measurements and UERE. Dilution of precision: HDOP, VDOP, TDOP, PDOP & GDOP.

UNIT-IV: Data formats:
RINEX Observation and Navigation Data formats GNSS: architecture, operation and signals of other global satellite systems such as Galileo, Beidou, GLONASS and regional systems such as IRNSS, QZSS.

UNIT-V: Differential GPS (DGPS):
Principle of DGPS, Types of DGPS: Local Area DGPS (LADPS), Wide Area DGPS (WADGPS). GPS Augmentation systems: Principle of operation of Satellite Based Augmentation system (SBAS) and Ground Based Augmentation System (GBAS):
GNSS Applications Surveying, Mapping, Marine, air and land Navigation, Military and Space Application.

TEXT BOOKS:

1. Elliot D Kaplan and Christopher J Hegarty, “Understanding GPS principles and applications”, Artech House Publishers, 2/e Boston & London 2005.
2. Pratap Misra and Per Enge, “Global Positioning System Signals, Measurement, and Performance”, Ganga- Jamuna Press, 2/e, Massachusetts, 2010.

REFERENCE BOOKS:

1. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, “GPS Theory and Practice,” Springer Verlog, 5/e, 2008.
2. 2. Ahmed El-Rabbany, “Introduction to GPS”, Artech House Publishers, 2/e, Boston 2006.
3. 3. Bradford W.Parkinson and James J. Spilker, “Global Positioning system: Theory and Application”,Vol.II, American Institution of Aeronautics and Astronautics Inc., Washington, 1996.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
AUTONOMOUS SYSTEMS
(PROFESSIONAL ELECTIVE VI)

Course Code: GR24A4088 **L/T/P/C: 3/0/0/3**
IV Year II Semester

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

1. understand the underlying mathematical models,
2. Develop control and guidance algorithms,
3. Implement perception and localization systems,
4. Design concepts with control system importance
5. Apply the Concepts of various Autonomous Systems and considering ethical implications.

UNIT-I:
Introduction to autonomous systems and their applications in robotics, drones, and self-driving vehicles LIDAR, radar, cameras, and IMUs (Inertial Measurement Units) role in perception and data collection.

UNIT-II:
Computer vision techniques for image processing, feature extraction, object detection, and tracking, along with deep learning architectures such as CNNs and RNNs for decision-making and navigation.

UNIT-III:
Kalman filtering and deep sensor fusion, to combine data from multiple sensors for enhanced accuracy. Path planning, real-time navigation, localization using SLAM, and reinforcement learning for decision-making in dynamic environments.

UNIT-IV:
Control Systems fundamentals, Open Loop and Closed Loop, Systems, Control systems for vehicle dynamics and the ethical, safety, and security aspects of autonomous systems are also discussed.

UNIT-V:
IoT, Robotics, Drones, Artificial Intelligence – Learning, Game Development, natural language processing, image, and video processing. Cloud Basics

TEXT BOOKS:

1. Autonomous Systems: A Comprehensive Approach by Michael A. Hsieh
2. Autonomous Robots: From Biological Inspiration to Implementation and Control by George A. Bekey.

REFERENCE BOOKS:

1. "Computer Vision: Algorithms and Applications" by Richard Szeliski
2. "Autonomous Vehicles: Opportunities, Strategies, and Disruptions" by Chris Gerdes, Wade H. H.
3. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville 6. "Robotics: Modelling, Planning and Control" by Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, and Giuseppe Oriolo.

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

Course Code:GR24A4026
L/T/P/C: 0/0/12/6
IV Year II Semester

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

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

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

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

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

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

OPEN ELECTIVES

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

Course Code: GR24A3010 **L/T/P/C: 3/0/0/3**

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

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

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

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

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

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

TEXT BOOKS:
1. Robbins, Stephen P. and Timothy A. Judge, Organisational Behaviour, Prentice -Hall, New Delhi.

2. Werner J. M., DeSimone, R.L., Human resource development, South Western.

REFERENCE BOOKS:

1. Luthans, Fred, Organizational Behaviour, McGraw-Hill, New York.
2. Gregory, Moorhead and Ricky W. Griffin, Managing Organizational Behaviour, Thomson South Western Publication.
3. Pareek, Udai and V. Sisodia, "HRD in the New Millennium, Tata McGraw - Hill Publishing Co. Ltd., New Delhi, 1999.
4. Haldar, U. K., Human resource development, Oxford University Press India.
5. Rao, T.V., Future of HRD, Macmillan Publishers India.
6. Rao, T.V., HRD Score Card 2500: Based on HRD audit, Response Books, SAGE Publications.
7. Mankin, D., Human resource development, Oxford University Press India.

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

Course Code: GR24A3024 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2. Locate and apply case law and common law to current legal dilemmas in the technology field.
3. Apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
4. Understand cybercrime and ethical practices and the student will be able to know and learn web technologies and related issues.
5. In position to interface with various issues pertaining to Intellectual Property, copy rights, patents rights etc. and provide an overview of cybercrime and framework.

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

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

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

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

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

TEXT BOOKS:
1. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
2. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012)
3. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)
4. Jonthan Rosenoer, Cyber Law, Springer, New York, (1997).

REFERENCE BOOKS:

1. Sudhir Naib, The Information Technology Act, 2005: A Handbook.
2. S. R. Bhansali, Information Technology Act, 2000
3. University Book House Pvt. Ltd. Jaipur (2003).
4. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi.

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

Course Code: GR24A4013 **L/T/P/C: 3/0/0/3**

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

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

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

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

UNIT-IV: Private and Public Sector, Public Sector:
Role and growth, Achievements of the public sector, Private Sector – Importance Problems, New foreign Trade Policy.

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

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

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INDIAN KNOWLEDGE SYSTEM
(OPEN ELECTIVE)

Course Code: GR24A3023 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Understand nature, scope and related fields of Indian knowledge system.
2. Demonstrate the scientific literature available in ancient Indian traditions
3. Understanding the application of Bharatiya Jnana Parampara
4. Understand Indian approach towards Wellbeing
5. Appreciate vast contribution of ancient Indian researchers, engineers, scientists and architects to the modern world

UNIT-I: Introduction to Indian Knowledge Systems:
Meaning, Nature, Scope and Salient Aspects of Bharatiya Jnana Parampara - Introduction to Vedas, Upanishads, Vidya, Kala, Jnana, Shastra - Practices and Continuity of Tradition

UNIT-II: Overview of History of Indian Education and Scientific Literature:
Gurukul System - Role of Sanskrit in Natural Language Processing - Scientific Literature – Vedic. Literature - Available Scientific Treatises - Interlinkings

UNIT-III: Introduction to Scientific Theories from Pure Sciences from Ancient Indian Knowledge Systems:
Overview of theories from available ancient Indian Literature about Physics, Chemistry and Mathematics - Interlinking's and applications

UNIT-IV: Introduction to Ancient Indian Wellness Systems:
Concept of Wellness – Yoga System - Ayurveda System - Ancient Indian Aesthetics Achievements of the public sector, Private Sector – Importance Problems, New foreign Trade Policy.

UNIT-V: Development of Engineering, Science, Technology & Fine Arts in India:
Various Industries - Silk, Cotton and Ship Building - Evolution of Indian Fine Arts – Cave and Temp Architecture, Vastu - Vidya, Sculpture, Forts and Stepwells, Observatories and Paintings - Music and Natyakala - Cultural Traditions & Folk Arts.

Pedagogy for Teachers: Apart from Classroom Instruction, the following Methods are Suggested.
1. Project based activities and learning.
2. Presentation and case studies.
3. Film screening and book reviews.
4. Visit to historical places, archives centre, research centre or library nearby.

Note: Activities mentioned above are only suggestive. Teacher-educators should encourage students to be innovative.

TEXT BOOKS:
1. B. Mahadevan, Bhat Vinayak and Nagendra Pavan R.N., (2022) 'Introduction to Indian Knowledge Systems: Concepts and Applications' PHI learning PVT, New Delhi ISBN

[9789391818203]
2. Dharmapal (1971) 'Indian Science and Technology in the Eighteenth Century'. Other India Press, Goa.
3. Kapil Kapoor, Singh Avdhesh Kumar, (2005) 'Indian Knowledge Systems' D.K. Printworld (P) Ltd. ISBN 10: 8124603367 / ISBN 13: 9788124603369
4. Chakradeo, Ujwala, Temples of Bharat, Aayu Publications, New Delhi, 2024.
5. D.N. Bose, S.N. Sen and B. V. Subbarayappa, A Concise History of Science in India, Indian National Science Academy, New Delhi, 2009.
6. Datta B. and A. N. Singh, History of Hindu Mathematics: Parts I and II, Asia Publishing House, Bombay, 1962.
7. Kapoor, K. (2021), Indian Knowledge System: Nature, Philosophy, Character in Indian Knowledge System, vol. 1, Pub. Indian Institute of Advanced Studies, Shimla
8. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Philosophical Systems, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.
9. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Knowledge: Framework and Classification, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.

VIDEO RESOURCES:

1. Introductory lectures by Prof. Gauri Mahulikar
2. Introductory lectures by Prof. Kapil Kapoor

WEBSITES:

- https://iksin dia.org/index.php
- Official Website of IKS- Indian Knowledge System
- https://www.youtube.com/watch?v=uKcf-hSlcUE
- Address by Prof Kapil Kapoor | Indian Institute of Advanced Study (FDP 2021)
- https://www.youtube.com/watch?v=MDJTXNiH2_A
- Mukul Kanitkar on Bharatiya Knowledge System
- https://www.youtube.com/watch?v=uARMhv97pjk
- https://www.youtube.com/watch?v=oTwgf56GbsA
- Scientific History of India | Mukul Kanitkar Lecture in DTU
- https://youtu.be/gNJNmPJqXJc?si=WFBbuUT65mLZzpOW
- Ancient India's Scientific Achievements & Contribution in Mathematics, Astronomy, Science & Medicine

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
A PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(OPEN ELECTIVE)

Course Code: GR24A4012 **L/T/P/C: 3/0/0/3**

Course Outcomes:
1. Study of Shrimad- Bhagwad-Gita wiil help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neethishatakam will help in developing versatile personality of students
4. To develop self-developing attitude towards work without self-aggrandizement and to develop suffering free meditative mind
5. To develop tranquil attitude in all favorable and unfavorable situations and to develop high spiritual intelligence

UNIT-I: Neetisatakam-Holistic development of personality
- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT-II: Neetisatakam-Holistic development of personality
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT-III: Approach to day to day work and duties
- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV: Statements of basic knowledge
- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:
- Classification, Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOKS/ REFERENCE BOOKS:
1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING MATERIALS FOR SUSTAINABILITY
(OPEN ELECTIVE)

Course Code: GR24A3009 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Describe the different types of environmental factors effecting materials
2. Report the work in sustainability for research and education
3. Illustrating the broad perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course
4. Perform cost/benefit analysis and life-cycle analysis of green buildings.
5. Identify the balance affordability, functionality, and environmental responsibility to create sustainable and effective building designs.

UNIT-I: Sustainability:
Introduction, need, and concept of sustainability, Social- environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols – Clean Development Mechanism (CDM), Environmental legislations in India – Water Act, Air Act

UNIT-II: Environmental management standards:
ISO 14000 series, Life Cycle Analysis (LCA) – Scope and Goal, Bio-mimicking, Environment Impact Assessment (EIA) – Procedures of EIA in India

UNIT-III:
Green Building Materials, Basic concepts of sustainable habitat, green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainably managed Materials, Depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials; Embodied Energy of Materials

UNIT-IV:
Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds (VOC's), Natural Non-Petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials, Engineering evaluation of these materials

UNIT-V:
Green Building Planning and Specifications**,** Environment friendly and cost effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Alternative Construction Methods, Energy Conservation Measures in Buildings, Waste &Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight, Plumbing and its Effect on Energy Consumption

TEXT BOOKS:
1. Alternative Building Materials and Technologies – By K S Jagadeesh, B V Venkata Rama Reddy & K S Nanjunda Rao – New Age International Publishers, 2007

2. Integrated Life Cycle Design of Structures – By AskoSarja – SPON Press, 2011
3. Non-conventional Energy Resources – By D S Chauhan and S K Srivastava – New Age International Publishers, 2021

REFERENCE BOOKS:

1. Emerald Architecture: case studies in green buildings, The Magazine of Sustainable Design, 2008
2. Understanding Green Building Guidelines: For Students and Young Professionals, Traci Rose Rider, W. W. Norton & Company Publisher.2009
3. Understanding Green Building Materials, Traci Rose Rider, W. W. Norton & Company Publisher.2011
4. Green Buildings (McGraw hill publication): by Gevorkian, 2006

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GEOGRAPHIC INFORMATION SYSTEMS AND SCIENCE
(OPEN ELECTIVE)

Course Code: GR24A3022 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Interpret the fundamental concepts of Geographic Information Science and Technology along with different data structures.
2. Demonstrate Map creation and design principles, including thematic map display, employment of map projections and cartographic design.
3. Analyze the types of digital maps for different themes.
4. Apply the spatial analysis to remote sensing data to generate thematic maps.
5. Solve the real-life problems associated with geospatial and remote sensing.

UNIT-I:
Fundamentals of GIS – Information Systems, Modelling Real World Features Data, Data Formats, Applications of GIS, – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Database Management – Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware – Computing, printing and scanning systems; Software – Standard Packages like Arc view, ArcGIS (commercial) & Auto-CAD Map, Map Info etc. QGIS open software- Salient features.

UNIT-II:
Topology – Types of Errors, Editing and Error Rectification, Types of Topology, Modeling topological Relationships, Tolerances.

UNIT-III:
Map – mapping concepts, analysis with paper-based maps, limitations, Computer Automated Cartography– History and Developments, GIS- Definition, advantages of digital maps.

UNIT-IV:
Spatial Analysis and Modelling – Proximity Analysis, Overlay Analysis, Buffer Analysis, Network Analysis, Spatial Auto Correlation, Gravity Modelling, DTM/DEM, Integration with Remote Sensing data

UNIT-V:
GIS Project Planning and Implementation – Under Standing the Requirements, Phases of Planning, Specifications, Data Procurement, Tendering, Human Resources, Back Up, Monitoring Progress

TEXT BOOKS:
1. Concepts & Techniques of GIS by C. P. Lo Albert, K. W. Yonng, Prentice Hall (India) Publications, 2nd edition, 2016.
2. Fundamental of GIS by Mechanical designs John Wiley &Sons, 4th edition, 2008.
3. Principals of Geographic Information Systems – Peter Beur and Rachael A.Mc Donnell, Oxford Publishers 2016.
4.

REFERENCE BOOKS:

1. Remote Sensing and Geographical Information systems by M. Anji Reddy JNTU Hyderabad.4th Edition 2014, B. S. Publications.
2. Introduction to Geographic Information Systems by Kang-tsung Chang, Tata McGraw-Hill Publishing Company Limited- 2008.
3. Remote sensing of the environment –An earth resource perspective by John R Jensen, Prentice Hall 4. GIS by Kang – tsung chang, TMH Publications & Co., 2nd edition, 2013.
4. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications, 1st edition,2016.
5. Remote Sensing and its applications by LRA Narayana, UniversityPress 1999.
6. Remote sensing and image interpretation by Thomas Lillesand, 7th Edition, John Wiley & sons,6th Edition 2011.
7. Fundamentals of Geographic Information systems by Michael N. Demers, 4th Edition, Wiley Publishers, 2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PLUMBING -WATER AND SANITATION
(OPEN ELECTIVE)

Course Code: GR24A4011 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Coordinate plumbing works from inception to completion with Owners, Architects, other consultants, and contractors.
2. Select proper plumbing materials and systems.
3. Read and interpret plumbing drawings.
4. Supervise code based plumbing installations. Understand methods to conserve water and energy, Protect health and safety of end users.
5. Enjoy better job opportunities and career options

UNIT-I: Introduction to Plumbing and Sanitation Importance of Codes, Architectural and Structural Coordination Codes and Standards: Scope, purpose; codes and standards in the building industry, UIPC-I (Uniform Illustrated Plumbing Code-India), NBC (National Building Code) and other codes, Local Municipal Laws, approvals, general regulations, standards, water supply, sewerage system, drainage system, workmanship, water conservation, protection of pipes and structures, waterproofing. of GIS – Information Systems, Modelling Real World Features Data, Data Formats, Applications of GIS, – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Database Management – Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware – Computing, printing and scanning systems; Software – Standard Packages like Arc view, ArcGIS (commercial) & Auto-CAD Map, Map Info etc. QGIS open software- Salient features.
Architectural and Structural coordination: Provisions for plumbing systems, coordination during the planning stage, various agencies involved and their roles, space planning for plumbing systems, water tanks, pump room, centralized hot water systems, toilet locations.

UNIT-II: Plumbing Terminology:
Definitions, use/purpose of the following. ***Plumbing Fixtures:*** accessible, readily accessible, aerated fittings, bathroom group, carrier, flood level rim, floor sink, flush meter valve, flush tanks, lavatories, macerating toilet, plumbing appliances, plumber. ***Traps:*** indirect waste, vent, blow off, developed length, dirty arm, indirect waste, receptors, slip joints, trap, and vent. ***Drainage:*** adapter fitting, adjusted roof area, air break, air gap, area drain, base, bell and spigot joint, building drain, branch, (DFU) Drainage Fixture Units, grease interceptor, joints, roof drain, smoke test, stack. ***Water supply:*** angle valve, anti-scald valve, backflow, bypass, check valve, cross connection, gate valve, gray water, joints.

UNIT-III: Plumbing Fixtures and Fittings:
Definitions of plumbing fixtures, fittings, appliances and appurtenances; maximum flow rates, water closets, urinals, flushing devices, washbasins, bath/shower, toilets for differently abled, kitchen sinks, water coolers, drinking fountain, clothes washer, dish washer, mop sink, overflows, strainers, prohibited fixtures, floor drains, floor, location of valves, hot water temperature controls, installation standard dimensions in plan and elevation.

UNIT-IV:

Traps, Interceptors, Indirect Waste and Vents Traps required, trap arms, developed length, trap seals, venting to traps, trap primers, prohibited traps, building traps. Discharge for indirect waste piping, nature of contents or systems, proper methods to install indirect waste piping, air gap and air break, sink traps, dish washers. Vent requirement, purpose of venting, trap seal protection, materials, vent connections, **Sanitary Drainage and Storm Drain** Preamble, one pipe and two pipe systems, different pipe materials and jointing methods, special joints, hangers and supports, protection of pipes and structures, alternative materials, workmanship, prohibited fittings and practices.

Water Supply, Gray and Reclaimed Water: Preamble, one pipe and two pipe systems, different pipe materials and jointing methods, special joints, hangers and supports, protection of pipes and structures, alternative materials, workman ship, prohibited fittings and practices, change in direction of flow, T and Y fittings, Storm drain required, prohibited connections, subsoil drains, sub-drains, gutters, channels or scuppers, roof drains, catchment, collect/capture storm water, discharging storm water, Rain Water Harvesting (RWH) definition, need, catchment, conduits, settlement tanks, treatment, possible uses, recharging pits, NBC requirements.

UNIT-V:

Water Supply, Gray and Reclaimed Water (Preamble, sources of water, potable and non-potable water, reclaimed water, calculating daily water requirement and storage, hot and cold water distribution system. pipe materials and jointing methods, alternative materials, hangers and supports, workmanship, prohibited fittings and practices, protection of pipes and Plumbing (Water and Sanitation) structures, pressure controls, unions, thermal expansion, types of valves, Definition of gray water, approvals, specifications and drawings, safety, total gray water discharge, holding tanks, valves and piping.

Introduction to water treatment plant (WTP) and STP: Introduction to Net Zero concept, need to reduce and reuse, rating of Water Efficient Plumbing fixtures and fittings, 24x7 water supply, metering and sub-metering, typical daily water and wastewater calculations for a project.

TEXT BOOKS:

1. Elements of Water Pollution Control Engineering, O.P. Gupta, Khanna Book Publishing, New Delhi. Edition ·1, 2019.
2. Plumbing Engineering" Author: R. G. Saran Publisher: S. K. Kataria & Sons Latest Edition: 2022 (Revised Edition)
3. "Water Supply and Sanitary Engineering" Authors: G. S. Birdie and J. S. Birdie Publisher: Dhanpat Rai Publishing Company Latest Edition: 2022 (33rd Revised Edition)
4. "Plumbing: Design and Installation" Author: L. G. Wade Publisher: Cengage Learning Latest Edition: 2019 (4th Edition)

REFERENCE BOOKS:

1. "Plumbing Engineering Design Handbook" (Volumes I & II) Publisher: American Society of Plumbing Engineers 2022 Edition (Volume 1: Fundamentals; Volume 2: Systems)
2. Water Efficiency and Sanitation Standard published by IPA Indian Plumbing Association (IPA) and IAPMO International Association of Plumbing and Mechanical Officials (India) Water Pollution, Berry, CBS Publishers, 2023 edition.
3. 'A Guide to Good Plumbing Practices', a book published by IPA, 2016 edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
NON-CONVENTIONALENERGYSOURCES
(OPEN ELECTIVE)

Course Code: GR24A3035 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Recall the concepts of Solar Energy and Solar collectors.
2. Illustrate the PVSolar system with energy backup.
3. Analyze the basic physics of wind power generation.
4. Determine the energy generation from biomass, biogas, and geothermal energy.
5. Discuss Tidal power systems and fuel cells.

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

UNIT-II: Photo Voltaic System:
Photo voltaic cells-Equivalent circuit- V-I Characteristics- Photovoltaic modules-constructional details- design considerations-Tracking-Maximum power point tracking–algorithms-PV solar system design with energy backup-Solar Thermo electric Conversion.

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

UNIT-IV: Biogas and Geothermal Energy:
Various fuels-Sources- Conversion technologies–Dry Processes-Biogas generation–Aerobic and anaerobic digestion- Factors affecting the generation of biogas –Classification of biogas plants-Different Indian digesters- Digester design considerations- Gasification process-Gasifiers-Applications. Geothermal Energy-sources-Hydro thermal convective-Geo-pressure resources-Petro-thermal systems(HDR)-Magma Resources-Prime Movers

UNIT-V: Tidal Energy:
Principle of operation-Open and closed cycles, Energy from Tides-Principle of Tidal Power—Components of tidal Power plants-Operation Methods-Estimation of Energy in Single and double basin systems-Energy and Power from Waves-Wave energy conversion devices-Fuel Cells-Design andPrincipleofoperation-TypesofFuelCells-Advantagesanddisadvantages-TypesofElectrodes- Applications-Basics of Batteries –Constructional details of Lead acid batteries- Ni-Cd Batteries.

TEXT BOOKS:
1. John Twidell & Wier, Renewable Energy Resources,CRCPress,2009.
2. D.P.Kothari, Singal, Rakesh, Ranjan, Renewable Energy Sources and Emerging Technologies, PHI, 2009.

REFERENCE BOOKS:

1. G.D.Rai–Non-Conventional Energy sources, Khanna publishers.
2. B.H.Khan,"Non-ConventionalEnergyResources",2ndedition,TataMcGraw-Hill,New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

CONCEPTSOF CONTROLSYSTEMS
(OPEN ELECTIVE)

Course Code: GR24A3046 **L/T/P/C: 3/0/0/3**

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

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

UNIT-I: Basic Concepts of Control System:

Terminology - plant, process, system, disturbances, controlled variable, manipulated variable etc., Block diagram of basic control system, application areas with examples. Classifications of control systems

UNIT-II: Mathematical Modelling of Systems:

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

UNIT-III: Time Response Analysis:

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

UNIT-IV: Stability:

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

UNIT-V: Frequency Response Analysis:

Need of frequency response analysis, Sinusoidal response of linear system, methods used in frequency response, Bode Plot, Frequency domain specifications.

TEXT BOOKS:

1. IJNagrath, M.Gopal, Control System Engineering,New Age International Publishers, Fifth edition.
2. NormanSNise, Control system engineering, JohnWiley& Sons,Inc.,Sixth edition

REFERENCE BOOKS:

1. RichardC.Dorf, Robert HBishop, Modern control systems, Pearson Education International, Twelfth edition.
2. ANagoorKani, Control Systems, CBS Publishers. Jon. S. Wilson; "Sensor Technology Hand Book", Elsevier Inc., 2005.

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

Course Code: GR24A4037 **L/T/P/C: 3/0/0/3**

Course Outcomes: On completion of the course, the student will be able to
1. Outline importance of BNN, ANN and its learning techniques and architectures.
2. Summarize the algorithms for various applications using Back propagation networks.
3. Interpret the concept of Fuzzy and Crispsets.
4. Model Fuzzy membership Function and rules for Applications.
5. Analyze the parameters of Genetic Algorithm.

UNIT-I: NEURALNETWORKS I (Introduction &Architecture):
Neuron, Nerve structure and synapse, Biological Neural network, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques.
to Information Theory, Shanon Capacity, Multimedia Data, Data Processing, Boolean Logics, Information Content, Entropy, Source Coding, Channel Coding, Modulation Schemes, Internet.

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

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

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

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

TEXT BOOKS:
1. JMZurada,"An Introduction to ANN",JaicoPublishing House.
2. Neural Networks, Fuzzy Logic, And Genetic Algorithms: Synthesis and Applications -byS. Rajasekaran, G. A. Vijayalakshmi Pai, PHI publishers.

REFERENCE BOOKS:
1. HungT.Nguyen,Nadipuram R.Prasad,CarolL. Walker andElbertA.Walker,"AFirstCourse in Fuzzy and Neural Control" Chapman & Hall, CRC.

2. Driankov,Dimitra,“AnIntroductiontoFuzzyControl”,NarosaPublication.
3. TimothyJRoss, “Fuzzy Logic with Engg. Applications”,McGraw.Hill.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INDUSTRIAL AUTOMATION AND CONTROL
(OPEN ELECTIVE)

Course Code: GR24A3056 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Explain the major automation theories, approaches and methodologies used in manufacturing.
2. Apply the knowledge for implementing the automated flow lines.
3. Employ the assembly systems and line balancing for automation
4. Implement the knowledge of material handling and storage systems in current industries.
5. Design adaptive control system for automated manufacturing.

UNIT-I: Introduction:
Introduction to automation, principles, reasons, types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding, tool changing and machine tool control transfer the automaton.

UNIT-II: Automated flow lines:
Methods of work part transport transfer, Mechanical buffer storage control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT-III: Assembly system and line balancing:
Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT-IV: Automated material handling and storage systems:
Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems. Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT-V: Adaptive control systems:
Introduction, adaptive control with optimization, adaptive control with constraints, application of adaptive control in machining operations. Consideration of various parameters such as cutting force, temperatures, vibration and acoustic emission in the adaptive controls systems.

TEXT BOOKS:
1. Mikell P.Groover, Automation, Production Systems, and Computer- integrated Manufacturing, prentice Hall, 2014
2. Serope Kalpakjian and Steven R. Schmid, edition, Pearson, 2013

REFERENCE BOOKS:
1. Automation, Production Systems, and Computer-Integrated Manufacturing. (2016). India: Pearson India.
2. Bolz, R. W. (2012). Manufacturing Automation Management: A Productivity Handbook. United States: Springer US.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OPERATIONS RESEARCH
(OPEN ELECTIVE)

Course Code: GR24A3034 **L/T/P/C: 3/0/0/3**

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

1. Formulate and solve linear programming problems using simplex and duality approaches for resource allocation.
2. Apply non-linear optimization techniques (single and multi-variable unconstrained methods) to practical engineering and management problems.
3. Analyze and solve transportation and assignment models for effective decision-making in logistics and resource allocation.
4. Evaluate inventory control systems and queuing models to optimize stock management and service efficiency.
5. Apply replacement and dynamic programming models for long-term decision-making in capital budgeting, maintenance, and system optimization.

UNIT-I: Introduction & Linear Programming:

Introduction: Development, Definition, Characteristics and Phases of Operations Research, Types of models: Operations Research models – Applications: Linear Programming Problem (LPP) formulation, Graphical solution method, Simplex method – Artificial variables techniques (Two–phase method, Big-M method), Duality principle

UNIT-II: Non-Linear Programming:

Introduction – Difference between linear and nonlinear programming, applications in engineering & management; **Single-variable unconstrained optimization**: Uni-modal functions, Elimination methods – Bisection/interval halving, Fibonacci method, Golden Section method; **Multi-variable unconstrained optimization**: Gradient of a function, optimality condition, Gradient methods – Steepest Descent Method, Conjugate Gradient Method (Fletcher–Reeves)

UNIT-III: Transportation & Assignment Models:

Transportation models: Formulation, Methods for finding feasible solution and optimal solution, Unbalanced transportation problems, degeneracy; **Assignment models**: Formulation, Optimal solution, Variants of Assignment Problem (e.g., unbalanced, maximization, traveling salesman problem)

UNIT-IV: Inventory & Queuing Models:

Inventory models: Single-item deterministic models, Purchase inventory models with one price break and multiple price breaks, Shortages not allowed, Stochastic models – demand as discrete or continuous variable, Instantaneous production, instantaneous demand and continuous demand (no setup cost)

Queuing models: Introduction, Single-channel system: Poisson arrivals, exponential service times, infinite/finite population, Multi-channel systems: Poisson arrivals, exponential service times with infinite population

UNIT-V: Replacement & Dynamic Programming:

Replacement models: Replacement of items that deteriorate with time (with and without time

value of money), Replacement of items that fail completely, Group replacement policy
Dynamic programming: Introduction – Bellman's Principle of Optimality Applications: capital budgeting, shortest path problem, linear programming problem

TEXT BOOKS:

1. Operations Research/ Prem Kumar Gupta, Dr. D.S. Hira
2. Operations Research / S. D.Sharma-Kedarnath
3. Operation Research /J.K.Sharma/MacMilan.

REFERENCE BOOKS:

1. A.K. Operations Research / R.Pannerselvam,PHI Publications.
2. Introduction to O.R /Taha/PHI
3. Operations Research / Wagner/ PHI Publications.
4. Introduction to O.R/Hiller and Libermann (TMH).
5. Operations Research /A.M.Natarajan, P.Balasubramani,A. Tamilarasi/Pearson Education.
6. Operations Research: Methods and Problems / Maurice Saseini, ArhurYaspan and Lawrence Friedman
7. O.R/Wayne L.Winston/Thomson Brooks/cole

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMPOSITE MATERIALS
(OPEN ELECTIVE)

Course Code: GR24A3066 **L/T/P/C: 3/0/0/3**

Course Outcomes: On completion of the course, the student will be able to
1. Identify the types of composite materials and their characteristic features
2. Explain the methods employed in composite fabrication.
3. Differentiate the strengthening mechanisms of composite and its corresponding effect on performance
4. Analyze the various criterions for isotropic, anisotropic and composite materials, prediction of laminates failure.
5. Examine experimental techniques utilized for failure mode of composites.

UNIT-I:
Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke's law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness

UNIT-II:
Manufacturing of composite materials, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes

UNIT-III:
Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria.

UNIT-IV:
Von Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai- Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates

UNIT-V:
Analysis of laminated plates- equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies.

TEXT BOOKS:
1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill,1994.
2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill,1998.

REFERENCE BOOKS:
1. Clyne, T. W. and Withers, P. J., "Introduction to Metal Matrix Composites", Cambridge University Press, 1993.
2. Strong, A.B., "Fundamentals of Composite Manufacturing", SME, 1989.

3. Sharma, S.C., “Composite materials”, Narosa Publications, 2000.
4. Broutman, L.J. and Krock,R.M., “ Modern Composite Materials”, Addison-Wesley, 1967.
5. Introduction to Composite Materials Design by Ever J. Barbero 3rd Edition 2017

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIGITAL ELECTRONICS FOR ENGINEERING
(OPEN ELECTIVE)

Course Code: GR24A3076 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Get basic knowledge on logic gates, Universal gates and their switching logics.
2. Realize Boolean expressions using NAND/NOR gates and reduce them using K map.
3. Know all types of combinational and sequential circuits.
4. Acquire knowledge on realization of logic families using diodes and transistor, and also on different types of integrated circuits.
5. Understand the characteristics and applications of operational amplifiers in different modes of operation.

UNIT-I: Number Systems:
Number systems, Complements of Numbers, Codes- Weighted and Nonweighted codes and its properties. Boolean Algebra: Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT-II: Minimization of Boolean functions:
Karnaugh Map Method - Up to four Variables, Don't Care Map Entries, Tabular Method, Combinational Logic Circuits: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.

UNIT-III: Sequential Circuits Fundamentals:
Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Fundamentals of shift registers, ripple and decade counters.

UNIT-IV: Realization of Logic Gates Using Diodes & Transistors:
AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL, CML and CMOS Logic Families and its Comparison, standard TTL NAND Gate Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tristate outputs, CMOS transmission gate.

UNIT-V: Integrated Circuits:
Classification, chip size and circuit complexity, basic information of op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC Characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

TEXT BOOKS:
1. Switching and Finite Automata Theory - ZviKohavi& Niraj K. Jha, 3rd Edition, Cambridge, 2010.
2. Modern Digital Electronics – R. P. Jain, 3rd Edition, 2007- Tata McGraw-Hill
3. Linear Integrated Circuits, D. Roy Chowdhury, New Age International(p) Ltd.
4. Op-Amps & Linear ICs, Ramakanth A. Gayakwad, PHI

REFERENCE BOOKS:

1. Digital Design- Morris Mano, PHI, 4th Edition,2006
2. Operational Amplifiers & Linear Integrated Circuits, R.F. Coughlin & Fredrick F. Driscoll, PHI
3. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications, Denton J. Daibey, TMH.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SENSOR TECHNOLOGY
(OPEN ELECTIVE)

Course Code: GR24A3085 **L/T/P/C: 3/0/0/3**

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

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

UNIT-I: Introduction to Sensor Systems:

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

UNIT-II: Resistive sensors:

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

UNIT-III: Inductive sensors:

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

UNIT-IV: Accelerometers:

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

UNIT-V: Overview of various smart sensors:

Digital temperature sensor (DS1621, TMP36GZ), Humidity sensor (DHT11, DHT22), Gas sensor (MQ2,MQ8), Pressure sensors (BMP180), Accelerometers (ADXL335); Structural health monitoring sensors, Introduction to MEMS and Flexible sensors.

TEXT BOOKS:

1. B. C. Nakra, K.K. Choudhury, "Instrumentation, Measurement and Analysis"-3rd Edition, Tata McGraw, 2009
2. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Applications", 3rd Edition.,

REFERENCE BOOKS:

1. Er. R.K. Rajput, "Electronic Measurements and Instrumentation", S. Chand & Company Ltd. 3rd Edition.
2. A.K.Sawhney, "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai.
3. Bentley, John P., "Principles of Measurement Systems", 4th Edition, Pearson/Prentice Hall, 2005
4. Jon. S. Wilson; "Sensor Technology Hand Book", Elsevier Inc., 2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMMUNICATION TECHNOLOGIES
(OPEN ELECTIVE)

Course Code: GR24A4078 **L/T/P/C: 3/0/0/3**

Course Outcomes: On completion of the course, the student will be able to
1. Understand the information theory and its coding styles.
2. Acquire knowledge on wireless communications and services.
3. Understand the various mobile networks and generations
4. Acquire knowledge on optical communications.
5. Know about network security through encryption and decryption.

UNIT-I: Information Theory:
Introduction to Information Theory, Shanon Capacity, Multimedia Data, Data Processing, Boolean Logics, Information Content, Entropy, Source Coding, Channel Coding, Modulation Schemes, Internet.

UNIT-II: Wireless Communication Technologies:
Introduction to Wireless Communication Technologies, WLAN, Wifi, Bluetooth, Other Wireless PAN And WAN Technologies, Satellite Communications, Broadcast Services.

UNIT-III: Cellular Mobile Networks:
Introduction to Cellular Mobile Networks, GSM(2G), UMTS (3G), LTE(4G), 5G Mobile Networks, Mobile Network Planning Aspects.

UNIT-IV: Optical Communication:
Introduction to Optical Communications, Optical Fiber, FTTC, FTTH, FTTBS, Free Space Optical Link, Channel Model with Different Factors, Deep Space Optical Communications.

UNIT-V: Network Security and Management:
Introduction to Network Security and Management, Symmetrical Encryption, Asymmetrical Encryption, Authentication, Hash-Value, Integrity Check, Telecommunications Management Network, SNMP, Functionalities of Network Management, Trends and Future Development.

TEXT BOOKS:
1. Shun-Ping Chen, “Fundamentals of Information and Communication Technologies” 2020
2. B.P. Lathi, “Communication systems”- BS Publications, 2006..

REFERENCE BOOKS:
1. Simon Haykin, John Wiley “Digital Communications” 2005.
2. Herbert Taub, Donald L Schilling Gautham Saha “Principles of Communication systems” 3rd edition McGraw-Hill 2008.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA SCIENCE FOR ENGINEERS

(OPEN ELECTIVE)

Course Code: GR24A3092 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:

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

UNIT-I:

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

UNIT-II:

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

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UNIT-III:

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

UNIT-IV:

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

UNIT-V:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA ANALYTICS USING OPEN SOURCE TOOLS
(OPEN ELECTIVE)

Course Code: GR24A3103 **L/T/P/C: 3/0/0/3**

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

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

UNIT-I: Graphics:

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

UNIT-II: Modeling Data:

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

UNIT-III: Mining Data:

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

UNIT-IV: Applications:

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

UNIT-V: Programming Environments and Data analytics:

Programming Environments: Software Tools, A Catalog of Scientific Software - Matlab, R, Python Results from Calculus: Common Functions, Calculus, Useful Tricks -Binomial theorem, Linear transformation.

Working with data: Sources for Data, Cleaning and Conditioning, Sampling, Data File Formats, The Care and Feeding of Your Data Zoo.

TEXT BOOKS:

1. Philipp K. Janert, Data Analysis with Open Source Tools, O'Reilly Media, Inc, November2010: First Edition

REFERENCE BOOKS:

1. G James, D. Witten, T Hastie, and R. Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer, 2013
2. Chambers, John, Software for Data Analysis Programming with R, Springer, 2008
3. Trevor Hastie Robert Tibshirani Jerome Friedman, The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Springer, 2014
4. Mark Gardener, Beginning R: The Statistical Programming Language, Wiley, 2013
5. Upadhyaya and A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007

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

Course Code: GR24A4096 **L/T/P/C: 3/0/0/3**

Course Outcomes: On completion of the course, the student will be able to
1. Analyze about augmented reality.
2. Identify AR devices for various applications.
3. Analyze about virtual reality.
4. Interpret about usage of VR devices and human factors involved.
5. Apply AR & VR technology in various domains.

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

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

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

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

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

TEXT BOOKS:
1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
2. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley IEEE Press, 2003/2006.

REFERENCE BOOKS:

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

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

Course Code: GR24A4115 **L/T/P/C: 3/0/0/3**

Course Pre-Requisite(s): Fundamentals of Management, Operations Research
Course Outcomes: After completing this course, students will be able to:
1. Understand concepts of services and its significance in the economy and society and distinguish it from goods.
2. Understand the service strategy, design, and development.
3. Comprehend ways to design services and able to understand service guarantee, recovery, and failures.
4. Forecast the service demand, supply and facilitate various methods to operate and manage services.
5. Understand the service productivity and how innovation can be approached from services point of view.

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

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

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

UNIT-IV:
Simple Forecasting Demand for Services: A review of different types of forecasting methods for demand forecasting.
Managing Capacity and Demand: Strategies for matching capacity and demand, Psychology of waiting, Application of various tools used in managing waiting line in services.
Managing Facilitating Goods: Review of inventory models, Role of inventory in services
Managing service supply relationship: Understanding the supply chain/hub of service, Strategies

for managing suppliers of service
Vehicle Routing Problem: Managing after sales service, understanding services that involve transportation of people and vehicle, Techniques for optimizing vehicle routes.

UNIT-V:
Service Innovation: Services Productivity, Need for Services Innovation
Student Project:
Option 1: Choose any service organization around and present it from the perspective of: nature of service, classification of service, blueprint or service design analysis, service quality, and any additional perspective you would like to add.
Option 2: Choose any latest research paper in services and explain your understanding and feedback on the same.

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

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

IT PROJECT MANAGEMENT
(OPEN ELECTIVE)

Course Code: GR24A4116 **L/T/P/C: 3/0/0/3**

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

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

UNIT-I:

Project Overview and Feasibility Studies- Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal

Project Scheduling: Project Scheduling, Introduction to PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculation and its importance, Cost reduction by Crashing of activity.

UNIT-II:

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

UNIT-III:

Agile Project Management: Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum, Lean, DevOps and IT Service Management (ITIL).

Other Agile Methodologies: Introduction to XP, FDD, DSDM, Crystal

UNIT-IV:

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

UNIT-V:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

Course Code: GR24A4117 **L/T/P/C: 3/0/0/3**

Course Outcomes: On completion of the course, the student will be able to
1. Understand the significance of marketing management concepts, marketing environment, consumer behaviour elements and strategies related to STP.
2. Understand various product management strategies and importance of branding, packing.
3. Comprehend the dynamics of marketing mix elements such as pricing, distribution, and promotion mix elements to leverage marketing concepts for effective decision making.
4. Demonstrate analytical skills in identification and resolution of problems pertaining to marketing management and marketing research and uses of various statistical tools in marketing research.
5. Understanding about the concepts of internet marketing and the fundamentals of business- to-business marketing strategy, CRM strategies.

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

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

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

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

UNIT-V:
Internet Marketing: Introduction to Internet Marketing. Mapping fundamental concepts of

Marketing (7Ps, STP); Strategy and Planning for Internet Marketing

Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy

Home Assignments:

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Marketing Management – Rajan Saxena.
2. Marketing Management – S.A. Sherlekar.
3. Service Marketing – S.M. Zha.
4. Journals – The IUP Journal of Marketing Management, Harvard Business Review.
5. Research for Marketing Decisions by Paul Green, Donald, Tull.
6. Business Statistics, A First Course, David M Levine at al, Pearson Publication.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BASICS OF JAVA PROGRAMMING

(OPEN ELECTIVE)

Course Code: GR24A3133 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:

1. Apply OOP principles by writing Java programs using data types, operators, and control structures.
2. Analyze Java programs by implementing classes, constructors, arrays, and inheritance, and differentiate overloading and overriding.
3. Demonstrate modular design with packages, interfaces, and abstract classes, and evaluate exception handling.
4. Implement multithreading and synchronization and utilize collections for efficient data management.
5. Design modern Java applications using JavaFX, Spring Boot, and Hibernate/JPA

UNIT-I:

Object Oriented Thinking: Introduction, Need of object-oriented programming, principles of object-oriented languages, Applications of OOP, history of JAVA, Java Virtual Machine, Java features, Program structures, Installation of JDK.

Variables, Primitive data types, Identifiers- Naming Conventions, Keywords, Literals, Operators-Binary, Unary and Ternary, Expressions, Primitive Type conversion and casting, flow of control-branching, conditional, loops.

UNIT-II:

CLASSES, INHERITANCE, POLYMORPHISM:

Classes and Objects: Classes, Objects, creating objects, methods, constructors- constructor overloading, cleaning up unused objects- Garbage collector, class variable and methods- static keyword, this keyword, arrays, Command line arguments, Nested Classes

Strings: String, String Buffer, String Tokenizer

Inheritance and Polymorphism: Types of Inheritance, deriving classes using extends keyword, super keyword, Polymorphism – Method Overloading, Method Overriding, final keyword, abstract classes.

UNIT-III:

INTERFACES, PACKAGES, EXCEPTIONS

Interfaces: Interface, Extending interface, interface Vs Abstract classes.

Packages: Creating Packages, using Packages, Access protection, java I/O package. Exceptions

Introduction, Exception handling Techniques: try…catch, throw, throws, finally block, user defined Exception.

UNIT-IV:

MULTI-THREADING, COLLECTIONS

java.lang.Thread, the main Thread, creation of new Threads, Thread priority, multithreading-using isalive() and join(), Synchronization, suspending and resuming Threads, Communication between Threads. Exploring java.io, Exploring java.util

Collections: Overview of Collection Framework : Array List, LinkedList, Vector, HastSet, Tree

Set, HashMap, Hash Table, Tree Map, Iterator, Comparator

UNIT-V:
Introduction to Spring Framework Overview of the Spring ecosystem, concepts of Inversion of Control (IoC) and Dependency Injection (DI), Spring Boot basics for rapid application development, and building a simple REST API with Spring Boot.
Data Access with Java Introduction to JDBC, an overview of JPA (Java Persistence API), using Hibernate with Spring Data JPA, and creating a simple CRUD application as an example.

Teaching Methodologies:
Power Point Presentations
Tutorial Sheets
Assignments

TEXT BOOKS:
1. Java: The Complete Reference, 10thedition, Herbert Schildt, McgrawHill.
2. Java Fundamentals: A Comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
3. Java for Programming, P.J.Dietel Pearson Education.

REFERENCE BOOKS:
1. Object Oriented Programming through Java, P.Radha Krishna, Universities Press.
2. Thinking in Java, Bruce Eckel, Pearson Education
3. Programming in Java, S.Malhotra and S.Choudhary, Oxford University Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INTRODUCTION TO DBMS
(OPEN ELECTIVE)

Course Code: GR24A3141 **L/T/P/C: 3/0/0/3**

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

1. Demonstrate the concepts of data mining, its applications
2. Apply data preprocessing techniques such as cleaning, integration, transformation, and reduction.
3. Implement clustering algorithms and evaluate their performance using similarity measures
4. Analyze association rules using Apriori and other frequent pattern mining techniques.
5. Examine outlier detection methods and justify their applications in real-world scenarios.

UNIT-I:

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

UNIT-II:

Introduction to Database Design: ER Diagrams, Entities, Attributes and Entity sets, Relationships and Relationship set, Extended ER Features, Conceptual Design with the ER Model, Logical database Design.

Relational Model: Introduction to Relational Model, Basic Structure, Database Schema, Keys, Relational Algebra

UNIT-III:

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

UNIT-IV:

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

UNIT-V:

Transaction Management: Transaction Concept, Transaction State, Concurrent Executions, Serializability, Testing for Serializability.

Concurrency Control: Lock based Protocols, Timestamp based protocols,

Recovery System: Recovery and Atomicity, Log based recovery, Shadow Paging, Recovery with concurrent Transactions.

Teaching Methodologies:

Power Point Presentations
Tutorial Sheets
Assignments

TEXT BOOKS:

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

REFERENCE BOOKS:

1. “Database Management Systems”, P. Radha Krishna HI-TECH Publications 2005.
2. “Database Management System”, Elmasri Navate, Pearson Education.
3. “Database Management System”, Mathew Leon, Leo

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

Course Code: GR24A4124 **L/T/P/C: 3/0/0/3**

Prerequisites: Students are expected to have knowledge of transactional and relational databases, probability, and statistics.

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

1. Demonstrate the concepts of data mining, its applications
2. Apply data preprocessing techniques such as cleaning, integration, transformation, and reduction.
3. Implement clustering algorithms and evaluate their performance using similarity measures
4. Analyze association rules using Apriori and other frequent pattern mining techniques.
5. Examine outlier detection methods and justify their applications in real-world scenarios.

UNIT-I:

Introduction: Why Data mining, What is Data Mining, What Kinds of Data Can Be Mined, What Kinds of Patterns Can Be Mined, Which Technologies are used, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining.

UNIT-II:

Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction.

UNIT-III:

Association Rule Mining: Introduction to association rule mining. Apriori algorithm and other frequent pattern mining techniques. Measuring the strength of association rules.

UNIT-IV:

Classification: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, k-Nearest-Neighbor Classifiers.

UNIT-V:

Clustering: Introduction to clustering and similarity measures.
Clustering algorithms: k-means, hierarchical clustering, density-based clustering.
Evaluating clustering results: silhouette score, Davies-Bouldin index.

Teaching Methodologies:

Power Point Presentations
Tutorial Sheets
Assignments

TEXT BOOKS:

1. Data Mining Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, Third Edition, 2012.

2. Introduction to Data Mining Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education.

REFERENCE BOOKS:

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

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

Course Code: GR24A3143 **L/T/P/C: 3/0/0/3**

Prerequisite: Students should have prior knowledge of:
- Basics of Programming, and
- Fundamentals of Data Structures and Algorithms, such as stacks, queues, and linked lists.

Course Outcomes: After completing this course, students will be able to:
1. Explain the objectives, structure, and functions of an operating system, including process, memory, storage, and security management, and demonstrate how OS services interact with users and hardware.
2. Apply process management concepts such as process states, scheduling algorithms, and interprocess communication; design and solve synchronization problems using semaphores, monitors, and classical solutions.
3. Analyze memory management strategies such as paging, segmentation, and swapping, and evaluate virtual memory techniques including demand paging, page replacement, and thrashing control.
4. Implement basic file operations and explain file system structure, directory management, allocation methods, and disk scheduling techniques for efficient storage management.
5. Identify, prevent, and recover from deadlocks; apply system protection principles and access control mechanisms to safeguard resources and files in different operating system environments.

UNIT-I: Introduction:
Overview, Objectives, User view, System view, Operating system definition, Computer System Organization, Computer System Architecture, OS Structure, OS Operations, Process Management, Memory Management, Storage Management, Protection and Security.
Operating System services, User and OS Interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, OS Structure.

UNIT-II: Process and CPU Scheduling:
Process concepts: The Process, Process State, Process Control Block, Threads, Process Scheduling-Scheduling Queues, Schedulers, Context Switch, Operations on Processes, System calls-fork(), exec(), wait(), exit(), Interprocess communication.
Process Scheduling: Basic concepts, Scheduling Criteria, Scheduling algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Thread scheduling. Process Synchronization, Critical Section Problem, Peterson's solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.

UNIT-III: Memory Management and Virtual Memory:
Memory Management Strategies - Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table.
Virtual Memory Management - Background, Demand Paging, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing.

UNIT-IV: Storage Management and File System:

Storage Management - File System, Concept of a File, System calls for File Operations – open (), read (), write (), close (), seek (), unlink (), Access methods - Directory and Disk Structure, File System Mounting, File Sharing, Protection.
File System Structure, File System Implementation, Directory Implementation, Allocation methods, Free-space Management, Efficiency, and Performance. Mass Storage Structure – Overview, Disk Structure, Disk Attachment, Disk Scheduling.

UNIT-V: Deadlocks and Protection:
Deadlocks - System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.
Protection – System Protection, Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Access Control, Revocation of Access Rights, Capability-based Systems, Language-based Protection.

TEXT BOOKS:
1. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, PHI, 2019.
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, 7th Edition, Wiley, 2006.

REFERENCE BOOKS:
1. Andrew S. Tanenbaum, Modern Operating Systems, 5th Edition, PHI, 2022.
2. Gary J. Nutt, Operating Systems: A Modern Perspective, 3rd Edition, Addison-Wesley, 2004.
3. R. Elmasri, A.G. Carrick, D. Levine, Operating Systems, First Edition, McGraw Hill, 2009.
4. Charles Crowley, Operating System: A Design-oriented Approach, Irwin Publishing, First Edition, 1996.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INTERNET OF THINGS

(OPEN ELECTIVE)

Course Code: GR24A3145 **L/T/P/C: 3/0/0/3**

Prerequisite:

The fundamental knowledge in C programming, Data Structures and Operating Systems

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

1. Understand IoT architecture and fundamental networking protocols and models.
2. Develop Arduino-based IoT applications integrating sensors and actuators.
3. Program Raspberry Pi using Python for cloud-connected IoT solutions.
4. Analyse various IoT applications including smart home and industrial systems.
5. Apply cloud and edge computing for IoT data analytics.

UNIT-I:

Introduction to IoT and Sensor Networks: Introduction to Internet of Things (IoT), Characteristics and Applications of IoT, IoT Architecture and Reference Models(IETF, ITU-T), Physical Design of IoT- Devices, Gateways, and Data Centers, Functional Blocks of IoT- Sensing, Actuation, Communication, Enabling Technologies: RFID, Wireless Sensor Networks.

Networking and Communication Protocols: MQTT, CoAP, ZigBee, HTTP Sensor Networks- Types, Topologies, and Protocols, Introduction to IoT Security and Privacy Fundamentals.

UNIT-II:

Machine to Machine (M2M) and Embedded Programming for IoT: Machine-to-Machine Communications Overview, Difference between IoT and M2M, Interoperability in IoT, Standards and Protocols.

Arduino: Introduction to Arduino Programming for IoT, Integration of Sensors and Actuators with Arduino, Hands-on Exercises- Sensor Data Acquisition and Actuator Control, Basic Communication Protocols, Implementation on Arduino-IoT Device Interoperability, Challenges and Solutions.

UNIT-III:

Raspberry Pi with Python Programming for IoT: Introduction to Python Programming , Basics, Overview of Raspberry Pi and its Role in IoT, Interfacing Raspberry Pi with Sensors and Actuators (UART, SPI, I2C).

Data Acquisition and Processing: Data Acquisition and Local Processing, Sending Data to Cloud Platforms, Implementation of IoT Projects Using Raspberry Pi.

Case Studies: Smart Home Automation, Healthcare Monitoring, Environmental Sensing.

UNIT-IV:

IoT Applications: Smart Homes-Smart Home Origin, Technologies, Implementation,

Smart Grids- Characteristics, Benefits, Architecture, Components, Smart Cities-Characteristics, Frameworks, Challenges, Industrial IoT-Requirements, Design Considerations, Applications.

UNIT-V:

Cloud and Edge Computing Models with IoT Use Cases: Introduction to Cloud Computing and Cloud Storage Models, Edge and Fog Computing Concepts for IoT, Web Servers and Cloud

Platforms for IoT (AWS IoT, Azure IoT, etc.).
IoT Use Cases: Smart Cities, Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT

TEXT BOOKS:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”, 2015.
3. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan. Trollope, David Hanes, Patrick Gassetete, Jerome Henry, Pearson Education Limted, 2017.

REFERENCE BOOKS:

1. Terokarvinen, kemo, karvinen and villeyvaltokari, “Make sensors”: 1st edition, Maker Media, 2014.
2. Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice, 2010.
3. Charles Bell, Beginning Sensor networks with Arduino and Raspberry Pi, Apress, 2013.
4. Fei Hu, Security and Privacy in Internet of Things (IoTs), CRC Press, Taylor & Francis Group, 2020.
5. S. Sahoo, S. Sahoo, S. Mishra, Software-Defined Networking for Future Internet Technology: Concepts and Applications, Routledge, 2022.

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

Course Code: GR24A4134 **L/T/P/C: 3/0/0/3**

Prerequisites: Basic knowledge of programming concepts (loops, functions, arrays) and fundamentals of databases.

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

1. Understand PHP basics including variables, constants, control structures, arrays, and functions for web application development.
2. Apply MySQL database concepts with PHP to design, query, and manage relational databases securely.
3. Implement advanced PHP features such as authentication, file upload, email handling, and encryption in dynamic websites.
4. Design and develop Perl programs using arrays, hashes, subroutines, and advanced features like file system interaction, modules, and object-oriented constructs.
5. Apply Python programming concepts including functions, built-in modules, exception handling, and OOP paradigms for web and general-purpose scripting.

UNIT-I: PHP Basics:

Basics - Features, Data types, Variables, Constants, Expressions, String interpolation, Control structures, Embedding PHP Code in Web pages.

Functions: Creating a Function, Function Libraries, Arrays, Strings and Regular Expressions.

UNIT-II: MySQL Basics:

Introduction: Database Concepts, Overview of MySQL database, Installation. Connection establishment and Accessing MySQL Server, Querying the database. Data Definition Language. Functions and Logical operators, Access Privilege System.

UNIT-III: Advanced PHP Programming:

PHP and Web Forms, Files, PHP Authentication and Methodologies - File-based, Database-based, IP-based. Uploading Files with PHP, Sending Email, PHP Encryption Functions, Mcrypt package.

UNIT-IV: PERL:

Names and Values, Variables, Scalar Expressions, Control Structures, Arrays, List, Hashes, Strings, Pattern and Regular Expressions, Subroutines.

Advanced PERL: Finer points of Looping, Pack and unpack, File system, Data structures, Packages, Modules, Objects, Interfacing to the Operating System.

UNIT-V: Python:

Introduction, Syntax and Indentation, Statements, Functions, Built-in-Functions, Basics of Object-Oriented Paradigm, Modules and Packages, Exception Handling.

TEXT BOOKS:

1. David Barron, The World of Scripting Languages, Wiley India Pvt. Ltd., 1st Edition, 2003.

2. Jason Gilmore, Beginning PHP and MySQL, From Novice to Professional, Apress (Dreamtech India), 3rd Edition, 2008.
3. Steve Holden and David Beazley, Python Web Programming, New Riders Publications, 1st Edition, 2001.

REFERENCE BOOKS:

1. James Lee and Brent Ware, Open Source Web Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP, Addison-Wesley (Pearson Education), 1st Edition, 2003.
2. Julie Meloni and Matt Telles, PHP 6 Fast & Easy Web Development, Cengage Learning, 1st Edition, 2008.
3. Ivan Bayross and Sharanam Shah, PHP 5.1, The X Team, SPD Publications, 1st Edition, 2006.