ACADEMIC REGULATIONS PROGRAMME STRUCTURE AND DETAILED SYLLABUS

GR22

Bachelor of Technology
(Electrical and Electronics Engineering)

(Effective for the students admitted from the Academic Year 2022-23)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

GOKARAJU RANGARAJU

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ACADEMIC REGULATIONS
PROGRAMME STRUCTURE
&
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Bachelor of Technology
Electrical and Electronics Engineering
(Four Year Regular Programme)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Bachupally, Kukatpally, Hyderabad, Telangana, India- 500090

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
HYDERABAD

Academic Regulations for B.Tech (Regular) under GR22

(Applicable for Batches Admitted from 2022-23)

Under Graduate Degree Programme in Engineering and Technology (UG)

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

S.No	Department	Programme Code	Programme
1	Civil Engineering	01	B.Tech Civil Engineering
2	Electrical and Electronics Engineering	02	B.Tech Electrical and Electronics Engineering
3	Mechanical Engineering	03	B.Tech Mechanical Engineering
4	Electronics and Communication Engineering	04	B.Tech Electronics and Communication Engineering
5	Computer Science and Engineering	05	B.Tech Computer Science and Engineering
6	Information Technology	12	B.Tech Information Technology
7	Computer Science and Business System	32	B.Tech Computer Science & Business System
8	Computer Science and Engineering (AIML)	66	B.Tech Computer Science and Engineering (AIML)
9	Computer Science and Engineering (Data Science)	67	B.Tech Computer Science and Engineering (Data Science)
10	Computer Science and Engineering (Artificial Intelligence)	61	B.Tech Computer Science and Engineering (Artificial Intelligence
11	Computer Science and Information Technology	33	B.Tech Computer Science and Information Technology

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

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

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

3. **Programme Pattern:**

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

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	BS	Basic Science	Includes Basic Science Courses
2	ES	Engineering Science	Includes Engineering Courses
3	HS	Humanities andSocial Sciences	Includes Management Courses
4	PC	Professional Core	Includes Core Courses related to the parent discipline/department/ branch ofEngineering
5	PE	Professional Elective	Includes Elective Courses related to the parent discipline/ department/ branch of Engineering
6	OE	Open Elective	Elective Courses from other technicaland/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 ofIndian Traditional Knowledge, Co and Extra Curricular Activities
9	VAC	Value Added Courses	Courses on current industry relevant topics improving breadth and depth in domain

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

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

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

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

5. Attendance Requirements:

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

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

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

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

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

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

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

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

b) Distribution and Weightage of marks

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

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

Assessment Procedure:

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

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

d) Mini Project:

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

Note:

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

ii) Plagiarism check I s 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 **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 **Report – 5 marks** **2)** At the end of the semester, Project work shall be displayed in the road show at the department level. Project work is evaluated by Project Review Committee for **10 marks** **3)** Technical Event Participation in project area/ MOOCs Course in project area/ Paper Publication/Publishing or Granting of a Patent/Hackathon participation/Book Publication – **10 marks.**
		60	External Evaluation	The Project report shall be presented before Project Review Committee in the presence of External Examiner and the same is evaluated for **60 marks**.

Note:

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

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

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

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

- I Year courses: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he/she (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.
- II Year II Semester *Real-Time/Field-based Research Project/Societal Related Project* course: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations.

There shall be NO external evaluation. The student is deemed to have failed, if he/she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (ii) secures less than 40% marks in this course.

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

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

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

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

11. **Re-registration for mid examination:** A student shall be given one time chance to re-register for a maximum of two subjects in a semester:

- If the internal marks secured by a student in Continuous Internal Evaluation marks for 40 (sum of average of 2 mid-term examinations, average of all assignments and Subject Viva-voce/ PPT/Poster Presentation/Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects

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

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

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

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

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

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

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

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

c) Provision of opting 2 OE courses through online mode.
d) Choice of placement-oriented value-added courses in every semester from II year till IV year
e) Students can take a year break after second or third year to work on R&D
f) Under Mandatory Courses

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

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

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

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

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

Computation of SGPA and CGPA:

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

i) $\mathbf{S_k}$ the SGPA of $\mathbf{k^{th}}$ 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 $\mathbf{i^{th}}$ course and **Gi** is the grade point scored by the student in the $\mathbf{i^{th}}$ 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 $\mathbf{S_k}$, where $\mathbf{k \geq 2}$.

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

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

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

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

Equivalence of grade to marks

Marks % = (CGPA -0.5)*10

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

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

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

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

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

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

17. Transitory Regulations

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of GR20 Regulations due to lack of attendance, shall be permitted to join I year I Semester of GR22 Regulations and he is required to complete the study of B.Tech programme within the stipulated period of eight academic years from the date of first admission in I Year.

2. A student who has been detained in any semester of II, III and IV years of GR20 regulations for want of attendance, shall be permitted to join the corresponding semester of GR22 Regulations and is required to complete the study of B.Tech within the stipulated period of eight academic years from

the date of first admission in I Year. The GR22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

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

C. For readmitted students in GR22 Regulations:

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

5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including GR22 Regulations. **There is NO exemption of credits in any case**.

6. If a student is readmitted to GR22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in GR22 Regulations will be substituted by another subject to be suggested by the college academic administration.

Note:

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

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

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

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

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

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

19. General Rules

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

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

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

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

Academic Regulations for B.Tech (Lateral Entry) under GR22

(Applicable for Batches Admitted from 2022-23)

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

a) Pursued programme of study for not less than three academic years and not more than six 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 toSecond 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 toThird year second semester.	Regular course of study of Third year first semester.
4	Third year second semester toFourth year first semester.	(i) Regular course of study of Thirdyear second semester. (ii) Must have secured at least 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to Fourth year second semester.	Regular course of study of Fourth year first semester.

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

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

Academic Regulations for B.Tech with Minors Programme under GR22

(Applicable for Batches Admitted from 2022-23)

1. Objectives

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

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

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

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

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

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

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

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

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

i) Prior to registration of MOOCS courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.

ii) Minimum credits for MOOCS course must be equal to or more than the credits specified in the Minor course structure provided by the University.

iii) Only Pass-grade/marks or above shall be considered for inclusion of grades in minor grade memo.

iv) Any expenses incurred for the MOOCS courses are to be met by the students only.

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

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

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

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

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

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

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

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

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

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

4. Registration for the courses in Minor Programme

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

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

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

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

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

5. Minor courses and the offering departments

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Bachupally, Kukatpally, Hyderabad–500090, India.

B. Tech Electrical & Electronics Engineering GR22 Course Structure

I B. Tech (EEE) - I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	BS	GR22A1001	Linear Algebraand Function Approximation	3	1	0	4	3	1	0	4	40	60	100
2	Chemistry	BS	GR22A1005	EngineeringChemistry	3	1	0	4	3	1	0	4	40	60	100
3	EEE	ES	GR22A1009	Basic Electrical Engineering	2	1	0	3	2	1	0	3	40	60	100
4	CSE	ES	GR22A1007	Programmingfor Problem Solving	2	1	0	3	2	1	0	3	40	60	100
5	EEE	ES	GR22A1018	Basic Electrical Engineering Lab	0	0	1	1	0	0	2	2	40	60	100
6	Chemistry	BS	GR22A1015	Engineering Chemistry lab	0	0	1.5	1.5	0	0	3	3	40	60	100
7	CSE	ES	GR22A1017	Programming for Problem Solving Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
8	ME	ES	GR22A1021	Engineering Workshop	1	0	1.5	2.5	1	0	3	4	40	60	100
TOTAL					**11**	**3**	**6**	**20**	**11**	**3**	**12**	**26**	**320**	**480**	**800**
9	Mgmt	MC	GR22A1022	Design Thinking	0	0	0	0	2	0	0	2	40	60	100

I B. Tech (EEE) - II Semester

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

II B. Tech (EEE) - I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	Maths	BS	GR22A2009	Computational Mathematics for Engineers	3	0	0	3	3	0	0	3	40	60	100
2	EEE	PC	GR22A2024	Electrical CircuitAnalysis	2	1	0	3	2	1	0	3	40	60	100
3	EEE	PC	GR22A2025	Principles of Analog Electronics	3	0	0	3	3	0	0	3	40	60	100
4	EEE	PC	GR22A2026	DC Machines and Transformers	3	0	0	3	3	0	0	3	40	60	100
5	EEE	PC	GR22A2027	Electromagnetic Fields	3	0	0	3	3	0	0	3	40	60	100
6	CSE	PC	GR22A2007	Data Base forEngineers	2	0	0	2	2	0	0	2	40	60	100
7	EEE	PC	GR22A2028	Principles of Analog Electronics Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
8	EEE	PC	GR22A2029	DC Machines and Transformers Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
TOTAL					**16**	**1**	**3**	**20**	**16**	**1**	**6**	**23**	**320**	**480**	**800**
9	Mgmt	MC	GR22A2003	Constitution of India	0	0	0	0	2	0	0	2	40	60	100
10	Mgmt	MC	GR22A2002	Value Ethics and Gender Culture	0	0	0	0	2	0	0	2	40	60	100

II B. Tech (EEE) - II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	EEE	PC	GR22A2030	Power Generation and Transmission	3	0	0	3	3	0	0	3	40	60	100
2	EEE	PC	GR22A2031	AC Machines	2	1	0	3	2	1	0	3	40	60	100
3	EEE	PC	GR22A2032	Control Systems	3	0	0	3	3	0	0	3	40	60	100
4	EEE	PC	GR22A2033	Principles of Digital Electronics	3	0	0	3	3	0	0	3	40	60	100
5	EEE	PC	GR22A2034	Microprocessors and Micro controllers	2	0	0	2	2	0	0	2	40	60	100
6	EEE	PC	GR22A2035	Principles of Digital Electronics Lab	0	0	2	2	0	0	4	4	40	60	100
7	EEE	PC	GR22A2036	AC Machines Lab	0	0	2	2	0	0	4	4	40	60	100
8	EEE	PC	GR22A2037	Control Systems Lab	0	0	2	2	0	0	4	4	40	60	100
TOTAL					**13**	**1**	**6**	**20**	**13**	**1**	**12**	**26**	**320**	**480**	**800**
9	Chemistry	MC	GR22A2001	Environmental Science	0	0	0	0	2	0	0	2	40	60	100
10	CSE	MC	GR22A2008	Java Programmingfor Engineers	0	0	0	0	2	0	0	2	40	60	100
11	English	MC	GR22A2108	Effective Technical Communication	0	0	0	0	2	0	0	2	40	60	100
12	EEE	MC	GR22A2109	Real-time Research Project/ Societal Related Project	0	0	2	2	0	0	4	4	50	--	50

III B. Tech (EEE) - I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	EEE	PC	GR22A3012	Power System Analysis	2	1	0	3	2	1	0	3	40	60	100
2	EEE	PC	GR22A3013	Power Electronics	3	0	0	3	3	0	0	3	40	60	100
3	EEE	PC	GR22A3014	Power Distribution and Protection	3	0	0	3	3	0	0	3	40	60	100
4		PE		Professional Elective I	3	0	0	3	3	0	0	3	40	60	100
5		OE		Open Elective I	3	0	0	3	3	0	0	3	40	60	100
6	EEE	PC	GR22A3020	Power Systems Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
7	EEE	PC	GR22A3021	Power Electronics Lab	0	0	2	2	0	0	4	4	40	60	100
8	EEE	PC	GR22A3022	Microprocessors and Microcontrollers Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
TOTAL					**14**	**1**	**5**	**20**	**14**	**1**	**10**	**25**	**320**	**480**	**800**

Professional Elective-I			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR22A3015	Electrical and Hybrid Vehicles
2	EEE	GR22A3016	Solar and Wind Energy Systems
3	EEE	GR22A3017	Electrical Machine Design
4	MECH	GR22A3018	Operations Research

Open Elective-I			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR22A3019	Non- Conventional Energy Sources

III B. Tech (EEE) - II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	EEE	PC	GR22A3090	Fundamentals of Digital Signal Processing	3	0	0	3	3	0	0	3	40	60	100
2	EEE	PC	GR22A3091	Sensors Measurements and Instrumentation	2	1	0	3	2	1	0	3	40	60	100
3	Mgnt	HS	GR22A2004	Economics and Accounting for Engineers	3	0	0	3	3	0	0	3	40	60	100
4		PE		Professional Elective II	3	0	0	3	3	0	0	3	40	60	100
5		OE		Open Elective II	3	0	0	3	3	0	0	3	40	60	100
6	EEE	PC	GR22A3096	Power System Analysis Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
7	EEE	PC	GR22A3097	Sensors Measurements and Instrumentation Lab	0	0	1.5	1.5	0	0	3	3	40	60	100
8	EEE	PW	GR22A3089	Mini Project	0	0	2	2	0	0	4	4	40	60	100
TOTAL					**14**	**1**	**5**	**20**	**14**	**1**	**10**	**25**	**320**	**480**	**800**

Professional Elective-II			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR22A3092	Modern Power Electronics
2	EEE	GR22A3093	HVDC Transmission Systems
3	EEE	GR22A3094	Advanced Control Systems
4	CSE	GR22A2074	Operating Systems

Open Elective-II			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR22A3095	Concepts of Control Systems

IV B. Tech (EEE) - I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	EEE	PC	GR22A4014	Power Semiconductor Drives	2	1	0	3	2	1	0	3	40	60	100
2		PE		Professional Elective III	3	0	0	3	3	0	0	3	40	60	100
3		PE		Professional Elective IV	3	0	0	3	3	0	0	3	40	60	100
4	Mgnt	HS	GR22A3116	Fundamentals of Management and Entrepreneurship	3	0	0	3	3	0	0	3	40	60	100
5		OE		Open Elective III	3	0	0	3	3	0	0	3	40	60	100
6	EEE	PC	GR22A4023	Basics of Digital Signal Processing Lab	0	0	2	2	0	0	4	4	40	60	100
7	EEE	PC	GR22A4024	Power Semiconductor Drives Lab	0	0	2	2	0	0	4	4	40	60	100
8	EEE	PW	GR22A4082	Project Work Phase-I	0	0	6	6	0	0	12	12	40	60	100
TOTAL					**14**	**1**	**10**	**25**	**14**	**1**	**20**	**35**	**320**	**480**	**800**

Professional Elective-III			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR22A4015	Wide Band Gap Power Devices
2	EEE	GR22A4016	High Voltage Engineering
3	EEE	GR22A4017	Digital Control Systems
4	EEE	GR22A4018	Industrial Automation

Professional Elective-IV			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR22A4019	Power Quality and FACTS
2	EEE	GR22A4020	Electrical Energy Audit
3	EEE	GR22A4021	Special Electrical Machines
4	ECE	GR22A3108	VLSI Design

Open Elective-III			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR22A4022	Artificial Neural Networks and Fuzzy Logic

IV B. Tech (EEE) - II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Hours				Int.	Ext	Total Marks
					L	T	P	Total	L	T	P	Total			
1	EEE	PC	GR22A4096	Power System Monitoring and Control	2	1	0	3	2	1	0	3	40	60	100
2		PE		Professional Elective V	3	0	0	3	3	0	0	3	40	60	100
3		PE		Professional Elective VI	3	0	0	3	3	0	0	3	40	60	100
4	EEE	PW	GR22A4145	Project Work Phase-II	0	0	6	6	0	0	12	12	40	60	100
TOTAL					**8**	**1**	**6**	**15**	**8**	**1**	**12**	**21**	**160**	**240**	**400**

Professional Elective-V			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR22A4097	Advanced Electric Drives
2	EEE	GR22A4098	Big Data Applications in Power Systems
3	EEE	GR22A4099	Modern Control Theory
4	EEE	GR22A4100	Industrial IOT

Professional Elective-VI			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR22A4101	Printed Circuit Board Design
2	EEE	GR22A4102	Electric Smart Grid
3	ECE	GR22A3112	Embedded Systems Design
4	CSE(DS)	GR22A3143	Big Data Analytics

PROFESSIONAL ELECTIVES – 4 THREADS

S. No.	Thread 1: Power Electronics	Thread 2: Power Systems	Thread 3: Machines and Control Systems	Thread 4: Computer & Electronics
1	Electrical and Hybrid Vehicles	Solar and Wind Energy Systems	Electrical MachineDesign	Optimization Techniques
2	Modern Power Electronics	HVDC Transmission Systems	Advanced ControlSystems	Operating Systems
3	Wide Band Gap Power Devices	High Voltage Engineering	Digital ControlSystems	Industrial Automation
4	Power Quality and FACTS	Electrical Energy Audit	Special Electrical Machines	VLSI Design
5	Advanced Electric Drives	Big Data Applications in Power Systems	Modern ControlTheory	Industrial IoT
6	Printed Circuit Board Design	Electric Smart Grid	Embedded Systems Design	Big Data Analytics

OPEN ELECTIVES FOR GR22 REGULATIONS

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

I YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
LINEAR ALGEBRA AND FUNCTION APPROXIMATION

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

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

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

UNIT I
FUNDAMENTALS OF VECTOR AND MATRIX ALGEBRA
Operations on vectors and matrices- Orthogonal projection of vectors- Exact and generalized inverse of a matrix- Rank of a matrix- Linear independence of vectors- Structured square matrices (Symmetric, Hermitian, skew-symmetric, skew-Hermitian, orthogonal and unitary matrices)- Vector and matrix norms Solution of a linear algebraic system of equations (homogeneous and non-homogeneous) using Gausselimination.

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 canonicalform 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 generalizedinverse- Estimation of the least squares error

UNIT IV
MULTIVARIABLE DIFFERENTIAL CALCULUS AND FUNCTION OPTIMIZATION
Partial Differentiation- Chain rule- Total differentiation- Jacobian- Functional dependence
Multivariable function Optimization- Taylor's theorem for multivariable functions- Unconstrained optimization of functions using the Hessian matrix- Constrained optimization using the Lagrange multipliermethod

UNIT V
FUNCTION APPROXIMATION TOOLS IN ENGINEERING
Function approximation using Taylor's polynomials- Properties of Chebyshev polynomials- Uniform approximation using Chebyshev polynomials

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

TEXT BOOKS

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

REFERENCES BOOKS

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING CHEMISTRY

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

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

UNIT I
ATOMIC AND MOLECULAR STRUCTURE

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

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

UNIT II
SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

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

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

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

UNIT III
BATTERIES AND CORROSION

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

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

UNIT IV
ENGINEERING MATERIALS AND WATER TECHNOLOGY

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

Plastics: Comparison between thermoplastics and thermosets, Fabrication of plastics - compression mouldingand injection moulding. Conducting polymers – Definition, classification and applications.
Water: Hardness - Causes, types and units. Boiler troubles-scales and sludges, caustic embrittlement. Waterpurification: Demineralization by Ion-exchange process, Desalination by reverse osmosis method.

UNIT V
STEREOCHEMISTRY AND ENERGY RESOURCES

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

Text Books

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BASIC ELECTRICAL ENGINEERING

Course Code: GR22A1009 **L/T/P/C: 2/1/0/3**
I Year I Semester

Course Outcomes:
1. Illustrate the basic electric circuits.
2. Analyze various parameters of AC circuits.
3. Construct the electric circuits with suitable theorems.
4. Interpret Magnetic circuits &electromechanical energy conversion.
5. Describe the wiring methods, working principles of circuit protective devices and personal safety measures.

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

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

UNIT III
NETWORK ANALYSIS
Nodal and Mesh Analysis, Linearity and Superposition, Thevenin's and Norton's theorems, Maximum powertransfer theorem and Reciprocity theorem

UNIT IV
INTRODUCTION TO MAGNETIC CIRCUITS AND ELECTROMECHANICAL ENERGY CONVERSION
Force - voltage and Force - Current analogy, Comparison of Electric and Magnetic circuits, Magnetic circuitsfor Transformer and rotating machines.
Energy Conversion Process – Concept of Energy and Co – energy, mechanical force in the electromagneticsystem, singly excited, doubly excited, electromechanical system, and dynamic equation.

UNIT V
ELECTRICAL INSTALLATIONS COMPONENTS
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB (Miniature Circuit Breaker), ELCB (Earth Leakage Circuit Breaker), MCCB (Moulded Case Circuit Breaker), Types of Wires and Cables, Earthing, power factor improvement (using capacitors).

Textbooks
1. D.P. Kothari and I.J. Nagrath "Basic Electrical Engineering", Third edition 2010, TataMcGraw Hill.
2. A. Sudhakar and Shyam Mohan "Basic Electrical Engineering", McGraw Hill Education.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. Vincent Deltoro "Electrical Engineering Fundamentals", Second Edition, Prentice HallIndia, 1989.

References

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROGRAMMING FOR PROBLEM SOLVING

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

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

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

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

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

UNIT IV
POINTERS AND STRUCTURES
Pointers: Idea of pointers, declaration and initialization of pointers, pointer to pointer, void pointer, null pointer, pointers to arrays and structures, function pointer.
Structures and Unions: Defining structures, declaring and initializing structures, arrays within structures, array of structures, nested structures, passing structures to functions, unions, typedef.

UNIT V
FILE HANDLING AND PREPROCESSOR IN C
Files: Text and binary files, creating, reading and writing text and binary files, random access to files, errorhandling in files.
Preprocessor: Commonly used preprocessor commands like include, define, undef, if, ifdef, ifndef, elif,Command Line Arguments, Enumeration Data Type.

Text Books

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BASIC ELECTRICAL ENGINEERING LAB

Course Code:GR22A1018 **L/T/P/C: 0/0/2/1**
I Year I Semester

Course Outcomes:

1. Analyze the concept of circuit laws and network theorems.
2. Examine AC electric circuits.
3. Explain the working principles of transformers and electrical machines.
4. Classify and compare different types of Electrical machines.
5. Summarize the concepts of an alternators.

LIST OF EXPERIMENTS

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

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

TASK-3: Verification of Superposition and Reciprocity Theorems.

TASK-4: Resonance in series RLC circuit

TASK-5: Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)

TASK-6: Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta,Delta-Delta, Delta-star, Star-Star)

TASK-7: Measurement of Active and Reactive Power in a balanced Three-phase circuit

TASK-8: Performance Characteristics of a Separately Excited DC Shunt Motor

TASK-9: Torque-Slip Characteristics of a Three-phase Induction Motor

TASK-10: No-Load Characteristics of a Three-phase Alternator

Textbooks

1. D.P. Kothari and I.J. Nagrath "Basic Electrical Engineering", Third edition 2010, TataMcGraw Hill.
2. A. Sudhakar and Shyam Mohan "Basic Electrical Engineering", McGraw Hill Education.

References

1. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education,2004.
2. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
3. A.Chakrabarti "Circuit Theory (Analysis and Synthesis)"Dhanpat Rai & Co.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING CHEMISTRY LAB

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

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

List of Experiments

1. Determination of Total Hardness of water by complexometric method using EDTA
2. Determination of Chloride content of water by Argentometry
3. Redox titration: Estimation of Ferrous ion using standard KMnO4 by Permanganometry
4. Estimation of HCl by Conductometric titrations
5. Estimation of Ferrous ion by Potentiometry using dichromate
6. Determination of Rate constant of acid catalyzed reaction of methyl acetate
7. Adsorption of Acetic acid by charcoal
8. Determination of Surface tension of liquid by using Stalagmometer
9. Determination of Viscosity of liquid by using Ostwald's Viscometer
10. Determination of Partition Coefficient of Acetic acid between n-butanol and water
11. Synthesis of Aspirin
12. Synthesis of Paracetamol

Reference Books
1. Vogel's text book of Practical organic chemistry, 5th Edition.
2. Senior Practical Physical Chemistry, B.D. Khosala, A. Gulati and V. Garg (R. Chand & Co., Delhi)
3. Text book on experiments and Calculations in Engineering Chemistry-S.S.Dara.

An introduction to practical chemistry, K.K. Sharma and D.S. Sharma (Vikas Publications, New Delhi)

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PROGRAMMING FOR PROBLEM SOLVING LAB

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

I Year I Semester

Course Outcomes:

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

TASK 1

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

TASK 2

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

TASK 3

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

TASK 4

a. Write a C program to find the roots of a quadratic equation using if-else.
b. Write a C program to input electricity unit charges and calculate total electricity bill according to the given condition:
   For first 50 units Rs. 0.50/unit For next 100 units Rs. 0.75/unit For next 100 units Rs. 1.20/unit For unit above 250 Rs. 1.50/unit
   An additional surcharge of 20% is added to the bill
c. Write a menu driven C program to implement a simple arithmetic calculator.
d. Write a C program to display number of days in month using switch case (The input is month number1 - 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 are starting and ending values to be supplied by the user.
c. Write a C program to calculate the sum of following series:(i) $S1=1+x/1!-x^2/2!+x^3/3!-x^4/4!+\ldots..xn/n!$ (ii)$S2= x^1/1+x^3/3+x^5/5+\ldots.+x^n/n$

TASK 7

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

TASK 8

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

TASK 9

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

TASK 10

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

TASK 11

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

TASK 12

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

TASK 13

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

TASK 14

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

TASK 15

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

Text Books

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING WORKSHOP

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

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

TRADES FOR EXERCISES: At least two exercises from each trade:
1. Carpentry
2. Fitting Shop
3. Tin-Smithy
4. Casting
5. Welding Practice
6. House-wiring
7. Black Smithy
8. **VIDEO LECTURES**: Carpentry, Fitting operations, Tin-Smithy, Casting, Welding, Electrical and Electronics, Black Smithy, Plumbing, Power tools in construction and Wood Working, Manufacturing Methods,

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

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DESIGN THINKING

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

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

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

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

UNIT-III
Ideation tools & exercises. Sample Design Challenge, Design Challenge Themes, Story telling and Tools forInnovation and creativity.

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

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

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

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

I YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

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

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

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

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

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 toSpherical and Cylindrical polar coordinates)
Application of double integral to find the area of a lamina and volume of a solid, application of the tripleintegral to find the volume of a solid

UNIT IV
VECTOR DIFFERENTIATION AND LINE INTEGRATION
Vector differentiation: Scalar and vector point functions, Concepts of gradient, divergence and curl offunctions 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, Conservativefields

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
APPLIED PHYSICS

Course Code: GR22A1003 **L/T/P/C: 3/1/0/4**
I Year II Semester

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

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

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

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

UNIT IV
Lasers: Introduction, Characteristics of lasers, Lasing action, Essential components of laser, Construction and working: Ruby laser, He-Ne laser and Semiconductor laser, Applications of lasers.
Fiber Optics: Introduction, Principle and Structure of an optical fiber, Basic components in optical fiber communication system, Comparison of optical fibers over conventional cables, Types of optical fibers, Acceptance angle-Numerical aperture, Losses associated with optical fibers, Applications of optical fibers.

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

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

Teaching methodologies:

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

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 onNPTEL.
5. Halliday and Resnick, Physics – Wiley.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGLISH

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

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

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

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

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

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

UNIT V

'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook 'English for Engineers'published by Cambridge University Press.

Vocabulary: One Word Substitutes, Technical vocabulary and their usage

Grammar: Common Errors in English

Reading: Reading Comprehension-Exercises for Practice

Writing: What is Report Writing - Technical Reports vs General Reports – Importance of Report Writing – Structure and characteristics of Report Writing - Relevance of Reports to Engineers

Text Books

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

References

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATA STRUCTURES

Course Code: GR22A1012 **L/T/P/C:2/1/0/3**

I Year II Semester

Course 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 linkedlist.

UNIT IV

Trees: Basic tree concepts, Binary trees**:** properties, types, representation of binary trees using arrays andlinked 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 resolutiontechniques–separate chaining, linear probing, quadratic probing, double hashing (only examples – no implementation).

Text Books

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
APPLIED PHYSICS LAB

Course Code: GR22A1013 **L/T/P/C: 0/0/3/1.5**
I Year II Semester

Course Outcomes:
1. Compare the behavior of p-n junction diode, Solar cells and LED.
2. Analyze the behavior of magnetic and electric fields with the help of graphs.
3. Infer the work function of a material through photoelectric effect.
4. Discuss the characteristics of Lasers and infer the losses in optical fibers.
5. Estimate the time constant of RC circuit and resonance phenomenon in LCR circuit.

List of Experiments

1. Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode.
2. Solar Cell: To study the V-I Characteristics of solar cell.
3. Light emitting diode: To study V-I characteristics of light emitting diode.
4. Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.
5. Hall effect: To determine Hall co-efficient of a given semiconductor.
6. Photoelectric effect: To determine work function of a given material and Planck's constant.
7. LASER: To study the V-I characteristics of LASER sources.
8. Optical fiber: To determine the bending losses of Optical fibers.
9. R-C Circuit: To determine the time constant of R-C circuit.
10. LCR Circuit: To determine the resonant frequency and Quality factor of LCR Circuit in series and parallel.

Note: Any 8 experiments are to be performed.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING ANDTECHNOLOGY
GRAPHICS FOR ENGINEERS

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

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

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

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

UNIT III
Projections of planes - definition and types of plane figures (triangle, square, pentagon, hexagon, and circle);projections of plane (inclined to one reference plane only).

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

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

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

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATA STRUCTURES LAB

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

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

TASK 1
a. Implement Bubble sort using a C program.
b. Implement Selection sort using a C program.
c. Implement Insertion sort using a C program.

TASK 2
a. Develop a C program for Quick sort.
b. Demonstrate Merge sort using a C program.
c. Design a C program for Radix Sort.

TASK 3
a. Write a C program to implement Stack operations using arrays.
b. Write a C program to implement Queue operations using arrays.
c. Write a C program to implement Circular Queue operations using arrays

TASK 4
a. Write a C program to convert infix expression to postfix expression.
b. Write a C program to evaluate a postfix expression.

TASK 5
a. Write a C program to check for balanced parenthesis.
b. Write a C program to implement priority queue using arrays.

TASK 6
a. Implement the following operations on Single Linked List using a C program.
   i. create
   ii. insert
   iii. delete
   iv. search
   v. display

TASK 7
a. Write a C program to implement Circular Linked List operations – create, insert, delete and display.

TASK 8

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

TASK 9

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

TASK 10

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

TASK 11

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

TASK 12

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

TASK 13

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

TASK 14

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

TASK 15

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

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

Text Books

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

References

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

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

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

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

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

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

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

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

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

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

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

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

Minimum Requirement of infrastructural facilities for ELCS Lab:
1. **Computer Assisted Language Learning (CALL) Lab**
2. **Interactive Communication Skills (ICS) Lab**

II YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMPUTATIONAL MATHEMATICS FOR ENGINEERS

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

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

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

UNIT II
Interpolation - Cubic spline- Differentiation
Interpolation with non-uniform data: Newton divided differences formula, operational calculus, Interpolationwith 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 problemsin ODE.

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

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

Reference Books

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTRICAL CIRCUIT ANALYSIS

Course Code: GR22A2024 **L/T/P/C:2/1/0/3**
II Year I Semester

Course Outcomes:
1. Analyze three-phase and mutually coupled circuits.
2. Apply the transient response of given DC circuits.
3. Solve electrical circuits using Laplace and Inverse Laplace transform.
4. Simplify the network by using two port parameters.
5. Summarize the concept of Fourier Series and Fourier transforms.

UNIT I
THREE PHASE CIRCUITS AND COUPLED CIRCUITS
Three-phase circuits: analysis of balanced and unbalanced circuits, measurement of power by three- and two-wattmeters, measurement of reactive power by single wattmeter.

UNIT II
SOLUTION OF FIRST AND SECOND ORDER NETWORKS
Solution of first and second order differential equations for Series and parallel RL, RC, RLC circuits, initial and final conditions in network elements, time constants, steady state and transient response Concept of Duality and Dual Networks.

UNIT III
ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS
Introduction to Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, Inverse Laplace Transform, transformed network with initial conditions, Transferfunction representation, Poles and Zeros.

UNIT IV
TWO PORT NETWORKS
Two Port Networks, terminal pairs, relationship of two port variables, impedance, admittance, hybrid and transmission parameters, condition for symmetry and reciprocity, interrelation ship between various parameters, interconnections of two port networks (series, parallel and cascade)

UNIT V
FOURIER SERIES AND FOURIER TRANSFORM
Representation of continuous-time periodic signals by Fourier series; Dirichlet's conditions; Properties of Fourier series, Trigonometric and Exponential Fourier series.
Fourier transform: Fourier transform of periodic signals, Properties of Fourier transforms, Fourier transforms involving impulse function.

Textbooks
1. W.H.Hayt and J.E.Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education,2013.
2. C.K.Alexander and M.N.O.Sadiku,"Fundamentals of Electric Circuits",McGraw Hill Education,2004.
3. Sreenivasulu N "Electrical Circuits", Reem Publications, 2009.

References
1. A.Chakrabarti – Dhanpat Rai & Co "Circuit Theory"(Analysis and Synthesis).
2. N.C.Jagan and C.Lakshmi narayana "Network Theory", BS Publications.
3. K.V.V.Murthy and M.S.Kamath,"Basic Circuit Analysis",JaicoPublishers,1999.

4. D.RoyChoudhury,"Networks and Systems",NewAgeInternationalPublications,1998.
5. M.E.Van Valkenburg, "Network Analysis", Prentice Hall, 2006.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PRINCIPLES OF ANALOG ELECTRONICS

Course Code: GR22A2025 **L/T/P/C: 3/0/0/3**
II Year I Semester

Course Outcomes:
1. Analyze the diode principle, rectifier, clipping and clamping circuits.
2. Understand the characteristics of BJT, JFET transistors.
3. Illustrate Op-Amp circuits in different applications.
4. Implementing Op-Amp based Linear and Non-linear Circuits.
5. Demonstrate the principle and operation of Oscillators and Multivibrator circuits.

UNIT I
DIODE CIRCUITS
P-N junction diode, biasing, V-I characteristics of a diode, diode equivalent circuits, static resistance, dynamic resistance, Zener breakdown, & Avalanche breakdown. Working of Half-wave and full-wave rectifiers, Clipping, types of clipping circuits, series. Clipper, Shunt Clipper, Clamping, types of clamping circuits.

UNIT II
BJT AND JFET CIRCUITS
BJT Structure, Principle and Operation of BJT, Types NPN, PNP, Common Emitter, Common Base and Common Collector Configurations, Input characteristics and Output Characteristics of a BJT; BJT as a switch, and amplifier, Operating point, DC Load line & AC load line.
Bipolar Junction Transistor small signal Hybrid parameter model, Common-emitter, common-base and common collector amplifiers, JFET Structure, principle, Types N-Channel, P-Channel , drain current - characteristics. UJT construction and principle.

UNIT III
OPERATIONAL AMPLIFIERS
Introduction to Operational Amplifier, block diagram of operational amplifier, ideal characteristics of op-amp, practical op-amp, idealized analysis of op-amp circuits. Inverting, non-inverting amplifier and VoltageFollower Circuit.
DC characteristics of op-amp: input bias current, input offset current, Input Offset Voltage, thermal drift, slew rate.

UNIT IV
LINEAR & NONLINEAR APPLICATIONS OF OP-AMP
Inverting summing amplifier, Non-Inverting Summing amplifier, Subtractor circuit, differential amplifier, instrumentation amplifier, integrator, differentiator.

UNIT V
OSCILLATORS
Basic principle of an Oscillator, RC Phase shift and Wein bridge Oscillators, Schmitt Trigger Circuit, Zero Crossing Detector, Square-wave (Astable Multivibrator), Precision rectifier, peak detector, Monostable Multivibrator.

Text/References Books:
1. S. Sedra and K. C. Smith, ―Microelectronic Circuits‖, New York, Oxford University Press,1998.
2. D Roy Choudhury, Shail B Jain, ―Linear Integrated Circuits‖, New Age International Pvt. Ltd.,Fourth Edition.

3. J. V. Wait, L. P. Huelsman and G. A. Korn, ―Introduction to Operational Amplifier theory and applications‖, McGraw Hill U. S.,1992.
4. P. R. Gray, R. G. Meyer and S. Lewis, ―Analysis and Design of Analog Integrated Circuits, John Wiley& Sons,2001.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DC MACHINES AND TRANSFORMERS

Course code:GR22A2026 **L/T/P/C: 3/0/0/3**
II Year I Semester

Course Outcomes:
1. Interpret the magnetic field in DC Machine.
2. Summarize concepts of generators and its applications.
3. Select the appropriate DC motors for a given applications and materials for Transformers.
4. Analyze the performance of Transformers.
5. Outline the performance of Three-phase Transformer.

UNIT I
DC MACHINES
Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, Armature windings- lap and wave windings, visualization of magnetic field producedby the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Principle Electro-mechanical energy conversion.

UNIT II
DC GENERATORS
Principle-Simple Loop generator, commutator action, construction, EMF equation, and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation. Types of field excitations – separately excited, self-excited. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. Characteristics of all generators, Applications.

UNIT III
DC MOTORS
Working principle of motor, construction, types of motors, and its applications Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction. Armature circuit equation for motoring and generation, Significance of back EMF, V-I characteristics and torque-speed characteristics self-excited. Speed control methods, Losses,load testing and testing of DC machines.

UNIT IV
SINGLE-PHASE TRANSFORMERS
Construction and operation of single-phase transformers, types of transformers, equivalent circuit, phasor diagram of Transformer No-load and ON-load.

Voltage regulation, losses and efficiency –Maximum Efficiency-Testing - open circuit and short circuit tests,polarity test, back-to-back test, separation of hysteresis and eddy current losses- effect of frequency and supply voltage. Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current. All-day efficiency, KVA rating.

UNITV
THREE-PHASE TRANSFORMERS
Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of and three-phase transformers, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers. Testing of three phase transformers.

Textbooks

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2012.

References

1. A.E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTROMAGNETIC FIELDS

Course Code: GR22A2027 **L/T/P/C: 3/0/0/3**
II Year I Semester

Course Outcomes:
1. Illustrate the Electric Field Intensity with respect to free space.
2. Summarize the Electric Field Intensity with respect to materials space.
3. Evaluate Magnetic Field Intensity and Force in Magnetic Fields.
4. Analyze the Maxwell's Equations in Time Varying Fields, Displacement current.
5. Apply Electro-Magnetic theory on different applications.

UNIT I
STATIC ELECTRIC FIELD
Coulomb's law- Electric Field Intensity-Electrical Field due to Point charge, Line, Surface and Volume Charge distributions. Gauss Law and its Applications-Maxwell's First Law-Work done in moving a point charge in an electrostatic field, Electric potential- Properties of potential function, potential gradient-ElectricDipole-Potential and EFI due to an Electric Dipole-Electrostatic Energy density.

UNIT II
CONDUCTORS & INSULATORS
Behavior of conductors in an electric field-Current density-Conduction and Convection current densities-Ohms Law in Point form- Continuity equation of current-Electric field inside a dielectric material-Polarization and Permittivity-Boundary conditions-Boundary conditions for two perfect dielectric materials. Capacitance-Capacitance of parallel plates, co-axial cable, spherical capacitors- Poisson's equation- Laplace's equation.

UNIT III
STATIC MAGNETIC FIELDS
Biot-Savart's Law-Magnetic Field Intensity-MFI due to a straight current carrying conductor, MFI due to circular conductor- Maxwell's Second Equation-Ampere's Law and its Applications viz MFI due to infinitelylong straight conductor only-Maxwell's Third Equation-Scalar and Vector Magnetic Potentials.

FORCE IN MAGNETIC FIELDS
Force on a moving point charge-Lorentz force equation- Force on a differential current element- Force between differential current elements-Magnetic Dipole and Magnetic Dipole Moment--Classification of magnetic materials- Magnetization and Permeability-Magnetic Circuits- Inductance-Self and Mutual Inductances-Neuman's Formula only.

UNIT IV
TIME VARYING FIELDS
Faraday's laws of Electromagnetic induction-it's integral and point forms-Maxwell's Fourth Equation-statically and dynamically induced EMFs-simple problems-Modification of Maxwell's equations for time varying fields-Displacement current.

UNIT V
ELECTROMAGNETIC WAVE PROPAGATION
Waves in general- wave propagation in lossy dielectrics-Plane waves in lossless dielectrics, free space, Goodconductors-power and the poynting vector, Reflection of a plane wave at normal incidence, oblique incidence.

Textbooks

1. Matthew N.O.Sadiku, “Principles of Electromagnetics”, Oxford University Publication, FourthEdition, 2014.
2. W.Hayt, John A.Buck “Engineering Electromagnetics”, McGraw Hill Education, 2012.

References

1. Pramanik, “Electromagnetism-Problems with solution”, Prentice Hall India, 2012.
2. G. W. Carter, “The electromagnetic field in its engineering aspects”, Longmans, 1954.
3. Pramanik, “Electromagnetism - Theory and applications”, PHI Learning Pvt. Ltd, NewDelhi, 2009.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DATABASE FOR ENGINEERS

Course Code:GR22A2007 **L/T/P/C: 2/0/0/2**
II Year I Semester

Course Outcomes:
1. To design ER Diagrams for an application and translate to logical model.
2. To develop database with the creation of tables and populating them with data.
3. To compose queries for retrieving data from the database.
4. To analyze the necessity for normal forms and other database objects in the database.
5. To interpret the need of atomicity, consistency, isolation and durability for a transaction.

UNIT I
Introduction to DBMS, Database System Applications, Database System vs. File System, Instances and Schema, ER Diagrams – Attributes and Entity Sets, Relationships and Relationship sets, Extended ER Features, Conceptual Design with ER Model, Logical Database Design, Construction of Tables using BasicDDL Commands.
To Practice:
1) Practicing ER Diagram for Hostel Management System, Airlines Reservation System.
2) Practicing DDL commands: Creating tables for various relations (in SQL).

UNIT II
Relational Model: Introduction To The Relational Model–Basic Structure, Database Schema, Integrity Constraints over relations, Keys, Construction of tables with integrity constraints using DDL and DML commands, Form of Basic SQL Query (SELECT) , SQL Operators, Use of DISTINCT keyword, Order by Clause.
To Practice:
1) Practicing DDL and DML commands: Creating tables with integrity constraints specified.
2) Practicing DQL command: Queries for above discussed commands.

UNIT III
Exploration of SELECT statement: SQL functions, Aggregate Operators, Group by and Having clauses,Joins, Types of Joins, Nested Queries, Correlated Nested Queries, Set Operators.
To Practice:
1) Practicing DQL/ DRL command: Using Select statement for various purposes as discussed in the chapter

UNIT IV
Other Database Objects: Introduction to Views, Types of Views, Dropping views, Introduction to Sequence,Index and Synonym.
Problems with Redundancy, Decomposition and its properties, Functional Dependencies, Normalization, Types of Normal Forms - 1NF, 2NF, 3NF, BCNF, 4NF.
To Practice:
1) Practicing queries to create view and retrieve data through views.
2) Practicing queries to create an index, sequence and synonym.

UNIT V
Transaction Management - Definition, Properties of Transaction, states of Transaction, Concurrent executions, Serializability, Lock based protocols, and Log based recovery.
Granting privileges to users (DCL) and Transaction Control Language (TCL) Commands

To Practice:

1) Practicing DCL commands - Grant, Revoke, Roles
2) Practicing TCL commands - Commit, Rollback, Savepoint.

Text Books

1. "Database Management Systems", Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill, 3rd Edition.

Reference Books

1. "Database System Concepts", Silberschatz, Korth, McGraw hill, V edition.
2. "Introduction to Database Systems", C.J. Date, Pearson Education.
3. "Database Systems design, Implementation, and Management", Rob &Coronel, 5th Edition.
4. "Database Management Systems", P. Radha Krishna, HI-TECH Publications, 2005.
5. "Database Management System", Elmasri Navate, Pearson Education.
6. "Database Management System", Mathew Leon, Leo.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PRINCIPLES OF ANALOG ELECTRONICS LAB

Course Code:GR22A2028 **L/T/P/C: 0/0/3/1.5**
II Year I Semester

Course Outcomes:
1. Identify types of active components.
2. Examine the characteristics of Diode and BJT.
3. Illustrate Operational Amplifiers based inverting and non-inverting amplifier circuits.
4. Articulate mathematical operation using Operational Amplifier.
5. Implement an Oscillator circuit.

List of Experiments

TASK 1
Plot the Diode Characteristics experimentally.

TASK 2
Obtain the output voltage waveform Half Wave Rectifier Using Diode

TASK 3
Shape the sine waveform through different Clipping Circuits experimentally.

TASK 4
Shape the sine waveform through different Clamping Circuits experimentally

TASK 5
Obtain Input and Output characteristics for CB, CE configurations of BJT.

TASK 6
Obtain Input and Output characteristics for CC configurations of BJT.

TASK 7
Obtain drain current characteristics of JFET.

TASK 8
Implement Inverting & Non-Inverting Amplifier using Operational Amplifier

TASK 9
Implement Subtractor Circuit/Differential Amplifier using Operational Amplifier

TASK 10
Implement Integrator Circuit using Operational Amplifier

TASK 11
Implement Differentiator Circuit using Operational Amplifier

TASK 12
Design RC Phase Shift Oscillator Circuit

Text/References Books

1. S. Sedra and K. C. Smith, ―Microelectronic Circuits‖, New York, Oxford University Press,1998.
2. D Roy Choudhury, Shail B Jain, ―Linear Integrated Circuits‖, New Age International Pvt. Ltd.,Fourth Edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DC MACHINES AND TRANSFORMERS LAB

Course Code:GR22A2029 **L/T/P/C: 0/0/3/1.5**
II Year I Semester

Course Outcomes:

1. Identify various parts of electrical DC machines and Transformers.
2. Develop knowledge helpful for application of DC machines and Transformers.
3. Demonstrate control of different DC Machines.
4. Illustrate the performance of dc machines using different testing methods.
5. Determine the parameters of equivalent circuit of single-phase transformer and performance.

TASK-1
Swinburne's test and Load Test of a D.C Shunt Motor

TASK-2:
Brake Test on a DC Shunt Motor

TASK-3
Brake Test on a DC Compound Motor

TASK-4:
Open Circuit Characteristics of a DC Shunt Generator

TASK-5
Load test on a D.C. Shunt Generator.

TASK-6
Load test on a D.C. Series Generator

TASK-7
Load test on D.C. Compound Generator

TASK-8
Hopkinson Test

TASK-9
Fields Test

TASK-10:
Separation of Core Losses of DC machine

TASK-11
OC, SC and Load tests on single phase transformer.

TASK-12
Sumpner’s test.

TASK-13
Scott connection.

In addition to the above experiments, at least any two of the following experiments are requiredto be conducted from the following list

TASK-14
Heat run test on transformer.

TASK-15
Separation of core losses of a single-phase transformer

TASK-16
Hysteresis loss determination.

TASK-17
Test on Auto Transformer.

TASK-18
Transient Analysis of DC Machine.

Textbooks
1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2012.

References
1. A.E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONSTITUTION OF INDIA

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

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

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

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

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

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

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

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

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

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

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

UNIT I
Values and Self-Development –social values and individual attitudes, Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.
❖ A Case study on values and self-development

UNIT II
Personality and Behaviour Development-positive thinking, punctuality, avoiding fault finding, Free fromanger, Dignity of labour, religious tolerance, Aware of self-destructive habits.
❖ A Case study on Personality

UNIT III
Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.
❖ A Case study on professional ethics

UNIT IV
Introduction to Gender - Definition of Gender, Basic Gender Concepts and Terminology, Attitudes towardsGender, 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

Textbooks
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
POWER GENERATION AND TRANSMISSION

Course Code:GR22A2030 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Outcomes:
1. Illustrate the basic concepts of Power Generation.
2. Solve the economics of power generation.
3. Demonstrate various power system components, line models and its performance.
4. Analyze the different concepts related to mechanical design of transmission lines and corona.
5. List overhead line insulators and cables for real time applications

UNIT I
GENERATION OF ELECTRIC POWER
Conventional Sources (Qualitative): Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant. Non-Conventional Sources (Qualitative): Ocean Energy, Tidal Energy, Wave Energy, wind Energy, Fuel Cells, and Solar Energy, Cogeneration and energy conservation and storage.

UNIT II
ECONOMICS OF POWER GENERATION
Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer.

UNIT III
TRANSMISSION LINE PARAMETERS AND PERFORMANCE
Line conductors, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, Composite conductors-transposition, bundled conductors, and effect of earth on capacitance. Representation of lines, short transmission lines, medium length lines, nominal T and PI-representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, D constants, Ferranti Effect. Sending end and receiving end power circle diagrams.

UNIT IV
MECHANICAL DESIGN OF OVERHEAD TRANSMISSION LINES AND CORONA
Tension and sag calculations, Factors affecting Sag, Sag template, Stringing charts, vibrations and vibrationdamper.
Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Disadvantages of corona, interference between power and Communication lines.

UNIT V
OVERHEAD LINE INSULATORS & INSULATED CABLES
Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods ofequalizing the potential, testing of insulators. Introduction, insulation, insulating materials.
Under-Ground Cables: Types of Cables, grading of cables, insulation resistance of a cable. Capacitance of asingle core and three core cables. Overhead lines versus underground cables, types of cables**.**

Textbooks
1. A Chakrabarti, M L Soni, P V Gupta & U S Bhatnagar, “A Text Book on Power Systems Engineering”, Dhanpat Rai &CoPvt.Ltd.
2. C.L. Wadhwa “Generation, Distribution and Utilization of Electrical Energy”, Second Edition, New

AgeInternational,2009.
3. C.L.Wadhwa “Electrical Power systems” New age Publishers 7th Edition 2017.

References

1. H.Cotton & H. Barber-The Transmission and Distribution of Electrical Energy, Third Edition, ELBS,B.I.Pub.,1985.
2. Paul Breeze “Power generation technologies”, Third Edition, Elsevier Publishers 2019.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
AC MACHINES

Course Code:GR22A2031 **L/T/P/C: 2/1/0/3**
II Year II Semester

Course Outcomes:
1. Understand the concepts of rotating magnetic fields.
2. Interpret the need for electrical Induction Machines.
3. Demonstrate working of single and three phase AC machines.
4. Evaluate Machine Variables in direct and quadrature axis form for salient pole type.
5. Summarize the concept of harmonic created in supply system, need for reduction and design of synchronous machines for reducing them.

UNIT I
FUNDAMENTALS OF AC MACHINE WINDINGS
Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding concentrated and distributed, sinusoidal distributed winding, winding distribution factor. Introduction to revolving magnetic field in 3-phase and 1-phase machines.

UNIT II
INDUCTION MACHINES
Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator Operation. Self-Excitation. Doubly-Fed Induction Machines.

UNIT III
SYNCHRONOUS GENERATORS
Synchronous Generator: Basic principle of operation, construction of salient & non-salient pole synchronous machines, generated EMF, effect of distribution and chording of winding, harmonics causes, reduction and elimination. Armature reaction, synchronous reactance, leakage reactance, Phasor diagram of non-salient type alternator. Voltage regulation-EMF, MMF, ZPF and ASA Methods. Two reaction theory- direct and quadrature axis reactance, Phasor diagram, slip test, synchronizing to infinite bus bars and paralleloperation, steady state power-angle characteristics.

UNIT IV
SYNCHRONOUS MOTORS
Synchronous Motor: Principle of operation, Phasor diagrams, torque and torque angle, effectof change in load, effect of change in excitation, V and inverted V curves. Synchronous condenser, hunting and damping. Methods of starting of synchronous motors. Testing of Synchronous motors.

UNIT V
SINGLE-PHASE INDUCTION MOTORS
Constructional features-double revolving field theory, equivalent circuit, determination of parameters. Types of 1-phase induction motors, Split-phase starting methods and applications

Text/References Books:

1. A.E.Fitzgerald and C.Kingsley, "Electric Machinery", McGraw Hill Education,2013.
2. M.G.Say,"PerformanceanddesignofACmachines",CBSPublishers,2002.
3. P.S.Bimbhra,"ElectricalMachinery",KhannaPublishers,2011.
4. I.J.Nagrath and D.P. Kothari, "Electric Machines", McGraw Hill Education,2010.
5. A.S.Langsdorf, "Alternating Current Machines", McGraw Hill Education,1984.
6. P.C.Sen,"PrinciplesofElectricMachinesandPowerElectronics",JohnWiley&Sons,2007.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONTROL SYSTEMS

Course Code:GR22A2032 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Outcomes:
1. Summarize the basic elements and structures of feedback control systems.
2. Analyze the time response and errors of physical systems.
3. Develop the Routh-Hurwitz table, root locus for the linear time-invariant systems.
4. Examine the stability of the system using Nyquist and Bode plots.
5. Model the physical system using State Space approach.

UNIT I
CONCEPTS OF CONTROL SYSTEMS AND TRANSFER FUNCTIONREPRESENTATION

Open loop and closed loop control systems, different examples of control systems, classification of control systems, characteristics and effects of feedback, impulse response and transfer functions, translational and rotational mechanical systems, Transfer function of DC and AC Servomotor, Synchro transmitter and receiver, Block diagram reduction techniques, signal flow graphs, reduction using Mason's gain formula.

UNIT II
TIME RESPONSE ANALYSIS

Standard test signals, time response of first order systems, characteristic equation of feedback control systems, transient response of second order systems-time domain specifications, steady state response-steady state errors and error constants, effects of proportional derivative,proportional integral systems.

UNIT III
STABILITY ANALYSIS &ROOT LOCUS TECHNIQUE

Concept of stability, Routh stability criterion, Routh Hurwitz stability criterion Root locus concept, construction of root loci, effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT IV
STABILITY ANALYSIS IN FREQUENCY DOMAIN

Frequency domain specifications, Bode diagrams, Determination of frequency domain specifications and transfer function from the Bode diagram- Phase and Gain margin, stability analysis from Bode plots. Polar plots, Nyquist plots and applications of Nyquist criterion to find the stability.

UNIT V
STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS

Concepts of state, state variables and state vector, derivative of state model from transfer function, derivative of transfer function from state model, diagonalization, Solution of State Equation, state transition matrix and its properties, Controllability and Observability.

Textbooks
1. A. Anand Kumar "Control Systems", 2nd edition, PHI Learning Private Limited
2. B.C.Kuo "Automatic Control Systems", 8th edition, 2003, John Wiley and Son's

References
1. I. J. Nagrath and M. Gopal "Control Systems Engineering", New Age International (P) Limited Publishers, 2nd edition

2. John Wiley “Control Systems Engineering”, by NISE 3rd Edition.
3. Katsuhiko Ogata “Modern Control Engineering”, Prentice Hall of India Pvt Ltd, 3rdedition,1998.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PRINCIPLES OF DIGITAL ELECTRONICS

Course Code:GR22A2033 **L/T/P/C: 3/0/0/3**
II Year II Semester

Course Outcomes:
1. Summarize the truth tables of logic gates and different number systems.
2. Apply K-Map and reduce the function to design Combinational logic circuits.
3. Develop different sequential circuits using Flip-Flops.
4. Illustrate the use of state diagram in designing Finite State Machines and classification of PLD's.
5. Outline the types and their architectures of Digital to Analog and Analog to Digital Converters.

UNIT I
NUMBER SYSTEMS AND LOGIC FAMILIES
Logic gates, Boolean algebra, Boolean Postulates, realization of Boolean functions with logic gates, number systems, one's and two's complements arithmetic, Binary codes: BCD, Weighted codes: -2421,8421, Gray code, error detecting and correcting codes, Hamming code.

UNIT II
MINIMIZATION TECHNIQUES
Standard and Canonical form representation for logic functions, minimization of logical functions using Boolean Postulates and Theorems, K-map representation, and simplification of logic functions using K-Map, don't care terms.

Combinational Logic Circuits: Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, carry look ahead adder, digital comparator, parity checker/generator, priority encoders.

UNIT III
SEQUENTIAL CIRCUITS:
SR Latch, the clocked SR flip flop, J- K, T and D types flip-flops, Triggering of Flip Flops, Analysis of Clocked Sequential Circuits, Flip-Flop Excitation Tables, Conversion from one Flip-Flop to other.

Registers: Analysis procedure, design procedure, Registers with parallel load, Shift registers; Serial Transfer, Serial Addition. Ripple Counters; Binary Ripple Counter, BCD Ripple Counter, Synchronous Counters; Binary Counter, Up-Down Counter, BCD Counter, Binary Counter with Parallel Load, Counter with Unused States, Ring Counter, Johnson Counter,

UNIT IV
FINITE STATE MACHINE
State diagram, State Assignment, Capabilities and Limitation, Mealy and Moore models. **Programmable Logic Devices:** ROM as a Programmable Logic Device, Programmable ArrayLogic and Programmable Logic Array, example problems based on digital designing.

UNIT V
DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS
Digital to Analog converters: Weighted resistor D/A converter, R-2R Ladder D/A Converter, Specifications for D/A converters. Analog to Digital converters: Sample and hold circuit, Flashtype A/D converter, Successive approximation type A/D converter, Counter Type A/D converter, Specifications of A/D converters.

Text/Reference Books

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
4. Charles H. Roth, Jr and Lizy Kurian John‘s, ―Digital Systems Design Using VHDL‖,Cengage Learning

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MICROPROCESSORS AND MICROCONTROLLERS

Course Code:GR22A2034 **L/T/P/C:2/0/0/2**
II Year II Semester

Course Outcomes:
1. Describe the internal architecture of 8086 Microprocessor.
2. Analyze assembly level programs of 8086 Microprocessors.
3. Discuss the internal architecture of 8051.
4. Develop skills in writing assembly level programs on the 8051.
5. Develop real-time systems on the 8051 Microcontroller using external interface peripherals.

UNIT I
8086 ARCHITECTURE
8086Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros.

UNIT II
ASSEMBLY LANGUAGE PROGRAMMING OF 8086 AND INTERFACING
Simple Programs involving Logical, Branch and Call Instructions, Sorting, Evaluating Arithmetic Expressions, String manipulations, Signal Descriptions of 8086, Common FunctionSignals, Minimum and Maximum Mode Signals.

Memory and I/O Interfacing: Memory Interfacing of 8086,8255 PPI, Various Modes of Operation, and Interfacing to 8086, Interfacing keyboard, Display, Stepper Motor Interfacing,D/A and A/D Converter.

UNIT III
THE 8051 ARCHITECTURE
Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization.
8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers andCounters

UNIT IV
INSTRUCTION SET AND PROGRAMMING
Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, indexed addressing, Bit inherent addressing, bit direct addressing.
8051 Instruction set: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs.

UNIT V
EXTERNAL COMMUNICATION INTERFACE
Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB. **Applications:**
LED, LCD, and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing.

Textbooks

1. Advanced Microprocessors and Peripherals, A. K. Ray and K. M. Bhurchandani, 2nd Edition, Tata McGraw-Hill, 2006.
2. Microprocessors and Interfacing, D.V. Hall, 2nd Edition, Tata McGraw-Hill, 2006.
3. The 8051 Microcontroller, Kenneth J. Ayala, 3rd Edition, Cengage Learning, 2010.

References

1. "The 8051 Microcontroller and Embedded Systems using Assembly and C"– Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition,Pearson Education, 2008.
2. Microcontrollers: Theory and Applications, Ajay V. Deshmukh, Tata McGraw-HillEducation, 2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PRINCIPLES OF DIGITAL ELECTRONICS LAB

Course Code: GR22A2035 **L/T/P/C: 0/0/4/2**
II Year II Semester

Course Outcomes:
1. Outline the advantages of function realization using logic gates through K-Map.
2. Construct Two-bit Adders and Subtractors.
3. Analyze the types of Data Selectors.
4. Build 1-bit and 2-bit Magnitude Comparator.
5. Classify the types of Flip-Flops and their Truth Tables.

LIST OF EXPERIMENTS

TASK-1
Design and verification of basic logic gates.

TASK-2
Simplify the given Boolean expression realize them using universal gates.

TASK-3
Design and implementation of half/full adder

TASK-4
Design and implementation of half subtractor/full subtractor

TASK-5
Design and implementation of parallel adder

TASK-6
Design and implementation of subtractor

TASK-7
Design and implementation of multiplexer

TASK-8
Design and implementation of Decoder

TASK-9
Design and implementation of one bit magnitude comparator

TASK-10
Design and implementation of two bit magnitude comparators

TASK-11
Implementation and verification of truth table for R-S, J-K, D and T flip-flops.

TASK-12
Implementation and verification of truth table for J-K flip-flop, Master-slave.

Text/Reference Books

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
AC MACHINES LAB

Course Code:GR22A2036 **L/T/P/C: 0/0/4/2**
II Year II Semester

Course Outcomes:
1. Relate the performance of different machines using different testing methods.
2. Determine the parameters of equivalent circuit of single phase induction motor.
3. Summarize the various methods to find regulation of an Alternator.
4. Apply various characteristics of three phase induction motor.
5. Experiment with synchronous machine to find direct and quadrature axis reactance.

LIST OF EXPERIMENTS

TASK-1
Sumpner's test.

TASK-2:
Heat run test on transformer.

TASK-3
Hysteresis loss determination

TASK-4
Brake Test on Slip Ring Induction Motor.

TASK-5:
No load and Blocked Rotor Tests on Squirrel Cage Induction Motor, Slip Torque Test.

TASK-6
Equivalent Circuit of a Single Phase Induction Motor.

TASK-7
Regulation of Alternator by Synchronous Impedance Method and MMF Method, PortierTriangle Method.

TASK-8
Determination of X_d and $X_q$of a Salient Pole Synchronous Machine from Slip Test.

TASK-9
V and inverted V curves of a 3-Phase Synchronous Motor.

TASK-10
Induction Generator.

TASK-11
Rotor-resistance starter for Slip Ring Induction Motor.

TASK-12

Star-delta starter for Squirrel Cage Induction Motor

Text/References Books:

1. A.E.Fitzgerald and C.Kingsley, "Electric Machinery", McGraw Hill Education,2013.
2. M.G.Say,"PerformanceanddesignofACmachines",CBSPublishers,2002.
3. P.S.Bimbhra,"ElectricalMachinery",KhannaPublishers,2011.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
CONTROL SYSTEMS LAB

Course Code:GR22A2037 **L/T/P/C: 0/0/4/2**
II Year II Semester

Course Outcomes:
1. Make use of simulation packages for simple control system programs.
2. Illustrate the characteristics of synchros.
3. Analyze the root locus and bode plots.
4. Find the transfer function of the DC motor/generator.
5. Contrast the lead and lag compensators and discuss the performance of servomotor and PID controller.

LIST OF EXPERIMENTS

TASK-1
Transfer function from zeros and poles and vice versa.

TASK-2
Step response, Ramp response and Impulse response of a given transfer function.

TASK-3
Root Locus from a Transfer function.

TASK-4
Bode Plot and Nyquist Plot from a Transfer function.

TASK-5
State Model from a Transfer function.

TASK-6
Zeros and poles from state model.

TASK-7
Transfer function of DC motor/Generator.

TASK-8
Time Response of second order system.

TASK-9
DC Servomotor.

TASK-10
PID Controller.

TASK-11
Characteristics of Synchros.

TASK-12
Lag& Lead Compensator.

Textbooks

1. A. Anand Kumar "Control Systems", 2nd edition, PHI Learning Private Limited
2. B.C.Kuo "Automatic Control Systems", 8th edition, 2003, John Wiley and Son's

References

1. I. J. Nagrath and M. Gopal "Control Systems Engineering", New Age International (P) Limited Publishers, 2nd edition
2. John Wiley "Control Systems Engineering", by NISE 3rd Edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENVIRONMENTAL SCIENCE

Course Code: GR22A2001 **L/T/P/C:2/0/0/0**
II Year II 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 allied problems
2. Interpret the key components in safe guarding the environment
3. Evolve an individual vision of harmonious interaction with natural world.
4. Appraise the quality of environment in order to create a healthy atmosphere.
5. Familiarize with the individual responsibilities towards green revolution.

UNIT I
INTRODUCTION AND AWARENESS ACTIVITIES
Environmental Science: Introduction, Definition, scope and importance.AWARENESS ACTIVITIES
Small group meetings about:
- Water management
- Waste water treatment
- Projects Vs Environment
- Zero waste management
- Circular economy
- Impact of Science & Technology on Environment
- E-waste management
- Biodiversity loss
- Renewable Energy

UNIT II
SLOGAN AND POSTER MAKING EVENT
- Food waste management
- Rain water harvesting
- Climate change
- Green Power
- Water conservation
- Green at work
- Role of IT in environment and human health
- Sustainable development

UNIT III
EXPERT LECTURES ON ENVIRONMENTAL SCIENCE
- Environmental Impact Assessment
- Industrial waste treatment
- Regenerative farming/Organic farming/Vertical gardens/Hydroponics
- Circular Economy

UNIT IV CLEANLINESS DRIVE
- Indoor air pollution
- Vehicular pollution

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

UNIT V
CASE STUDIES

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

Textbooks

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

References

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
JAVA PROGRAMMING FOR ENGINEERS

Course Code: GR22A2008 **L/T/P/C: 2/0/0/0**
II Year II Semester

Course Outcomes:
1. Identify the model of Object-Oriented Programming: Abstract data types,Encapsulation, Inheritance and Polymorphism
2. Summarize the fundamental features like Interfaces, Exceptions and Collections
3. List the advantages of multi-threading.
4. Design interactive programs using Applets, AWT and Swings
5. Develop real time applications using the features of Java.

UNIT I
INTRODUCTION TO OOP
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.

UNIT II
PROGRAMMING CONSTRUCTS
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.
Classes and Objects- Classes, Objects, Creating objects, methods, constructors- constructor overloading, cleaning up unused objects- Garbage collector, class variable and methods- statickeyword, this keyword, arrays, Command line arguments.

UNIT III
INHERITANCE
Types of Inheritance, Deriving classes using extends keyword, method overloading, super keyword, final keyword, abstract class.
Interfaces: Interface, Extending interface, interface Vs Abstract classes.

UNIT IV
PACKAGES
Creating Packages, using Packages, Access protection, java I/O package. Exploring java.io andString classes. Exceptions - Introduction, Exception handling techniques - try, catch, throw, throws, finally block, user defined Exception.

UNIT V
MULTITHREADING
Java.lang. Thread, the main Thread, creation of new Threads, Thread priority, multi Threading- using isalive() and join(), Synchronization, suspending and resuming Threads,Communication between Threads.

Textbooks
1. Java: The Complete Reference, 10thedition, Herbert Schildt, Mc Graw Hill.
2. Java Fundamentals: A Comprehensive Introduction, Herbert Schildt and Dale Skrien,TMH.
3. Java for Programming, P.J.Dietel Pearson Education

References

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
EFFECTIVE TECHNICAL COMMUNICATION

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

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

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

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

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

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

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

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

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

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

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

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

Course Outcomes:

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

III YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER SYSTEM ANALYSIS

Course Code: GR22A3012 **L/T/P/C: 2/1/0/3**
III Year I Semester

Course Outcomes:
1. Develop Per Unit equivalent reactance networks of Power System.
2. Formulate the Impedance and admittance matrices necessary for Power Flow Studies.
3. Solve Power Flow equations using different numerical methods.
4. Evaluate fault currents for different types of faults and analyze short circuit studies.
5. Compare Steady state stability and Transient state stability of Power system.

UNIT I
POWER FLOW STUDIES-1
Per-Unit System of Representation, Per-Unit equivalent reactance network of a three phase Power System, Numerical Problems. Y-bus formation by Direct Inspection Method, Numerical Problems. Necessity of Power Flow Studies – Data for Power Flow Studies – Derivation of Static load flow equations – Load flow solutions using Gauss Seidel Method: Acceleration Factor, Load flow solution with and without P-V buses, Algorithm and Flowchart. Numerical Load Flow Solution for Simple Power Systems (Max. 3-Buses): Determination of Bus Voltages, Injected Active and Reactive Powers (One Iteration only) and finding Line Flows/Losses for the given Bus Voltages.

UNIT II
POWER FLOW STUDIES-2
Newton Raphson Method in Rectangular and Polar Co-Ordinates form, Load Flow Solution with and without PV Busses- Derivation of Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods. - Comparison of Different Load flow Methods – DC load Flow.

UNIT III
FORMATION OF ZBUS
Partial network, Algorithm for the Modification of Zbus Matrix for addition of an element for the following cases: Addition of an element from a new bus and reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old buses (Derivations and Numerical Problems)-Modification of Zbus for the changes in network (Problems).

SHORT CIRCUIT ANALYSIS
Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems. Symmetrical Component Theory: Symmetrical Component Transformation, Positive, Negative and Zero sequence components: Voltages, Currents and Impedances. Sequence Networks: Positive, Negative and Zero Sequence Networks, Numerical Problems.
Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without fault impedance, Numerical Problems.

UNIT IV
STEADY STATE STABILITY ANALYSIS
Elementary concepts of Steady State, Dynamic and Transient Stability. Description of: Steady state Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of steady state stability and Methods to improve steady state stability.

UNIT V

POWER SYSTEM TRANSIENT STABILITY ANALYSIS

Derivation of Swing Equation. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation - Solution of Swing Equation: Point-by-Point Method and Modified Euler's method. Multi machine stability. Methods to improve Transient Stability.

Textbooks

1. C. L. Wadhwa, "Electric Power Systems", New Age International.
2. I.J.Nagrath & D.P Kothari, "Modern Power System Analysis", Tata McGraw- Hill.
3. Grainger and Stevenson, "Power System Analysis", Tata McGraw Hill.

References

1. P.Kundur, "Power System Stability and Control" McGraw Hill Education, 1994
2. Hadi Saadat, "Power System Analysis", TMH Edition.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
4. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER ELECTRONICS

Course Code: GR22A3013 **L/T/P/C: 3/0/0/3**
III Year I Semester

Course Outcomes:
1. Distinguish between signal level and power level devices and familiarize about the characteristics of power electronic switching devices.
2. Illustrate the performance of controlled rectifiers and AC-DC converters.
3. Analyze the steady state performance of DC-DC choppers.
4. Explain the switching states and instantaneous outputs of voltage source inverters.
5. Interpret the performance of the AC-AC converters.

UNIT I
POWER SWITCHING DEVICES
Diode, Thyristor, MOSFET, IGBT: V-I Characteristics; R, RC, UJT firing circuits for thyristor; Line and forced commutation circuits of a thyristor; Gate drive circuits for MOSFET and IGBT.

UNIT II
AC-DC CONVERTERS
Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load, Numerical Problems, Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

UNIT III
DC-DC CONVERTERS
Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage, Numerical Problems.

UNIT IV
DC-AC CONVERTERS
Power circuit of single-phase voltage source inverter, switching states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage.
Power circuit of a three-phase voltage source inverter: (120-degree mode), switching states, instantaneous output voltages, average output voltages, Numerical Problems.

UNIT V
AC-AC CONVERTERS
AC Voltage controller with R and RL loads - numerical problems. Cyclo-converters: step up cyclo converters; step down cyclo converters, numerical problems.

Textbooks
1. M. H. Rashid, “Power Electronics: Circuits, Devices, and Applications”, Pearson Education India, 2009
2. P. S. Bimbhra, “Power Electronics”, Khanna Publishers.

References

1. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.
2. B K.Bose “Modern power Electronics and AC Drives” Prentice Hall India Learning Private Limited, 2005.
3. N. Mohan and T. M. Undeland, “Power Electronics: Converters, applications and Design”, John Wiley & Sons, 2007.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER DISTRIBUTION AND PROTECTION

Course Code: GR22A3014 **L/T/P/C: 3/0/0/3**
III Year I Semester

Course Outcomes:
1. Analyze the concepts of Power Distribution system.
2. Describe various substation layouts.
3. Classify various types of Protective Relays and identify their applications.
4. Summarize various protection schemes for power system components.
5. Identify reasons for the generation of over-voltages and components protections.

UNIT I
D.C. DISTRIBUTION & A.C DISTRIBUTION
Classification of DC Distribution Systems. - Comparison of DC vs. AC, Under-Ground vs. Over-Head Distribution Systems. - Requirements and Design features of Distribution Systems.
-Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed at one end and both ends (equal/unequal Voltages) and Ring Main Distributor.

Introduction of AC distribution, Single phase, 3-phase, 3 phases 4 wire system, bus bar arrangement, Selection of site for substation. Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

UNIT II
SUBSTATIONS
Classification of Substations, Comparison of Outdoor and Indoor Sub-stations, Transformer Sub-stations, Pole mounted Sub-stations, Underground Sub-stations, Equipment in a transformer sub-station and its symbols, Bus-bar Arrangements in Sub-stations, Terminal and Through Sub-stations, Key diagrams of 66/11 kV & 11 kV/400 V indoor Sub-station.

UNIT III
PROTECTIVE RELAYS
Fundamental requirements of Protective Relaying, Principle of Operation and Construction of Attracted armature, Balanced Beam, induction Disc and Induction Cup relays.
Relays Classification: Instantaneous, DMT and IDMT types.
Application of relays: Over current/ Under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays. Universal torque equation, Distance relays: Impedance, Reactance and Mho and Off-Set Mho relays, Characteristics of Distance Relays and Comparison.

UNIT IV
CIRCUIT BREAKERS
Arcing phenomenon and arc interruption, DC and AC circuit breaking, restriking voltage and recovery voltage, rate of rise of recovery voltage, resistance switching, current chopping, interruption of capacitive current, Types of circuit breakers – air blast, oil, SF6, vacuum circuit breakers, MCBs, MCCBs, comparison of different circuit breakers, Rating and selection of Circuit breakers.

UNIT V
OVER VOLTAGE PROTECTION AND INSULATION COORDINATION
Over voltage due to arcing ground and Peterson coil, lightning, horn gaps, surge diverters, rod gaps,

expulsion type lightning arrester, valve type lightning arrester, ground wires, ground rods, counter poise, surge absorbers, insulation coordination, volt-time curves.

Textbooks

1. C.L.Wadhwa " Electrical Power systems :New age Publishers 7th Edition 2017.
2. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.

References

1. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.
2. Sunil S. Rao, 'Protective Switch Gear', Khanna Publishers, New Delhi, 13th Edition, 2008.
3. Badri Ram and Vishwakarma, D.N., 'Power System Protection and Switchgear', Tata McGraw Hill Publishing Company Ltd., 2nd Edition, 2011.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTRICAL AND HYBRID VEHICLES
(PROFESSIONAL ELECTIVE -I)

Course Code: GR22A3015 **L/T/P/C: 3/0/0/3**
III Year I Semester

Course Outcomes:
1. Summarize the Economic Aspects of EVs compared to ICEs.
2. Explain the braking system in EVs and HEVs.
3. Identify various hybrid drive-train topologies.
4. Analyze the configuration and control of different motor drives.
5. Interpret the different possible ways of energy storage requirements in Hybrid and Electric Vehicles.

UNIT I
ENVIRONMENTAL IMPACT AND HISTORY OF MODERN TRANSPORTATION
Air Pollution and Global Warming, social and environmental importance and Impact of hybrid and electric vehicles, History of Electric Vehicles, History of Hybrid Electric Vehicles, History of Fuel Cell Vehicles.

UNIT II
BRAKING FUNDAMENTALS AND REGENERATIVE BRAKING IN ELECTRIC VEHICLES
General Description of Vehicle Movement, Vehicle Resistance, Dynamic Equation, Tire–Ground Adhesion and Maximum Tractive Effort, Power Train Tractive Effort and Vehicle Speed, Vehicle Power Plant and Transmission Characteristics, Brake Performance.
Braking Energy Consumed in Urban Driving, Importance of Regenerative Braking in Electric and Hybrid Vehicles.

UNIT III
INTRODUCTION TO ELECTRIC AND HYBRID ELECTRIC VEHICLES
Hybrid Electric Drivetrains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies; Introduction to pure EV's (BEV, FCV).

UNIT IV
ELECTRIC PROPULSION SYSTEMS
Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration, and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT V
ENERGY STORAGE REQUIREMENTS IN HYBRID AND ELECTRIC VEHICLES
Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

Textbooks
1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.

2. Iqbal Hussain, “Electric & Hybrid Vehicles – Design Fundamentals”, Second Edition, CRC Press, 2011.

References

1. Hybrid Vehicles and the future of personal transportation, Allen Fuhs, CRC Press, 2011.
2.Vehicle Power Management: Modelling, Control and Optimization, Xi Zhang, Chris Mi, Springer,2011.
3. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SOLAR AND WIND ENERGY SYSTEMS
(PROFESSIONAL ELECTIVE -I)

Course Code: GR22A3016 **L/T/P/C: 3/0/0/3**
III Year I Semester

Course Outcomes:
1. Outline the fundamental concepts of solar energy.
2. Develop the design considerations of solar thermal power generation.
3. Explain the operation of power electronic converters with Photovoltaics.
4. Illustrate power generation and characteristics of wind system.
5. Analyze performance of various turbines in wind power generation.

UNIT I
SOLAR RESOURCE
Introduction, solar radiation geometry and measurement, solar day length, Estimation of solar energy availability, Hourly Global, Diffuse and Beam Radiation on Horizontal Surface under Cloudless Skies, Solar Radiation on Inclined Plane Surface.

UNIT II
SOLAR THERMAL POWER GENERATION
Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, Elementary analysis.

UNIT III
SOLAR PHOTOVOLTAIC GENERATION
Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms, Converter Control, Simulation of Power Electronics Converters with Solar PV system.

UNIT IV
PHYSICS OF WIND POWER
History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power- cumulative distribution functions.

UNIT V
WIND GENERATOR TOPOLOGIES
Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent Magnet Synchronous Generators, Power electronics converters, Simulation of Power Electronics Converters for Wind Energy systems.

Textbooks
1. Ranjan, D.P.Kothari, “Renewable Energy Sources and Emerging Technologies” 2nd edition, PHI.
2. G.D Rai “Non – Conventional Energy Resources”, 3rd Edition Khanna Publishers.

References
1. S. P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, McGraw Hill, 1984.
2. G. N. Tiwari and M. K. Ghosal, “Renewable Energy Applications”, Narosa Publications, 2004.

3. B.H.Khan, “Non- Conventional Energy Resources”, 2nd edition, Tata McGraw-Hill, New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTRICAL MACHINE DESIGN
(PROFESSIONAL ELECTIVE -I)

Course Code:GR22A3017 **L/T/P/C: 3/0/0/3**
III Year I Semester

Course Outcomes:
1. Explain the performance parameters of electrical machines.
2. Outline the various factors which influence the design.
3. Analyze Electrical, Magnetic and Thermal loading of Induction Machines.
4. Summarize the principles of electrical machine design and carry out a basic design of Synchronous machine.
5. Make use of software tools for Electrical Machine Design.

UNIT I
Introduction to major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT II
Transformers Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT III
Induction Motors Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

UNIT IV
Synchronous Machines Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

UNIT V
Computer aided Design (CAD): Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

Textbooks
1. A. K. Sawhney, “A Course in Electrical Machine Design”, Dhanpat Rai and Sons, 1970.
2. M.G. Say, “Theory & Performance & Design of A.C. Machines”, ELBS London.

References
1. S. K. Sen, “Principles of Electrical Machine Design with computer programmes”, Oxford and IBH Publishing, 2006.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
OPERATIONS RESEARCH
(PROFESSIONAL ELECTIVE -I)

Course Code: GR22A3018 **L/T/P/C: 3/0/0/3**
III Year I Semester

Course Outcomes:
1.Apply the various linear programming techniques for optimal allocation of limited resources such as machine, material and money.
2. Solve transportation problems to minimize cost and understand the principles of assignment of jobs and recruitment policies.
3.Solve sequencing problems and to distinguish various inventory models and develop proper inventory policies
4. Apply game theory to analyze various business competitions and analyze the various waiting line oriented situations.
5. Develop optimum replacement policy and Dynamic Programming Techniques.

UNIT I
Introduction: Development – Definition– Characteristics and Phases of operations Research– Types of models – operation Research models– applications.
Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

UNIT II
Transportation models: Formulation – Methods for finding feasible solutions; North west corner rule, Least cost entry method, Vogel's approximation method. Optimal solution; MODI method. Unbalanced transportation problem and Degeneracy.
Assignment models - Formulation – Optimal solution - Variants of Assignment Problem

UNIT III
Sequencing: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.
Inventory: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be a discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

UNIT IV
Theory of games: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle– m X 2 and 2 X n games -graphical method.
Waiting lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

UNIT V
Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not

counted and counted – Replacement of items that fail completely, group replacement.

Dynamic programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

Textbooks:

1. Operations Research - Prem Kumar Gupta and D S Hira/ S Chand Publishing/ 2015
2.Operations Research / S. D.Sharma/KedarNath RamNath Publication/2020

References:

1. Operations Research / R.Panneerselvam, 3rd Edition/PHI Publications/ 2023
2. Operations Research An Introduction - Hamdy A Taha/8 th Edition/ Prentice Hall/2006
3. Principles of Operations Research: With Applications to Managerial Decisions – Harvey M. Wagner/Prentice-Hall Operations Research/2020
4. Operations Research - Kanthi Swarup, P.K. Gupta, Man Mohan Sultan Chand & Sons/ 2019
5. Operations Research/A.M.Natarajan, P.Balasubramani,A.Tamilarasi/Pearson Education/2006

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER SYSTEMS LAB

Course Code: GR22A3020 **L/T/P/C: 0/0/3/1.5**
III Year I Semester

Course Outcomes:
1. Illustrate different components related to power system protections.
2. Distinguish the characteristics of different relays.
3. Determine transmission line model parameters.
4. Make use of suitable relay for distance protection.
5. Analyze transmission line performance using appropriate transmission line model.

LIST OF EXPERIMENTS

Task-1: Characteristics of Over Current relay for Phase fault.

Task-2: Characteristics of Over Current relay for Earth fault.

Task-3: Characteristics of Induction Disc type Relay.

Task-4: Testing of Differential Relay.

Task-5: Characteristics of Over Voltage Relay.

Task-6: Characteristics of Under Voltage Relay.

Task-7: Testing of Negative sequence Relay.

Task-8: To determine Efficiency and Regulation of 3 Phase Transmission model.

Task-9: Determination of ABCD parameters for short, medium, and long lines.

Task-10: Ferranti effect of a Transmission line.

Task-11: Zones Protection using Distance Relay.

Task-12: Reactive power compensation of a Transmission line.

Textbooks
1. C.L.Wadhwa " Electrical Power systems :New age Publishers 7th Edition 2017.
2. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.

References
1. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.
2. Sunil S. Rao, 'Protective Switch Gear', Khanna Publishers, New Delhi, 13th Edition, 2008.
3. Badri Ram and Vishwakarma, D.N., 'Power System Protection and Switchgear', Tata McGraw Hill Publishing Company Ltd., 2nd Edition, 2011

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER ELECTRONICS LAB

Course Code:GR22A3021 **L/T/P/C: 0/0/4/2**
III Year I Semester

Course Outcomes:
1. Choose appropriate switching devices and firing circuits based on their characteristics and application.
2. Analyze the operation of different phase-controlled converters.
3. Interpret the performance of single-phase Induction motor.
4. Evaluate the operation of Inverters and Cyclo-converters.
5. Judge the performance of AC voltage controllers through virtual platforms.

LIST OF EXPERIMENTS

Task-1: Study of Characteristics of SCR, IGBT, MOSFET.

Task-2: Analysis of Single-phase Half Controlled Converter with R-load.

Task-3: Analysis of Single-phase Fully Controlled Converter with R-load.

Task-4: Open loop analysis of Buck Converter.

Task-5: Open loop analysis of Boost Converter.

Task-6: Analysis of Single-phase Full Bridge Inverter with R & RL load.

Task-7: Analysis of Single-phase Cyclo-converter with R & RL load.

Task-8: Analysis of Three Phase Fully Controlled Converter.

In addition to the above experiments, any two from the following list shall be demonstrated.

Simulation of

Task-9: Analysis of R, RC & UJT firing circuits.

Task-10: Analysis of Single-Phase AC Voltage Controller.

Task-11: Analysis of Three Phase Half Controlled Con-verter.

Task-12: Open loop analysis of Buck-Boost Converter.

Task-13: Speed control of single-phase Induction Motor.

Textbooks

1.M. H. Rashid, “Power Electronics: Circuits, Devices, and Applications”, Pearson Education India 2009.
2. P. S. Bimbhra, “Power Electronics”, Khanna Publishers.

References

1. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.
2. B K.Bose “Modern power Electronics and AC Drives” Prentice Hall India Learning Private Limited,2005.
3.N. Mohan and T. M. Undeland, “Power Electronics: Converters, applications and Design”, John Wiley & Sons, 2007.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MICROPROCESSORS AND MICROCONTROLLERS LAB

Course Code:GR22A3022 **L/T/P/C: 0/0/3/1.5**
III Year I Semester

Course Outcomes:
1. Illustrate the assembly level language programming to microprocessors.
2. Model circuits for interfacing different modules to microcontrollers.
3. Infer various programming languages for different microcontrollers.
4. Experiment with different types of communicating devices.
5. Test for various programs which can control different electrical components.

LIST OF EXPERIMENTS

Task-1: Program for 16-bit arithmetic operations for 8085/8086 microprocessor.

Task-2: Program for sorting an array for 8085/8086 microprocessor.

Task-3: Program for string manipulations for 8085/8086 microprocessor.

Task-4: Interfacing LED's using 8051 microcontrollers.

Task-5: Interfacing LCD & Keypad using 8051 microcontrollers.

Task-6: Interfacing DC Motor using 8051 microcontrollers.

Task-7: Switches and LED's interfacing to ATmega microcontrollers.

Task-8: LCD/OLED interfacing to ATmega microcontrollers.

Task-9: Serial Communication with ATmega microcontrollers.

Task-10: Device control using ATmega microcontrollers.

Task-11: DC Motor control using ATmega microcontrollers.

Task-12: Bluetooth interfacing with ATmega microcontrollers.

Textbooks

1.Advanced Microprocessors and Peripherals, A. K. Ray and K. M. Bhurchandani, 2nd Edition, Tata McGraw-Hill, 2006.
2. Microprocessors and Interfacing, D.V. Hall, 2nd Edition, Tata McGraw-Hill, 2006.

References

1."The 8051 Microcontroller and Embedded Systems using Assembly and C"– Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, 2nd Edition, Pearson Education, 2008.
2. Microcontrollers: Theory and Applications, Ajay V. Deshmukh, Tata McGraw-Hill Education, 2005.
3. The 8051 Microcontroller, Kenneth J. Ayala, 3rd Edition, Cengage Learning, 2010.

III YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING

Course Code: GR22A3090 **L/T/P/C: 3/0/0/3**
III Year II Semester

Course Outcomes:
1. Outline digital signals and reconstruction of signals through Sampling theorem.
2. Analyze Linear Shift Invariant systems using z-transform, properties of z-transform and its stability.
3. Identify the different types of Frequency domain analysis and their algorithms.
4. Distinguish between FIR and IIR Digital Filters along with their types.
5. Illustrate the advantage of optimal filter designing in estimating the signals from corrupted with noise.

UNIT I
DISCRETE-TIME SIGNALS AND SYSTEMS
Discrete time signals and systems: Sequences representation; Representation of discrete systems using difference equations, Natural Sampling Method, reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

UNIT II
Z-TRANSFORM
z-Transform, Analysis of Linear Shift Invariant systems using z-transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

UNIT III
DISCRETE FOURIER TRANSFORM
Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT: Periodicity, Circular Convolution of signals, Fast Fourier Transform Algorithm: Direct Computation of DFT, Radix-2 FFT algorithms, Implementation of FFT algorithms.

UNIT IV
DESIGN OF DIGITAL FILTERS
Design of FIR Digital filters: Window method, Frequency Sampling Method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-Pass, Band- Stop and High Pass Filters.

UNIT V
APPLICATIONS OF DIGITAL SIGNAL PROCESSING
Random Process, Stationary Random Process, Power Density spectrum, Correlation-Ergodic Process, Innovations representations of a Stationary Random Process: Rational Power Spectra, Optimal filtering using ARMA Model, Weiner Filter, Linear Mean-Square Estimation.

Textbooks
1. A.V. Oppenheim and R. W. Schafer, “Discrete Time Signal Processing”, Prentice Hall, 1989.
2. J. G. Proakis and D.G. Manolakis, “Digital Signal Processing: Principles, Algorithms And Applications”, Prentice Hall, 1997.

References
1. J. R. Johnson, “Introduction to Digital Signal Processing”, Prentice Hall, 1992.
2. D. J. DeFatta, J. G. Lucas and W. S. Hodgkiss, “Digital Signal Processing”, John Wiley & Sons, 1988.

3. L. R. Rabiner and B. Gold, “Theory and Application of Digital Signal Processing”, Prentice Hall, 1992.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SENSORS MEASUREMENTS AND INSTRUMENTATION

Course Code:GR22A3091 **L/T/P/C: 2/1/0/3**
III Year II Semester

Course Outcomes:
1. Illustrate the fundamentals and measurement of different electrical quantities.
2. Solve unknown electrical parameters using Bridges and Meters.
3. Summarize functioning of Oscilloscopes and the usage of Digital voltmeters.
4. Identify the working principles of various Sensors/Transducers.
5. Analyze usage of various Sensors/Transducers in real time applications.

UNIT I
FUNDAMENTALS OF ELECTRICAL MEASUREMENTS
Ammeters & Voltmeters PMMC & Moving Iron Instruments C.T.s and PTs Ratio and Phase angle errors. Measurement of Power and power factor. Measurement of Active and Reactive power.

UNIT II
MEASUREMENT OF ENERGY AND OTHER ELECTRICAL QUANTITIES
Single phase & Three phase energy meters, Crompton's Potentiometer, AC potentiometers. Measurement of resistance, Inductance and Capacitance by bridges: Wheatstone bridge, Kelvin Double Bridge, Maxwell's Bridge, Anderson's bridge, Desauty's Bridge, Schering Bridge Derivations only.

UNIT III
OSCILLOSCOPE AND DIGITAL VOLTMETERS
Components of Cathode Ray Oscilloscope: Time base Generator, Horizontal & Vertical Amplifier, Electrostatic Deflection. Measurement of phase and frequency. Sampling Oscilloscope, Digital Storage Oscilloscope. Digital Voltmeters- Successive Approximation, Ramp, Dual slope Integration.

UNIT IV
SENSOR FUNDAMENTAL PRINCIPLES
Sensors / Transducers, Principle, Types, Basic Requirements, Classification, Selection, Resistive type, Inductive type and Capacitive type. Linear Variable Differential Transducer (LVDT), Strain Gauge (Elementary).

UNIT V
SENSOR APPLICATIONS
Introduction and Working Principles: Flow - rate sensors: Displacement Flow Sensors, Velocity Flow Sensors, Thermistors and Thermocouples, Ultrasonic sensor, Acceleration Sensors.

Textbooks
1.A.K.Shawney, "Electrical and Electronic Measurement and Instruments", Dhanpat Rai & Sons Publications.
2. D. Patranabis, "Sensors and Transducers", PHI Publications.

References
1. S. J. Prosser, E. Lewis, "Sensors and Their Applications", CRC Press.
2. Er. R K Rajput, "Electrical Measurements and Measuring Instruments", S.Chand Publishing.
3. Ernest O Doebelin, "Measurement Systems", Mc Graw Hill Publishers.

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

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

Course Outcomes:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

Textbooks

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

References

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
MODERN POWER ELECTRONICS
(PROFESSIONAL ELECTIVE -II)

Course Code: GR22A3092 **L/T/P/C: 3/0/0/3**
III Year II Semester

Course Outcomes:
1. Illustrate modern power semiconductor devices.
2. Interpret power electronic resonant converters in power control applications.
3. Compare the performance and control of multi-level inverters.
4. Explain the performance of DC power supplies.
5. Analyze the fundamental concepts of AC power supplies and UP.

UNIT I
MODERN POWER SEMICONDUCTOR DEVICES
Modern power semiconductor devices- MOS turn Off Thyristor (MTO) - Emitter Turn Off Thyristor (ETO) Integrated Gate- Commutated Thyristor (IGCTs)-MOS-controlled Thyristors (MCTs)-Static Induction circuit comparison of their features.

UNIT II
RESONANT PULSE INVERTERS
Resonant pulse inverters-series resonant inverters- with unidirectional & Bidirectional switches. Analysis of half bridge resonant inverter - evaluation of currents and Voltages of a simple resonant inverter-Analysis full bridge resonant inverter with bidirectional switches.

UNIT III
MULTILEVEL INVERTERS
Multilevel concept-Classification of multilevel inverters- Diode clamped multilevel inverter-principle of operation, main features. Improved Diode Clamped inverter-principle of operation- Flying capacitors multilevel inverter principle of operation-main features.

UNIT IV
DC POWER SUPPLIES
DC power supplies-classification-switched mode dc power supplies-fly back Converter - forward converter- push pull converter-half bridge converter-Full bridge converter-Resonant dc power supplies-bidirectional dc power supplies-Applications.

UNIT V
AC POWER SUPPLIES
AC power supplies classification-switched mode ac power supplies. Resonant AC power supplies-bidirectional ac power supplies-multistage conversions-control circuits-applications. Introduction-power line disturbances-power conditioners-uninterruptible Power supplies applications.

Textbooks
1. M. H. Rashid, “Power Electronics: Circuits, Devices, and Applications”, Pearson Education India, 2009.
2. P. S. Bimbhra, “Power Electronics”, Khanna Publishers.

References
1. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.

2. B K.Bose “Modern power Electronics and AC Drives” Prentice Hall India Learning Private Limited, 2005.
3. N. Mohan and T. M. Undeland, “Power Electronics: Converters, applications and Design”, John Wiley & Sons, 2007.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
HVDC TRANSMISSION SYSTEMS
(PROFESSIONAL ELECTIVE -II)

Course Code:GR22A3093 **L/T/P/C: 3/0/0/3**
III Year II Semester

Course Outcomes:
1. Compare the differences between HVDC and HVAC transmission.
2. Analyze the rectifier and inverter commutating circuits.
3. Discuss the different control strategies.
4. Identify suitable filters to eliminate harmonics in HVDC system.
5. Explain the impact of faults on the performance of HVDC system.

UNIT I
HVDC TRANSMISSION
Introduction, equipment required for HVDC systems, Comparison of AC and DC Transmission, Limitations of HVDC transmission lines, reliability of HVDC systems, comparison of HVDC link with EHVAC link, HVDC convertors, HVDC –VSC transmission System: VSC system components, Control of Active and reactive power, Applications of VSC systems.

UNIT II
HVDC CONVERTORS OPERATION AND ANALYSIS
Thyristors and their characteristics, silicon rectifiers IGBT's ,HVDC voltage source converters principle and operation , 6 pulse convertor configuration, ideal communication process without gate control, DC output voltage , gate control of valves, analysis of voltage wave forms with overlap angle, analysis of communication circuits , equivalent circuit of rectifier, Inverter operation with overlap, Equivalent circuit of inverter , complete equivalent circuit of HVDC link, power factor and reactive power of converters, analysis of 12 pulse converter, power flow in HVDC links, Power flow and current control , power loss in DC systems, operation and analysis of VSC converters, VSC inverter operation , power flow in VSC-DC transmission, comparison between CSC(classical HVDC) and VSC-HVDC system.

UNIT III
HVDC CONVERTER CONTROL
AC transmission and its control , necessary of dc link control, rectifier control , inverter control , constant beta control, constant gamma control, compounding of rectifiers, current compounding of inverter , complete HVDC system characteristics , power reversal in DC link, voltage dependent current order limit(VDCOL), system control hierarchy ,individual phase control, cosine control of phase delay, linear control phase delay , equidistance pulse control, pulse frequency control , constant current control, inverter exhibition angle control, constant power control, control system for HVDC converter ,inverter operation problem, control of VSC converters.

UNIT IV
HARMONICS IN HVDC SYSTEM
Harmonics due to converter, characteristic current harmonics in the 12 pulse converter ,
harmonics in VSC converter , harmonic model and equivalent circuit ,design of AC filters , single tuned and double tuned high pass filters , second order filters and C-Type filter, Reactive power considerations of AC filters , Active filters and their applications, filters with VSC-HVDC schemes.

UNIT V
FAULTS AND PROTECTION SCHEMES IN HVDC SYSTEMS
3-phase symmetrical fault and asymmetrical faults, commutation failure, DC Faults with Two-Level

VSC, DC circuit breaker, Protection against Over currents/Over voltages, Multi Terminal HVDC system: series and parallel MTDC systems and their operation and control, AC-DC system interaction short circuit rates and its effects. Advantages and Problems with ground return.

Textbooks

1. HVDC transmission by S Kamakshaiah and V Kamaraju, Tata McGraw Hills Publications.
2. K.R.Padiyar., HVDC Power Transmission System(English) 2nd edition.

References

1. Arillaga., High Voltage Direct Transmission, (London)Peter Peregrinus, 1981.
2. High Voltage Direct Current Transmission: Converters, Systems and DC Grids, Dragan Jovcic, Khaled Ahmed, Wiley Publishers, 2015.
3. Direct Current Transmission, Edward Wilson Kimbark, Vol-1, John Wiley & Sons, 1971.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ADVANCED CONTROL SYSTEMS
(PROFESSIONAL ELECTIVE –II)

Course Code: GR22A3094 **L/T/P/C:3/0/0/3**
III Year II semester

Course Outcomes:
1. Develop controllers using state feedback and pole placement techniques.
2. Analyze the stability of Linear and Nonlinear continuous time systems.
3. Examine the stability analysis of nonlinear control systems using Lyapunov method.
4. Demonstrate non-linear system behavior by phase plane and describing function methods.
5. Infer optimal control problems for linear and nonlinear systems.

UNIT I
STATE FEEDBACK CONTROLLER AND STATE OBSERVERS
Design of state feedback controller using pole placement technique, Ackerman's formula, Stability Improvements by State Feedback, Necessary and Sufficient Conditions for Arbitrary Pole Placement, Design of State Observer, Compensator Design by the Separation Principle.

UNIT II
NON-LINEAR SYSTEMS ANALYSIS
Introduction, Common Nonlinear System Behaviours, Common Nonlinearities in Control Systems, Fundamentals, Describing Functions of Common Nonlinearities, Stability Analysis by Describing Function Method, Concept of Phase Plane Analysis, Construction of Phase Portraits, System Analysis on the Phase Plane.

UNIT III
LIAPUNOV STABILITY ANALYSIS
Stability of Equilibrium State in the Sense of Liapunov, Graphical Representation of Stability, Asymptotic Stability and Instability, Sign-Definiteness of Scalar Function, Second Method of Liapunov, Stability Analysis of Linear Systems, Krasovski's Theorem, Liapunov Function Based on Variable Gradient Method

UNIT IV
DESCRIBING FUNCTION ANALYSIS
Describing Functions for Common Types of Nonlinearities, Describing Function Analysis, Stability and Limit Cycles.

Phase Plane Analysis
Analytical Methods for constructing Trajectories, Graphical Methods for constructing Trajectories, Isocline Method, Delta Method, Pell's Method, Lienard's Method, Classification of Singular Points, Phase-Plane Analysis of Linear control system, Phase-plane Analysis of Non-linear control system, Minimum Time Trajectory, Optimum Switching Curve.

UNIT V
OPTIMAL CONTROL THEORY
Introduction, Optimal control problems, Mathematical procedures for optimal control
design: Calculus of variations, Pontryagin's optimum policy, Bang-Bang Control, Hamilton-Jacobi Principle.

Textbooks
1. B. N. Sarkar, "Advanced Control Systems", PHI Learning Private Limited.

2. Hassan K Khalil, “Nonlinear Systems”, Prentice Hall Publications.

References

1. S.K Bhattacharya, “Control Systems theory and applications”, Pearson India.
2. M. Gopal, Control System Principles and Design Tata – McGraw Hill, 1997.
3. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Eleventh Edition, Prentice Hall, Pearson Education, 2008.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
OPERATING SYSTEMS
(PROFESSIONAL ELECTIVE –II)

Course Code: GR22A2074 **L/T/P/C: 3/0/0/3**
III Year II Semester

Course Outcomes:
1. Explain different functions and types of operating system and implement various process management concepts for maximization of CPU throughput.
2. Analyze synchronization problems and design a deadlock management scheme.
3. Optimize memory management for improved system performance.
4. Demonstrate disk management, implement disk scheduling and file system interface.
5. Describe protection and security policies for OS.

UNIT I
Operating System Overview: Objectives and functions, Computer System Architecture, Evolution of Operating Systems, System Services, System Calls, System Programs, OS Structure, Virtual machines.
Process Management: Process concepts, CPU scheduling-criteria, Algorithms with evaluation, Preemptive / Non-Preemptive Scheduling, Threads, Multithreading Models**.**

UNIT II
Concurrency: Process synchronization, Critical-section problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic problems of synchronization, Monitors.
Deadlocks: Principles of deadlock–system model, Deadlock characterization, Deadlock prevention, Detection and Avoidance, Recovery from deadlock.

UNIT III
Memory Management: Swapping, Contiguous memory allocation, Paging, Structure of the page table, Segmentation.
Virtual Memory: Demand paging, Page replacement algorithms, Allocation of Frames, Thrashing.

UNIT IV
Mass-storage Structure: Overview of Mass-storage structure, Disk structure, Disk attachment, Disk scheduling, Swap-space management.
File System Implementation: Access Methods, File system structure, File system implementation, Directory implementation, Allocation methods, Free-space management.

UNIT V
Protection: Goals and Principles of Protection, Implementation of Access Matrix, Access control, Revocation of Access Rights.
Security: The Security problem, Program threats, System and network threats, Implementing security defenses.

Textbooks
1. Operating System Principles, 7th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.

References
1. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

2. Operating System: A Design-oriented Approach, 1st Edition b y Charles Crowley, Irwin Publishing
3. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison- Wesley
4. Modern Operating Systems, Andrew S Tanenbaum 3rd Edition PHI.
5. Operating Systems, R. Elmasri, A. G. Carrick and D. Levine, Mc Graw Hill.
6. Operating Systems in depth, T. W. Doeppner, Wiley.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER SYSTEMS ANALYSIS LAB

Course Code: GR22A3096 **L/T/P/C: 0/0/3/1.5**
III Year II Semester

Course Outcomes:
1. Construct Impedance and Admittance matrices using step by step procedure.
2. Solve load flow problems using a suitable numerical technique.
3. Analyze various faults in power system.
4. Determine the transient stability of a given power system.
5. Choose suitable protection scheme for transmission line protection.

LIST OF EXPERIMENTS

Task-1: Computation of line parameters.

Task-2: Formation of bus Admittance matrix.

Task-3: a) Load Flow solution using Newton Raphson method in polar coordinates.

b) Load Flow solution using Newton Raphson method in rectangular coordinates.

Task-4: Unsymmetrical fault Analysis: LG, LL, LLG Fault.

Task-5: Z–Bus Building Algorithm.

Task-6: a) Obtain Symmetrical Components of a set of Unbalanced currents.

b) Obtain the original Unbalanced phase voltages from Symmetrical Components

Task-7: Zones Protection.

Task-8: Short circuit analysis.

Task-9: Tripping sequence of protective devices.

Task-10: Transient Stability analysis.

Task-11: Power flow solution of power system model.

Task-12: Solution of Simultaneous differential equations by Modified Euler's method.

Textbooks
1. C. L. Wadhwa, "Electric Power Systems", New Age International.
2. I.J.Nagrath & D.P Kothari, "Modern Power System Analysis", Tata McGraw- Hill.

References
1. P.Kundur, "Power System Stability and Control" McGraw Hill Education, 1994.
2. Hadi Saadat, "Power System Analysis", TMH Edition.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SENSORS MEASUREMENTS AND INSTRUMENTATION LAB

Course Code: GR22A3097 **L/T/P/C: 0/0/3/1.5**
III Year II Semester

Course Outcomes:
1. Identify physical and electrical quantities using Sensors/Transducers.
2. Develop basic programs for computer-controlled data acquisition, measurement, and transfer of data across the sensor network for different types of sensors.
3. Illustrate experimental data by monitoring, capturing and interpretation.
4. Examine various output configurations using measuring instruments.
5. Determine the unknown values using various types of bridges.

LIST OF EXPERIMENTS

Task-1: Voltage and Current Detection Circuitry using AT mega microcontroller.

Task-2: Temperature, Pressure and Humidity Detection Circuitry.

Task-3: Measure One-cycle data of a periodic waveform from a DSO.

Task-4: Measurement of displacement with the help of LVDT/Pot.

Task-5: Measurement of distance with the help of Ultrasonic Sensor.

Task-6: Measurement of luminous intensity with the help of Light Sensor.

Task-7: Measurement of moist level using Soil Moisture Sensor and Rainfall Sensor.

Task-8: Measurement of Power and Energy in Single phase circuit.

Task-9: Measurement of three-dimensional coordinates using Accelerometer Sensor.

Task-10: Measurement of unknown Resistance by Kelvin double Bridge.

Task-11: Measurement of unknown Inductance by Anderson's Bridge.

Task-12: Measurement of unknown Capacitance by Desauty's Bridge.

Textbooks
1. Electrical and Electronic Measurement and Instruments by A.K.Shawney Dhanpat Rai & Sons Publications.
2. Sensors and Transducers By D. Patranabis , PHI Publications.

References
1. Sensors and Their Applications XII by S. J. Prosser, E. Lewis CRC Press.
2. Electrical Measurements and Measuring Instruments, by Er. R K Rajput by S. Chand Publishing.
3. Measurement Systems by Ernest O Doebelin by Mc Graw Hill.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MINI PROJECT

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

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

IV YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER SEMICONDUCTOR DRIVES

Course Code: GR22A4014 **L/T/P/C: 2/1/0/3**
IV Year I Semester

Course Outcomes:
1. Analyze 1Φ & 3Φ converters fed DC motors and categorize the electric drive system based on the applications.
2. Identify various modes of operation for electrical drives.
3. Examine the performance characteristics of converter fed and chopper fed DC motor drives.
4. Illustrate speed control techniques of an induction motor drive for real time applications.
5. Compare Separate control and self-control of synchronous motors drive.

UNIT I
PHASE CONTROLLED CONVERTER FED DC MOTOR
Introduction to Thyristor controlled Drives, single phase semi and full controlled converters connected to DC separately excited and DC series motors – continuous current operation – output voltage and current waveforms – speed and torque expressions – speed-torque – characteristics – problems on converter fed DC motors. Three phase semi and fully controlled connected to DC separately excited and DC series motors - output voltage and current waveforms – speed and torque expressions – speed –torque characteristics – problems.

UNIT II
FOUR QUADRANT OPERATION OF DC DRIVES
Introduction to four quadrant operation – motoring operations, electric braking – plugging, dynamic and regenerative braking operations. Four quadrant operation of DC motors by dual converters – Closed loop control of DC motor (block diagram only).

UNIT III
CONTROL OF DC MOTORS BY CHOPPERS
Single quadrant, two quadrant and four quadrant chopper fed dc separately excited and series motors – continuous current operation – voltage and current waveforms – speed torque expressions and characteristics – problems – closed loop operation (block diagram only).

UNIT IV
CONTROL OF INDUCTION MOTOR
Variable voltage characteristics – control of induction motor by Ac voltage controllers – waveforms – speed torque characteristics. Variable frequency characteristics – variable frequency control of induction motor by voltage source and current source inverter and cyclo converters – PWM control of VSI and CSI – comparison of VSI and CSI operations - speed torque characteristics – problems on induction motor drives - closed loop operation of induction motor drives (block diagram only). Static rotor resistance control – slip power recovery – static scherbius drive – static Kramer drive – their performance and speed torque characteristics – advantages -applications – problems.

UNIT V
CONTROL OF SYNCHRONOUS MOTOR
Separate control & self-control of synchronous motors – operations of self-controlled synchronous motors by VSI and CSI, Cycloconverters. Load commutated CSI fed synchronous motor – operation – waveforms – speed torque characteristics – applications- advantages and problems- Closed loop control operation of synchronous motor drives (block diagram only)

Textbooks

1. B. K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education, Asia, 2003.
2. Dubey G. K. “Power semiconductor control drives” Prentice Hall, Englewood Cliffs, New Jersey, 1989.

References

1. G. K. Dubey, “Fundamentals of Electrical Drives”, CRC Press, 2002.
2. R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall, 2001.
3. Simulation of Power Electronic Circuits, M.B. Patil, V. Ramanarayanan, V.T. Ranganathan, Narosa Publications, 2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
WIDE BAND GAP POWER DEVICES
(PROFESSIONAL ELECTIVE -III)

Course Code: GR22A4015 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Compare SI based devices with wideband gap power devices.
2. Demonstration of GAN characteristics.
3. Illustrate characteristics of SIC devices.
4. Develop GAN based power electronics circuits.
5. Construct SIC based circuits for different power electronics applications.

UNIT I
INTRODUCTION OF DEVICES
Introduction to basic power devices, Fundamentals of semiconductors, Introduction of Wind band gap devices SiC, GaN, C(Diamond), necessity of wind band Gap, advantage of wide band gap semiconductors, Ideal specific on-resistance for Si and WBG devices, Material properties of Si and WBG semiconductors

UNIT II
GAN DEVICES
Fabrication of GaN Devices, Characterization, and modelling GaN devices, Switching Characteristics, Advantages of GaN over si power semiconductors, Driver design considerations for high power applications, Design for breakdown voltage – various edge terminations

UNIT III
SIC DEVICES
Fabrication of SiC Devices, Characterization and modelling SiC devices, Switching Characteristics, Advantages of SiC over silicon power semiconductors, Si and SiC vertical power and trench MOSFETs, Si and SiC Schottky diodes, Si and SiC PiN diodes, Driver design considerations for High frequency and High voltage applications.

UNIT IV
GAN APPLICATIONS
Consumer applications, Industrial applications, energy converters, Electric Vehicles, white goods, and battery chargers.

UNIT V
SIC APPLICATIONS
High efficiency inverters for solar and wind power, power converters for electric and hybrid vehicles, power inverters for Industrial equipment's, high voltage switches for X-ray generators.

Textbooks
1.Mohan, Undeland and Robbins, "Power Electronics: Converters, Applications and Design", John's Wiley and Sons.
2. B Jayant Balija, Fundamentals Power Electronic Devices, Springer.

References
1. B Jayant Balija, SIC Devices, world Scientific Publishing, 2005.

2. Fei (Fred) Wang, Zheyu Zhang, and Edward A. Jones, Characterization of Wide Bandgap Power Semiconductor Devices, IET ENERGY ENGINEERING.
3. B. W. Williams, Power Electronics: Devices, Drivers, Applications, and Passive Components, TMH.

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

Course Code: GR22A4016 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Explain the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.
2. Categorize the different methods of breakdown mechanisms that occur on application of high voltages.
3. Interpret various methods for generating high voltages and currents.
4. Identify the procedures for the measurement of high D.C., A.C. & Impulse voltages and currents.
5. Analyze various tests to be conducted on HV equipment.

UNIT I
BREAKDOWN IN GASES
Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Paschen's law, Corona discharge.

UNIT II
BREAKDOWN IN LIQUID AND SOLID INSULATING MATERIALS
Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials in transformers, rotating machines, circuit breakers and bushings.

UNIT III
GENERATION OF HIGH VOLTAGES
Generation of high voltages, Rectifier circuits, Cockcroft-Walton voltage multiplier circuit, electrostatic generator, generation of high AC voltage by cascaded transformers, series resonant circuit, tripping and control of impulse generators.

UNIT IV
MEASUREMENTS OF HIGH VOLTAGES AND CURRENTS
Introduction, generating voltmeter, capacitive voltage transformer, electrostatic voltmeter, spark gaps for measurement of impulse voltages, measurement of high DC, AC and impulse currents – hall generator, current transformer, Rogowski coil, Cathode ray oscillographs for impulse voltage and current measurement.

UNIT V
HIGH VOLTAGE TESTING OF ELECTRICAL APPARATUS AND HIGH VOLTAGE LABORATORIES
Various standards for HV Testing of electrical apparatus, IS, IEC standards, testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

Textbooks
1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering", McGraw Hill Education, 2015.
2. C. L. Wadhwa, "High Voltage Engineering", New Age International Publishers, 2007.

References

1.Küchler, Andreas. High Voltage Engineering: Fundamentals-Technology-Applications. Springer, 2017.
2.E. Kuffel, W. S. Zaengl and J. Kuffel, “High Voltage Engineering Fundamentals”, Newnes, Publication,2000.
3. Rizk, Farouk AM, and Giao N. Trinh. “High voltage engineering”. CRC Press, 2018.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DIGITAL CONTROL SYSTEMS
(PROFESSIONAL ELECTIVE -III)

Course Code: GR22A4017 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Develop the mathematical model of LTI systems.
2. Interpret the stability of open loop and closed loop discrete-time systems.
3. Analyze the controllability and observability of discrete time system.
4. Construct digital controllers for time invariant systems.
5. Model state feedback and output feedback controllers.

UNIT I
DISCRETE REPRESENTATION OF CONTINUOUS SYSTEMS
Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent. Z-Transform and Inverse Z Transforms.

UNIT II
DISCRETE SYSTEM ANALYSIS AND STABILITY OF DISCRETE TIME SYSTEM Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system. Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.

UNIT III
STATE SPACE APPROACH FOR DISCRETE TIME SYSTEMS
State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Re-Constructability and observability analysis. Effect of pole zero cancellation on the controllability & observability.

UNIT IV
DESIGN OF DIGITAL CONTROL SYSTEM
Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.

UNIT V
DESIGN OF DIGITAL CONTROL USING STATE SPACE CONCEPTS
Formulation of the Optimal Control Problem, Optimal State Regulator, Use of State Regulator results to solve other optimal control problems, Eigen value Assignments by state feedback. State Observers, Stochastic Optimal Sate Estimations.

Textbooks
1. K. Ogata, “Digital Control Engineering”, Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988.

References
1. G. F. Franklin, J. D. Powell and M. L. Workman, “Digital Control of Dynamic Systems”, Addison-Wesley, 1998.

2. B.C. Kuo, “Digital Control System”, Holt, Rinehart and Winston, 1980.
3. M. Sami Fadali & Antonio Visioli, “Digital Control Engineering Analysis and Design”, Academic Press, 1980.

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

Course Code:GR22A4018 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Explain the importance of Automation and classification of industries.
2. Make use of Architecture, I/O Modules, and programming structure of PLC for industrial automation.
3. Construct the ladder logic for gates using instructions of PLC.
4. Examine various PLC functions to construct ladder logic for applications.
5. Demonstrate the analog operations of PLC and analyze the robot controlling.

UNIT I
INTRODUCTION TO AUTOMATION & INDUSTRIAL CONTROL SYSTEM
Basic Elements of an Automated System - Power to Accomplish the Automated Process, Program of Instructions, Control System. Advanced Automation Functions - Safety Monitoring, Maintenance and Repair Diagnostics, Error Detection and Recovery. Levels of Automation.

Process Industries Versus Discrete Manufacturing Industries - Levels of Automation in the Two Industries, Variables and Parameters in the Two Industries. Continuous Versus Discrete Control - Continuous Control Systems, Discrete Control Systems. Computer Process Control - Control Requirements, Capabilities of Computer Control, Forms of Computer Process Control.

UNIT II
PLC BASICS & PLC PROGRAMMING
PLC System, I/O Modules and Interfacing, CPU Processor, Programming Equipment Programming Formats, Construction of PLC Ladder Diagrams, Devices connected to I/O Modules.
Input Instructions, Outputs, Operational Procedures, Programming examples using contacts and coils. Drill press operation.

UNIT III
DIGITAL LOGIC GATES
Programming in the Boolean Algebra System, Conversion examples, Ladder diagrams for process control, Ladder Diagrams & Sequence Listings, Ladder Diagram Construction and Flow chart for Spray Process System.
PLC REGISTERS Characteristics of Registers, Module addressing, Holding registers, Input registers, Output registers.

UNIT IV
PLC FUNCTIONS
Timer functions & Industrial Applications, Counters, Counter function Industrial Applications. Arithmetic functions, Number Comparison Functions, Number Conversion Functions.
DATA HANDLING FUNCTIONS: SKIP, Master Control Relay, Jump, Move, FIFO, FAL, ONS, CLR and Sweep functions and their applications.

UNIT V
SEQUENCE FUNCTIONS AND ANALOG OPERATIONS
Sequence Functions and Applications, Controlling of Two-Axis and Three Axis Robots with PLC, Matrix Functions.
Analog Modules and Systems, Analog Signal Processing, Multi Bit Data Processing, Analog Output

Application Examples. PID principles, Position indicator with PID Control, PID Modules, PID Tuning, PID Functions.

Textbooks

1. Mikell P. Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing", Fourth Edition, Pearson.
2. "Programmable Logic Controllers - Principle and Applications" by John W Webb and Ronald A Reiss, Fifth edition, PHI, 2009.

References

1. Jr. Hackworth and F.D Hackworth Jr, "Programmable Logic Controllers - Programming Method and Applications", Pearson India, 2003.
2. Gary Dunning, Delmar, "Introduction to Programmable Logic Controllers", Thomas Learning, 3rd Edition, 2005.
3. RG Jamkar, "Industrial Automation Using PLC SCADA & DCS", Global Education, second edition, 2018.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER QUALITY AND FACTS
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR22A4019 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Interpret the basic types of FACTS controllers.
2.Classify the FACTS devices for power-flow control and working principles of Shunt compensators.
3. Summarize the working principles of various Series compensators and their characteristics.
4. Identify the various power quality problems in distribution systems.
5. Categorize the working principles of DVR and DSTATCOM, to improve power quality.

UNIT I
FACTS CONCEPTS
Transmission Interconnections, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Basic Types of FACTS Controllers-Shunt Connected Controllers, Series Connected Controllers, Combined Shunt and Series Connected controllers.

UNIT II
SHUNT COMPENSATORS
Objectives of shunt compensation, Midpoint voltage regulation, Improvement of Transient stability, power oscillation damping, Principle of operation of FC-TCR(SVC) compensator, characteristic of FC-TCR and control diagram, Basic concept of voltage source converter, principle of operation of STATCOM, characteristic of STATCOM, control diagram.

UNIT III
SERIES COMPENSATORS
Objectives of series compensation, Improvement of Transient stability, power oscillation damping, Principle of operation of Thyristor controlled series compensator (TCSC), operating characteristics, TCSC control diagram, Principle of operation voltage source converter type series compensator (SSSC). Basic principle of operation of UPFC, transmission control capabilities of UPFC.

UNIT IV
POWER QUALITY MEASUREMENTS
Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise. Tolerance of Equipment: CBEMA curve.

UNIT V
WORKING PRINCIPLE OF DVR, DSTATCOM
Principle of operation of DSTATCOM, Control in UPF mode of operation and zero voltage regulation mode, Full bridge single phase DVR and Three phase three wire DVR topology description, Principle of operation of active series compensator (DVR).

Textbooks
1. N. G. Hingorani and L. Gyugyi, “Understanding FACTS: Concepts and Technology of FACTS Systems”, Wiley-IEEE Press, 1999.

2. Bhim singh, Ambrish chandra and Kamal AL-Haddad, “Power Quality Problems and Mitigation Techniques” John wiley and sons Ltd 2015.

References

1. K. R. Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd. 2007.
2. Roger C. Dugan “Electrical Power Systems Quality”, Second Edition, Mc Graw-Hill.
3. Bollen, Math HJ. *Understanding power quality problems*. Vol. 3. New York: IEEE press, 2000.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTRICAL ENERGY AUDIT
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR22A4020 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Interpret the current energy scenario and energy need of growing economy.
2. Identify the Energy and its various forms and Electricity tariffs.
3. Analyze types of energy audit, energy costs, bench marking, energy performance.
4. Illustrate Electricity billing, electrical load management and maximum demand control.
5. Interpret various types of air compressors, compressor efficiency and Compressed air system components.

UNIT I
ENERGY SCENARIO
Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change.

UNIT II
BASICS OF ENERGY AND ITS VARIOUS FORMS
Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT III
ENERGY MANAGEMENT & AUDIT
Definition: energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.

UNIT IV
ENERGY EFFICIENCY IN ELECTRICAL SYSTEMS
Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution transformer losses.

UNIT V
ENERGY EFFICIENCY IN INDUSTRIAL SYSTEMS
Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test. Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System:
Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities, Cooling Towers: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.

Textbooks

1. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991.
2. W.R. Murphy & G. Mckay Butter worth "Energy management", Elsevier publications 2012.

References

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online).
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online).
3. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-4, Energy Performance Assessment for Equipment and Utility Systems (available online).

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
SPECIAL ELECTRICAL MACHINES
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR22A4021 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:
1. Summarize Various Special Electrical Machines.
2. Explain Permanent magnet brush less DC Motors.
3. Identify the control techniques used in PMSM.
4. Analyze the performance of Synchronous Reluctance Motor for different applications.
5. Interpret the different types of switched reluctance motors.

UNIT I
INTRODUCTION OF SPECIAL MACHINES
Construction and principle of operation - Emf equation of BLPM sine wave motor- Flux density distribution.

UNIT II
PERMANENT MAGNET BRUSHLESS DC MOTORS
Permanent Magnet materials– Magnetic Characteristics –Permeance Coefficient-Principle of operation–Types–Magnetic circuit analysis–EMF and torque equations –Commutation Power controllers–Motor characteristics and control.

UNIT III
PERMANENT MAGNET SYNCHRONOUS MOTORS
Principle of operation–Ideal PMSM –EMF and Torque equations–Armature reaction MMF– Synchronous Reactance – Sine wave motor with practical windings - Phasor diagram – Torque/speed characteristics-Power controllers- Converter Volt-ampere requirements.

UNIT IV
SYNCHRONOUS RELUCTANCE MOTORS
Constructional features–Types–Axial and Radial flux motors–Operating principles–Variable Reluctance and Hybrid Motors–SYNREL Motors–Voltage and Torque Equations- Phasor diagram - Characteristics.

UNIT V
SWITCHED RELUCTANCE MOTORS
Constructional features–Rotary and Linear SRMs- Principle of operation–Torque production– Steady state performance Prediction-Analytical method-Power Converters and their controllers – Methods of Rotor position sensing – Sensor less operation – Closed loop control of SRM - Characteristics.

Textbooks
1. T.J.E.Miller, “Brush less Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989.
2. T.Kenjo, “Stepping Motors and Their Microprocessor Controls”, Clarendon Press London, 1984.

References
1. R.Krishnan, “Switched Reluctance Motor Drives–Modeling, Simulation, Analysis, Design and Application”,CRCPress, NewYork, 2001.

2. P.P.Aearnley, “Stepping Motors–A Guide to Motor Theory and Practice”, Peter Perengrinus London, 1982.
3. T.Kenjoand, S.Nagamori, “Permanent Magnet and Brushless DC Motors”, Clarendon Press, London, 1988.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
VLSI DESIGN
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR22A3108 **L/T/P/C: 3/0/0/3**
IV Year I Semester

Course Outcomes:

1. Visualize the fabrication process of IC technology.
2. Analyze and design CMOS subsystems.
3. Draw stick diagrams and layouts for NMOS and CMOS circuits using design rules.
4. Implement the VLSI design using programmable logic devices.
5. Understand various testing schemes of ICs.

UNIT I
INTRODUCTION

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 BiCMOS Circuits: I_{ds}- V_{ds} relationships, MOS transistor threshold Voltage V_t, g_m, g_{ds}, Figure of merit ω_o; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter-analysis and design, BiCMOS Inverters, Power Dissipation

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.

Textbooks

1. Kamran Eshraghian, Douglas A.Pucknell, Sholeh Eshraghian, “Essentials of VLSI circuits and systems” –PHI,2011.

2. Neil H.E Weste, David Harris, “CMOS VLSI Design–A circuits and systems perspective”, Fourth Edition, Addison Wesley, 2011.
3. K. Lal Kishore and V. S. V. Prabhakar, “VLSI Design”, 1st Edition, I.K. International, 2009.

References

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BASICS OF DIGITAL SIGNAL PROCESSING LAB

Course Code: GR22A4023 **L/T/P/C: 0/0/4/2**
IV Year I Semester

Course Outcomes:
1. Outline importance of functions in programming DSP board.
2. Summarize the types of GPIOs of DSP board.
3. Interpret the output signal obtained from ADC of DSP board.
4. Develop the program to function as input and output of DSP board.
5. Examine the PWM pulses from DSP board.

LIST OF EXPERIMENTS

Task-1: Watchdog with CPU Timer interrupts.

Task-2: Implementing Loop instructions.

Task-3: Configuring GPIO port pins of DSP board.

Task-4: Toggling onboard LEDs of DSP board.

Task-5: Acquisition of signal from ADC.

Task-6: Interfacing an external LED using DSP board.

Task-7: Generation of PWM pulses for converter operation.

Task-8: Generation of enhanced PWM pulses with a dead band.

Task-9: Programming in FLASH.

Task-10: Speed control of DC Motor using DSP board.

Textbooks
1. A.V. Oppenheim and R. W. Schafer, “Discrete Time Signal Processing”, Prentice Hall, 1989.
2. J. G. Proakis and D.G. Manolakis, “Digital Signal Processing: Principles, Algorithms and Applications”, Prentice Hall, 1997.

References
1. J. R. Johnson, “Introduction to Digital Signal Processing”, Prentice Hall, 1992.
2. D. J. DeFatta, J. G. Lucas andW. S. Hodgkiss, “Digital Signal Processing”, John Wiley & Sons, 1988.
3. L. R. Rabiner and B. Gold, “Theory and Application of Digital Signal Processing”, Prentice Hall, 1992.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER SEMICONDUCTOR DRIVES LAB

Course Code: GR22A4024 **L/T/P/C: 0/0/4/2**
IV Year I Semester

Course Outcomes:
1. Select appropriate power electronic converter for different electrical machines.
2. Examine DC Motor by giving different inputs step, ramp and parabolic signals.
3. Illustrate Closed loop speed control for Induction motor drives.
4. Apply Speed control in different modes of operation of BLDC and PMSM.
5. Estimate Speed of SRM from rotor position.

LIST OF EXPERIMENTS

Task-1: Firing angle control of thyristor-based DC drive connected to DC motor.

Task-2: Closed loop speed control of DC motor using PI, PID, PD controllers.

Task-3: Response of DC motor for Step, Ramp and Parabolic input signals.

Task-4: Speed control of DC motor using armature voltage control with PI, PID controllers.

Task-5: Open loop V/F control of AC motor.

Task-6: Closed loop speed control of AC motor with step, ramp, parabolic inputs using PI, PID controllers.

Task-7: Closed loop speed control of AC motor coupled with DC generator using PI, PID controllers.

Task-8: Speed Control of SRM (Switched Reluctance Motor) in Forward Motoring and Reverse Motoring Mode.

Task-9: Speed Control of PMBLDC Motor in Forward Motoring, Reverse Motoring and Forward Breaking Mode.

Task-10: Speed Control of PMSM in Forward Motoring Mode.

Task-11: Closed loop control of Semi Converter fed separately Excited DC motor.

Task-12: Closed loop V/F based control of induction motor.

Textbooks
1. B. K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education, Asia, 2003.
2. Dubey G. K. “Power semiconductor control drives” Prentice Hall, Englewood Cliffs, New Jersey, 1989.

References
1. T.J.E.Miller, “Brush less Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989.
2. R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall, 2001.

3. Simulation of Power Electronic Circuits, M.B. Patil, V. Ramanarayanan, V.T. Ranganathan, Narosa Publications, 2013.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING ANDTECHNOLOGY
PROJECT WORK - PHASE I

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

Course Outcomes:

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

IV YEAR
II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
POWER SYSTEM MONITORING AND CONTROL

Course Code: GR22A4096 **L/T/P/C: 2/1/0/3**
IV Year II Semester

Course Outcomes:
1. Analyze the optimal operation of generators and its characteristics.
2. Identify various methods to control the voltage, frequency, and power flow.
3. Make use of system data for power system control and security.
4. Classify electricity markets and their pricing principles.
5. Interpret the concepts of Energy management.

UNIT I
ECONOMIC OPERATION OF POWER SYSTEMS AND UNIT COMMITMENT
Optimal operation of Generators in Thermal Power Stations, - heat rate Curve – Cost Curve – Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses – Loss Coefficients, General transmission line loss formula. Numerical problems.
Constraints in Unit Commitment, UC solution methods: Priority- list methods, forward dynamic programming approach.

UNIT II
CONTROL OF FREQUENCY AND VOLTAGE
Turbines and Speed-Governors, Load frequency control of single area and Two area system: Steady state analysis, Dynamic Response, Droop Control and Power Sharing, Automatic Generation Control, Excitation Systems.

UNIT III
MONITORING AND CONTROL
Overview of Energy Control Centre Functions: Introduction to SCADA: Grid Operation & Control, advantages of SCADA operation, Data Acquisition, Monitoring and Event Processing, Control Functions, State-estimation: Maximum likelihood weighted least squares estimation. Factors effecting power System Security, Introduction of Contingency analysis, Preventive Control and Emergency Control.

UNIT IV
POWER SYSTEM ECONOMICS
Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition).

UNIT V
POWER MANAGEMENT
Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework.

Textbooks
1. J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education,1994.
2. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education,2003.

References

1. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power Systems”, Wiley, 2012.
2. P.Kundur, “Power System Stability and Control” McGraw Hill Education, 1994
3. O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ADVANCED ELECTRIC DRIVES
(PROFESSIONAL ELECTIVE -V)

Course Code: GR22A4097 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1. Explain vector control strategies for Induction motor drives.
2. Develop vector control strategies for Synchronous motor drives.
3. Classify Speed and Torque control techniques in BLDC and PMSM.
4. Demonstrate the operation of switched reluctance motor drives.
5. Interpret the implementation of DSP based motion control.

UNIT I
THEORY OF TRANSFORMATIONS
Concept of space vector, direct and quadrature axis variables, various types of Krause transformation, condition for power invariance, Expression for power with various types of transformation, Transformations between reference frames, Clarke and Park's Transformations, Variables observed from various frames.

UNIT II
PERMANENT MAGNET SYNCHRONOUS MACHINES AND THEIR CONTROL
Dynamic Modeling of Permanent Magnet Synchronous- Transformation to Rotor Reference Frames, Three-Phase to Two-Phase Transformation, Evaluation of Control Characteristics of the PMSM, Design of Current and Speed Controllers, Applications of PMSM drive.

UNIT III
PERMANENT MAGNET BRUSH LESS DC MACHINES AND THEIR CONTROL
Modeling of PM Brushless dc Motor, The PMBDCM Drive Scheme, Design Considerations for the PMBDC Motor, Design of Current and Speed Controllers, Applications of PMBLDC drive.

UNIT IV
SWITCHED RELUCTANCE MOTOR DRIVES
Principle of Operation of the Switched Reluctance Motor, SRM Configurations, Closed-Loop, Speed-Controlled SRM Drive, Design of Current Controllers, Torque Control, Design of the Speed Controller, Applications of SRM drive.

UNIT V
REALIZATION OF BLDC MOTOR DRIVES USING DSP BASED CONTROL
Main Circuit, Driving Circuit, Microprocessor Control Circuit, DSP Control Circuit, Protecting Circuit, Sensor less Control Circuits, ASIC for BLDC Motor Drives.

Textbooks
1. B.K. Bose, "Modern Power Electronics & AC Drives", Pearson Education India, 2015, 1st Edition.
2. R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, 2009.

References
1. Ramu, Krishnan, "Switched reluctance motor drives: modeling, simulation, analysis, design, and applications" CRC Press, 2001.

2. Chang-liang Xia, “Permanent magnet brushless DC motor drives and controls” Science Press, 2012.
3. H. A. Taliyat and S. G. Campbell, “DSP based Electromechanical Motion Control”, CRC press, 2003.
4. T.J.E.Miller, “Brush less Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BIG DATA APPLICATIONS IN POWER SYSTEMS
(PROFESSIONAL ELECTIVE -V)

Course Code:GR22A4098 **L T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1.Summarize the challenges of creating a highly scalable, easily managed, secure foundation for data management.
2.Make use of analytical models specific to the utility enterprise.
3.Analyze the available and desired data sources as well as the business value of that data.
4.Identify the difficulties in adapting to the needs of high-volume and varied data types.
5.Select value from utility data and visualize the utility.

UNIT I
BUILDING THE FOUNDATION FOR DATA ANALYTICS
What Are Data Analytics? Building the Analytical Architecture, The Art of Data Management, Managing Big Data Is a Big Problem, The Truth Won't Set You Free, One Size Doesn't Fit All, Solving the "Situation-Specific" Dilemma, The Build-Versus-Buy War Rages On, When the Cloud Makes Sense, Change Is Danger and Opportunity.

UNIT II
APPLYING ANALYTICAL MODELS IN THE UTILITY
Understanding Analytical, What Exactly Are Models? Using Descriptive Models for Analytics, Using Diagnostic Models for Analytics, How Diagnostic Tools Help Utilities, Predictive, Prescriptive Analytics, An Optimization Model for the Utility, Toward Situational Intelligence
Moving Beyond Business Intelligence, Energy Forecasting, Asset Management, Demand Response and Energy Analytics, Dynamic-Pricing Analytics, Revenue-Protection Analytics.

UNIT III
SOURCING DATA
Smart Meters, Sensors, Control Devices, Intelligent Electronic Devices, Distributed Energy Resources, Consumer Devices, Historical Data, Third-Party Data, Working with a Variety of Data Sources, Data Fusion.

UNIT IV
BIG DATA INTEGRATION, FRAMEWORKS AND DATABASES
Storage Modalities, Hyperscale, Network-Attached Storage, Object Storage, Data Integration, The Costs of Low-Risk Approaches, Let the Data Flow, Hadoop, MapReduce, Hadoop Distributed File System, How Does This Help Utilities? Other Big Data Databases, NoSQL 166, In-Memory or Main Memory Databases, Object-Oriented Database, Management Systems, Time Series Database Servers, Spatial and GIS Databases, The Curse of Abundance.

UNIT V
EXTRACTING VALUE & ENVISIONING THE UTILITY
Mining Data for Information and Knowledge, The Process of Data Extraction, Hadoop: A Single-Purpose, Batch-Data Platform? Stream Processing, Complex Event Processing, Process Historians Big Data Comprehension, Why Humans Need Visualization? The Role of Human Perception: Preattentive Processing, The Utility Visualized, Advancing Business Intelligence, High-Impact Operations, Improving Customer Value, Making Sense of It All.

Textbooks

1.Carol L. Stimmel, "Big Data Analytics Strategies for the Smart Grid" , CRC Press, Taylor & Francis Group.
2. Reza Arghandeh &Yuxun Zhou,"Big Data Application in Power Systems", Elsevier publications.

References

1. Ali Tajer, Samir M. Perlaza, H. Vincent Poor,"Advanced Data Analytics for Power Systems", Cambridge University Press.
2. Arturo Román Messina, "Data Fusion and Data Mining for Power System Monitoring", CRC Press, Taylor & Francis Group.
3. Ahmed F. Zobaa and Trevor J. Bihl, "Big Data Analytics in Future Power Systems", CRC Press, Taylor & Francis Group.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MODERN CONTROL THEORY
(PROFESSIONAL ELECTIVE -V)

Course Code:GR22A4099 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1. Develop state feedback model of the system.
2. Distinguish full order and reduced order state observers.
3. Illustrate robust controller for tracking and disturbance rejection.
4. Explain continuous and discrete time linear state regulator.
5. Model sliding mode controller and reduce chattering problem.

UNIT I
STATE FEEDBACK
Non uniqueness of state model, Similarity transformation, Invariance of system properties. Controllability – necessary and sufficient condition - Pole assignment using State feedback – Ackerman's formula for feedback gain determination, Observability. Duality. Effect of state feedback on controllability and observability. Controllable subspace – decomposition of state into controllable and uncontrollable components.

UNIT II
DESIGN OF FULL AND REDUCED ORDER OBSERVERS
Design of full order observer – Bass Gura algorithm. The separation principle - Combined observer – controller compensator. Design of reduced order observer. Unobservable subspace – decomposition of state into observable and unobservable components – Canonical decomposition theorem.

UNIT III
DESIGN OF ROBUST CONTROL SYSTEM
Reducibility – realization of transfer function matrices. Model decomposition and decoupling by state feedback. Design of robust control system for asymptotic tracking and disturbance rejection using State variable equations. Transfer function interpretations – transfer function form of observer and state estimate feedback. State space interpretation of internal model principle.

UNIT IV
STATE REGULATOR
Discrete time linear state regulator – Algorithm for the solution, Use of observer in implementing the control law. Continuous time linear state regulator – Matrix Riccati equation. Time invariant linear state regulator – the reduced matrix Riccati equation - An iterative method to solve the reduced matrix Riccati equation. Suboptimal linear regulator.

UNIT V
VARIABLE - STRUCTURE CONTROLLER
Concept of variable - structure controller and sliding control, reaching condition, and reaching mode, implementation of switching control laws. Reduction of chattering in sliding and steady state mode.

Textbooks
1. Modern Control Engineering, Katsuhiko Ogata, 5th Edition, Prentice Hall India, 1997.
2. Modern Control System Theory, M. Gopal, Revised 2nd Edition, New Age International Publishers, 2005.

References

1. Control System Design, Graham C. Goodwin, StefanF. Graebe and Mario E. Salgado, Pearson Education, 2000.
2. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, 11th Edition, Pearson Edu India, 2009.
3. M. Vidyasagar, Nonlinear Systems Analysis, Prentice - Hall International editions,1993.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INDUSTRIAL IoT
(PROFESSIONAL ELECTIVE -V)

Course Code: GR22A4100 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1. Summarize the terminologies of IoT and I-IoT.
2. Demonstrate the concept of Industrial process and devices used in IoT.
3. Identify how to generate data flow in industry and its protocols.
4. Analyze the strategy, implementation, and the developing architecture in I-IoT.
5. Examine the Solutions for Cloud I-IoT applications.

UNIT I
INTRODUCTION TO IOT
IoT background, IoT key technologies, IoT use cases, what is the I-IoT, use cases of the I-IoT, IoT and I-IoT – similarities and differences. IoT analytics and AI.

UNIT II
UNDERSTANDING THE INDUSTRIAL PROCESS AND DEVICES
Technical requirements, The industrial process, Automation in the industrial process; Control and measurement systems; Types of industrial processes; Continuous processes, Batch processes, Semi-continuous processes, Discrete processes. Introduction of CIM pyramid.

UNIT III
THE I-IOT DATA FLOW
The Industrial IoT data flow in a factory; The edge device; The Industrial IoT data flow in the cloud; Measurements and the actuator chain; Controllers; Designing Industrial Internet Systems.
Industrial Protocols: I-IoT WAN Technologies and Protocols.

UNIT IV
I-IOT STRATEGY AND IMPLEMENTATION
I-IoT Strategy Planning: I-IoT Implementation Methodology, Challenges in Adopting I-IoT, Managing Data Factors Need to Be Invested Primarily to Implement I-IoT.
Developing Industrial IoT and Architecture: Introduction to the I-IoT platform and architectures; Understanding the time-series technologies; Data-processing and the analytics platform; Advanced analytics; Big data analytics.

UNIT V
IMPLEMENTING A CLOUD INDUSTRIAL IOT SOLUTION
A brief overview on-I-IoT analytics; Implementing a Custom Industrial IoT Platform-Mosquitto as MQTT connector-Working with an MQTT client.

Textbooks
1. Giacomo Veneri, Antonio Capasso, “Hands-On Industrial Internet of Things: Create a powerful Industrial IoT”, Packt Publishing Ltd.
2. Internet of Things for Architects: by Perry LeaPackt Publishing Ltd.

References
1. Alasdair Gilchrist, “Industry 4.0 The Industrial Internet of Things”, Apress.

2. Uthayan Elangovan, “Smart Automation to Smart Manufacturing Industrial Internet of Things”, Perry LeaPackt Publishing Ltd
3. Iresh A. Dhotre, “Industrial Internet of Things”, Technical publications

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PRINTED CIRCUIT BOARD DESIGN
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR22A4101 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1. Outline about the components process of PCB design flow.
2. Apply advanced techniques, skills, and modern tools for designing and fabrication of PCBs.
3. Build design considerations for layout planning of PCB.
4. Interpret various types of applications of digital circuit PCBs.
5. Analyze a schematic circuit and develop their own PCB circuit.

UNIT I
INTRODUCTION TO PRINTED CIRCUIT BOARD DESIGNING CONCEPTS
Introduction & Brief History: What is Printed Circuit Board (PCB), Difference between PWB and PCB, Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials, Study of Packages of Electronic Components. Study of SMD Components. Process of PCB design and product development flow.

UNIT II
INTRODUCTION TO DEVELOPMENT TOOLS
Proprietary tools like Eagle, Ultiboard, Orcad and Opensource tools like KiCad, Design Issues: Transmission line, Cross talk, and Thermal management.

UNIT III
LAYOUT PLANNING AND DESIGN -I
Reading Drawing and diagrams, General PCB design considerations, Mechanical design considerations, Electrical design considerations, fabrication, and assembly considerations, Environmental factors.

UNIT IV
LAYOUT PLANNING AND DESIGN -II
Layout design, checklist, Design rules for Digital circuit PCBs, Analog circuit PCBs, high frequency and fast pulse applications, Power electronic applications, Microwave applications.

UNIT V
INTRODUCTION PRINTED CIRCUIT BOARD PRODUCTION TECHNIQUES
Photo printing, film master production, reprographic camera, basic process for double sided PCBs photo resists, Screen printing process, plating, relative performance and quality control, etching machines, Solders alloys, fluxes, soldering techniques, Mechanical operations.

Textbooks
1. R. S. Khandpur, “Printed circuit board design, fabrication assembly and testing”, Tata McGraw Hill 2006
2. Walter C. Bosshar, “Printed circuit Board: Design and technology”, Tata Mcgraw-hill 1983.

References
1. Clyde F. Coombs, Jr, Happy T. Holden, “Printed Circuits Handbook”, Sixth Edition, McGraw-Hill Education Year: 2016.
2. Robert torzwell, “Flexible Printed circuit board Design and manufacturing”, McGraw-Hill Education, 2018

3. Charles A. Harper" High Performance Printed Circuit Boards",1st Edition, ISBN-13:978-0070267138, McGraw-Hill Professional Engineering Publication.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTRIC SMART GRID
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR22A4102 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
1. Explain the architecture of smart grid.
2. Identify suitable communications and measurement technology for smart grid.
3. Make use of various performance analysis tools for smart grid design.
4. Examine the stability of smart grid.
5. Utilize renewable energy resources and storage facilities for the sustenance of smart grid.

UNIT I
SMART GRID ARCHITECTURAL DESIGNS
Introduction – Comparison of Power grid with Smart grid – power system enhancement – communication and standards - General View of the Smart Grid Market Drivers - Stakeholder Roles and Function - Measures -Representative Architecture - Functions of Smart Grid Components Wholesale energy market in smart grid-smart vehicles in smart grid.

UNIT II
SMART GRID COMMUNICATIONS AND MEASUREMENT TECHNOLOGY
Communication and Measurement - Monitoring, Phasor Measurement Unit (PMU), Smart Meters, Wide area monitoring systems (WAMS) – Advanced metering infrastructure- GIS and Google Mapping Tools.

UNIT III
PERFORMANCE ANALYSIS TOOLS FOR SMART GRID DESIGN
Introduction to Load Flow Studies - Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods - Load Flow State of the Art: Classical, Extended Formulations, and Algorithms –Load flow for smart grid design-Contingencies studies for smart grid.

UNIT IV
STABILITY ANALYSIS TOOLS FOR SMART GRID
Voltage Stability Analysis Tools-Voltage Stability Assessment Techniques Voltage Stability Indexing-Application and Implementation Plan of Voltage Stability in smart grid-Angle stability assessment in smart grid-Approach of smart grid to State Estimation-Energy management in smart grid.

UNIT V
RENEWABLE ENERGY AND STORAGE
Renewable Energy Resources-Sustainable Energy Options for the Smart Grid-Penetration and Variability Issues Associated with Sustainable Energy Technology-Demand Response Issues-Electric Vehicles and Plug-in Hybrids PHEV Technology-Environmental Implications-Storage Technologies-Grid integration issues of renewable energy sources.

Textbooks
1. James Momoh, “Smart Grid: Fundamentals of design and analysis”, John Wiley & sons Inc, IEEE press 2012.
2. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, JianzhongWu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, JohnWiley & sons inc, 2012.

References

1. Clark W.Gellings, “The smart grid: Enabling energy efficiency and demand response”, Fairmont Press Inc, 2009.
2. Krzyszt of Iniewski, “Smart Grid Infrastructure & Networking”. McGraw Hill Education Pvt. Ltd., 2014.
3. Fereidoon P. Sioshansi, “Smart Grid: Integrating Renewable, Distributed & Efficient Energy”, Academic Press, 2011.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
EMBEDDED SYSTEMS DESIGN
(PROFESSIONAL ELECTIVE – VI)

Course Code: GR22A3112 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:
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. Analyze to understand what a microcomputer is, the core of the embedded system.
5. Remember the definitions of ASICs, PLDs, memory, memory interface. Analyze to understand different concepts of a RTOS, sensors, memory interface, communication interface.

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.

UNITV
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.

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

References

1. Frank Vahid, Tony Givargis, “Embedded System Design” - John Wiley.
2. Lyla, “Embedded Systems” –Pearson, 2013.
3. David E. Simon, “An Embedded Software Primer” - Pearson Education.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
BIG DATA ANALYTICS
(PROFESSIONAL ELECTIVE – VI)

Course Code: GR22A3143 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Pre - Requisites:
Students should have knowledge of one Programming Language (Java/ Python), thorough practice of SQL, and exposure to Linux/ UNIX Environment.

Course Outcomes:
1. Interpret the need for HDFS in processing big data.
2. Examine the purpose of data ingestion tools in Big Data Systems.
3. Implement distributed processing of big data using Map Reduce or Pig.
4. Compose Queries with Hive or HBase to analyze the data.
5. Inspect the components of Apache Spark to perform in memory processing.

UNIT - I
Introduction to Big Data and Hadoop
Types of Digital Data, Definition of Big Data, V's of Big Data, Advantages of Big Data, Characteristics of Hadoop, RDBMS Vs Hadoop, Ecosystem components of Hadoop, Big Data Analytics Pipeline, Hadoop Distributions, Need for HDFS, Characteristics of HDFS, HDFS Components, HDFS High Availability Architecture, Block Replication Method, Rack Awareness, HDFS Commands.

UNIT - II
Data Ingestion into Big Data Systems and ETL
Big Data Ingestion Tools, Apache Sqoop, Benefits of Apache Sqoop, Sqoop Connectors, Importing and Exporting to and from Hadoop using Sqoop, Limitations of Sqoop, Apache Flume Model, Data Sources for FLUME, Components of FLUME Architecture.

UNIT - III
Distributed Processing - Map Reduce and PIG
Need for YARN, Elements of YARN Architecture, Characteristics of Map Reduce, Phases of Map Reduce with an Example, Anatomy of MR Job Run with YARN, Handling Failures, Task Execution, Map Reduce Input and Output Formats, Shuffle and Sort, Joins in Map Reduce, Introduction to PIG, Components of PIG, Data Types in PIG – Simple and Complex, PIG Execution Modes, PIG Interactive Modes, Comparison of PIG with databases, Data Processing Operators.

UNIT - IV
Apache Hive and NOSQL Database - HBase
Features of HIVE, HIVE Architecture, HIVE Metastore, Datatypes in HIVE, HIVEQL, Tables, File Format Types–Text, Sequence, AVRO, Parquet, Querying Data, Types of NOSQL Database, Characteristics of HBASE, Architecture, HBase Vs RDBMS, HBASE Shell Commands.

UNIT - V
Apache Spark
Functional Programming, Components of Apache Spark, Applications of in - memory processing, Hadoop Ecosystem Vs. Spark, Spark Architecture, RDDs in Spark, SparkSQL, Architecture of SparkSQL, DataFrames, Data Analytics, Types of Analytics.

Textbooks

1. Tom White “Hadoop: The Definitive Guide”4thedition, O’reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

References

1. Michael Berthold, David J.Hand, "Intelligent DataAnalysis”,Springer,2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRCpress(2013)
3. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big DataAnalyticswithOracleREnterpriseandOracleRConnectorforHadoop”, McGraw- Hill/Osborne Media(2013),Oracle press.
4. Anand Rajaramanand Jefrey David Ulman,“Mining of Massive Datasets”, Cambridge UniversityPress,2012.
5. Bill Franks, “Taming the Big Data Tidal Wave:Finding Opportunities in Huge Data Streams with Advanced Analytics”,JohnWiley&sons,2012.
6. GlenJ.Myat,“Making Sense of Data”,John Wiley&Sons,2007
7. PeteWarden,“BigDataGlossary”,O’Reily,2011.
8. Michael Mineli, Michele Chambers, Ambiga Dhiraj,"Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today'sBusinesses",WileyPublications,2013.
9. Arvind Sathi,“BigDataAnalytics:DisruptiveTechnologiesforChangingtheGame”,MCPress,2012 Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch ,
10. James Giles, David Corigan,"Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications,2012.

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

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

Course Outcomes:

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

OPEN ELECTIVES

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

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

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

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

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

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

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

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

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

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

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

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

Course Outcomes:

To acquaint the student with the determinants of intra -individual, inter-personnel and inter-group behaviour in organizational setting.

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

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

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

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

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

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

Text Books:

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

Reference Books:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

UNIT I
Graphics: A Single Variable – Dot and Jitter Plots, Histograms and Kernel Density Estimates, The Cumulative Distribution Function, Rank-Order Plots and Lift Charts, Summary Statistics and Box Plots, Practice using Numpy, Two Variables- Scatter Plots, Smoothing, Logarithmic Plots, Banking, Practice using Matplotlib, Time As A Variable- Time-Series Analysis, More Than Two Variables- False-color plots, 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: GR22A4054 **L/T/P/C:3/0/0/3**

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

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

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

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

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

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

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

Reference Books:
1. LaValle, "Virtual Reality", Cambridge University Press, 2016.
2. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual 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
BASICS OF JAVA PROGRAMMING
(OPEN ELECTIVE)

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

Course Outcomes:

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

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

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

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

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

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

Text Books:
1. Herbert Schildt, Dale Skrien, Java Fundamentals A Comprehensive Introduction, 1/e, Tata McGraw Hill, 2017.
2. Herbert Schildt, The Java complete References, 9/e, Tata McGraw Hill,2014.

Reference Books:

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

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

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

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

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

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

UNIT I

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

UNIT II

Introduction to Database Design: ER Diagrams, Entities, Attributes and Entity sets, Relationships and Relationship set, Extended ER Features, Conceptual Design with the ER Model, Logical database Design.

Relational Model: Introduction to Relational Model, Basic Structure, Database Schema, Keys, Relational Algebra

UNIT III

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

UNIT IV

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

UNIT V

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

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

Reference Books:

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

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

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

Course Outcomes:

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

UNIT I

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

UNIT II

Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction.

Introduction to Data Warehouse: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Marts.

UNIT III

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

UNIT IV

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

UNIT V

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

Textbooks:

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

Reference Books:

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

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

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

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books:

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

Reference Books:

1. Introduction to Computer Science using Python, Charles Dierbach, Wiley India Edition.
2. Fundamentals of Python, K. A. Lambert, B.L. Juneja, Cengage Learning.

3. Think Python, how to think like a computer scientist, Allen B. Downey, SPD, O'Reilly.
4. Core Python Programming, Wesley J. Chun, second edition, pearson.

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

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

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

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

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

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

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

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

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

Text Books:
1. Internet of Things, Jeeva Jose, Khanna Publishing, 2018
2. Internet of Things, Abhishek S Nagarajan, RMD Sundaram, Shriram K Vasudevan, Wiley, 2019
3. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan Trollope, David Hanes, Patrick Gassetete, Jerome Henry,Pearson Education Limted, 2017

Reference Books:
1. The Internet of Things, Michael Miller, Pearson Education Limited, 2015

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

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

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

Course Outcomes:

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

UNIT- I

PHP Basics

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

UNIT -II

MySQL Basics

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

UNIT -III

Advanced PHP Programming

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

UNIT- IV

PERL: Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

Advanced PERL: Finer points of looping, pack and unpack, file system, data structures, packages, modules, objects, interfacing to the operating system.

UNIT -V

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

Text Books:

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

Reference Books:

1. Open Source Web Development with LAMP using Linux ,Apache,MySQL,Perl and PHP, Lee and B.Ware(Addison Wesley) Pearson Education.
2. Programming Python,M.Lutz,SPD.

3. PHP 6 Fast and Easy Web Development ,Julie Meloni and Matt Telles, Cengage
4. Learning Publications.
5. PHP 5.1,I.Bayross and S.Shah,The X Team,SPD.
6. Core Python Programming,Chun,Pearson Education.
7. Guide to Programming with Python,M.Dawson,Cengage Learning.

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

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

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

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

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

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

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

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

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 andcompete in a new era. John Wiley & Sons.

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

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

Course Outcomes:

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

UNIT I

Project Overview and Feasibility Studies- Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal

Project Scheduling: Project Scheduling, Introduction to PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculationand its importance, Cost reduction by Crashing of activity.

UNIT II

Cost Control and Scheduling: Project Cost Control (PERT/Cost), Resource Scheduling & Resource Leveling

Project Management Features: Risk Analysis, Project Control, Project Audit and Project Termination.

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books:

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

Reference Books:

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

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

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

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Internet Marketing: Introduction to Internet Marketing. Mapping fundamental concepts ofMarketing (7Ps, STP); Strategy and Planning for Internet Marketing
Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets.

Place in business markets. Promotion in business markets. Relationships, networks, and customer relationship management. Business to Business marketing strategy

Home Assignments:

Written Analyses of Cases – Students are expected to report on their analysis and 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 Schindl

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

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

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

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

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

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

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

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

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

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

Reference Books:

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

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

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

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

User-Centric Computing: The UCC framework with illustrative case study, User-Centric models-descriptive, predictive models and taxonomy, Introduction to GOMS family of models

Computational user models (classical), Keystroke-Level Model(KLM), (CMN)GOMS Model, The Fitts' Law, The Hick-Hyman Law.

UNIT IV

Computational user models(contemperory): 2D and 3D pointing models, The steering Law and constrained navigation, Model for hierarchial menu selection, Mobile typing models(sibgle finger and two thumb typing), Model for touch performance(FFitts' law),

Formal system models: Introduction to formal models in UCD, Formal modelling of user-computer dialogue.

UNIT V

Empirical Research Methods: Introduction and research question formulation,Variables determination and experiment design, Data Analysis including model building

User-Centric Design Evaluation: Introduction to User-Centric design evaluation and expert evaluation technique, : User evaluation and model-based evaluation.

Text Books:

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

(3rd Edition), Pearson.

Reference Books:

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

Website Links:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DESIGN PATTERNS
(OPEN ELECTIVE)

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

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books:

1. Design Patterns by Erich Gamma, Pearson Education.

Reference Books:

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

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

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

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books:

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

Reference Books:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Reference Books:
1.Hung T. Nguyen, Nadipuram R. Prasad, Carol L. Walker and Elbert A. Walker, "A First Course in Fuzzy and Neural Control" Chapman & Hall, CRC.
2. Driankov, Dimitra, "An Introduction to Fuzzy Control", Narosa Publication.

3. Timothy J Ross, “Fuzzy Logic with Engg.Applications”, McGraw. Hill.

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

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

Course Outcomes:

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

UNIT - I: Basics of Communication Systems

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

UNIT - II: Analog Modulation

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

UNIT - III: Pulse Analog Modulation

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

UNIT – IV: Digital Modulation

Basics of digital modulation, Advantages of digital modulation over analog modulation, Types of digital modulation: ASK, FSK, PSK, QAM, Comparison of digital modulation techniques

UNIT - V: Performance Analysis of Analog and Digital Modulation

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

Text Books:

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

Reference Books:

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

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

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

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

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

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

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

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

UNIT-V
Overview of various smart sensors: Digital temperature sensor (DS1621, TMP36GZ), Humidity sensor (DHT11, DHT22), Gas sensor (MQ2, MQ8), Pressure sensors (BMP180), Accelerometers (ADXL335); Structural health monitoring sensors, Introduction to MEMS and Flexible sensors.

Text Books:
1. B. C. Nakra, K.K. Choudhury, “Instrumentation, Measurement and Analysis” -3rd Edition, Tata McGraw, 2009
2. Jacob Fraden, “HandBook of Modern Sensors: physics, Designs and Applications”, 3rd ed., Springer, 2010.

Reference Books:
1. A.K. Sawhney, “Electrical and Electronic Measurements and Instrumentation”, DhanpatRai.

2. Er. R.K. Rajput, “Electronic Measurements and Instrumentation”, S. Chand & Company Ltd. 3rd Edition.
3. Bentley, John P., “Principles of Measurement Systems”, 4th edition, Pearson/Prentice Hall, 2005
4. Jon. S. Wilson, “Sensor Technology HandBook”, Elsevier Inc., 2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMMUNICATION TECHNOLOGIES
(OPEN ELECTIVE)

Course Code: GR22A4045 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Analyze the properties of basic Modulation techniques and apply them to Digital Communication
2. Apply error probability concepts to evaluate the performance of spread spectrum systems.
3. Understand the principle concepts of telecommunication systems and networking
4. Analyze link budgets for satellite communication, considering factors such as path loss, atmospheric effects, and antenna gain.
5. Evaluate the suitability of various technologies in cellular, mobile and wireless communication scenarios.

UNIT- I: Review of Digital Communication System

Review of fundamental concepts and parameters in Digital Communication. Digital modulation schemes, Power spectra of digital modulation signals.

UNIT- II: Spread-Spectrum Modulation

Introduction, Pseudo-Noise sequences, direct- sequence spread spectrum (DSSS) with coherent BPSK, processing gain, probability of error, frequency-hop spread spectrum (FHSS). Application of spread spectrum: CDMA.

UNIT- III: Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony. **Networking and Local Area Networks:** Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

UNIT- IV

Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.

Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT-V:

Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA.

Wireless Technologies: Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless Networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Text Books:

1. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education, 2005.
2. Simon Haykin and Michael Moher, “Modern Wireless Communications,” Pearson Education, 2005.
3. Marvin K. Simon, Sami M. Hinedi and W. C. Lindsay, “Digital Communication Techniques,” Eastern Economy Edition, 2010.

Reference Books:

1. Principles of communication systems By Taub Schilling, T.M.H
2. Andrew J Viterbi, “CDMA principles spread spectrum communications,” Adison Wesley, 1995.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INDUSTRIAL AUTOMATION AND CONTROL
(OPEN ELECTIVE)

Course Code: GR22A3030 **L/T/P/C:3/0/0/3**

Prerequisites: Manufacturing Technology

Course Outcomes:
1. Explain the major automation theories, approaches and methodologies used in manufacturing.
2. Apply the knowledge for implementing the automated flow lines.
3. Employ the assembly systems and line balancing for automation
4. Implement the knowledge of material handling and storage systems in current industries.
5. Design adaptive control system for automated manufacturing.

UNIT I
Introduction: Introduction to automation, principles, reasons, types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding, tool changing and machine tool control transfer the automaton.

UNIT II
Automated flow lines: Methods of work part transport transfer, Mechanical buffer storage control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines**.**

UNIT III
Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT IV
Automated material handling and storage systems: Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems. Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT V
Adaptive control systems: Introduction, adaptive control with optimization, adaptive control with constraints, application of adaptive control in machining operations. Consideration of various parameters such as cutting force, temperatures, vibration and acoustic emission in the adaptive controls systems.

Text Books:
1. Mikell P. Groover, Automation, Production Systems, and Computer- integrated Manufacturing, prentice Hall, 2014
2. Serope Kalpak Jian and Steven R.Schmid, Manufacturing – Engineering and Technology, 7th edition, Pearson, 2013

Reference Books:
1. Automation, Production Systems, and Computer-Integrated Manufacturing. (2016). India: Pearson India.
2. Bolz, R. W. (2012). Manufacturing Automation Management: A Productivity Handbook. United States: Springer US.

3. Boucher, T. O. (2012). Computer Automation in Manufacturing: An Introduction. Switzerland: Springer US.
4. Altintas, Y. (2012). Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design. United States: Cambridge University Press.
5. Morriss, S. B. (1995). Automated manufacturing systems. United Kingdom: Glencoe.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMPOSITE MATERIALS
(OPEN ELECTIVE)

Course Code: GR22A3105 **L/T/P/C: 3/0/0/3**

Prerequisites: Material Engineering

Course Outcomes:

1. Identify the types of composite materials and their characteristic features
2. Explain the methods employed in composite fabrication.
3. Differentiate the strengthening mechanisms of composite and its corresponding effect on performance
4. Analyze the various criterions for isotropic, anisotropic and composite materials, prediction of laminates failure.
5. Examine experimental techniques utilized for failure mode of composites.

UNIT I

Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke's law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness.

UNIT II

Manufacturing of composite materials, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes

UNIT III

Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria.

UNIT IV

Von Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai- Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates.

UNIT V

Analysis of laminated plates- equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies.

Text Books:

1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill,1994.
2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill,1998.

Reference Books:

1. Clyne, T. W. and Withers, P. J., "Introduction to Metal Matrix Composites", Cambridge University

Press, 1993.
2. Strong, A.B., “Fundamentals of Composite Manufacturing”, SME, 1989.
3. Sharma, S.C., “Composite materials”, Narosa Publications, 2000.
4. Broutman, L.J. and Krock,R.M., “ Modern Composite Materials”, Addison-Wesley, 1967.
5. Introduction to Composite Materials Design by Ever J. Barbero 3rd Edition 2017

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

Course Code: GR22A3018 **L/T/P/C: 3/0/0/3**

Course Outcomes:

1. Apply the various linear programming techniques for optimal allocation of limited resources such as machine, material and money
2. Solve transportation problems to minimize cost and understand the principles of assignment of jobs and recruitment policies.
3. Solve sequencing problems and to distinguish various inventory models and develop proper inventory policies
4. Apply game theory to analyze various business competitions and analyze the various waiting line oriented situations.
5. Develop optimum replacement policy and Dynamic Programming Techniques.

UNIT I

Introduction: Development – Definition– Characteristics and Phases of operations Research– Types of models – operation Research models– applications.
Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

UNIT II

Transportation models: Formulation – Methods for finding feasible solutions; North west corner rule, Least cost entry method, Vogel's approximation method. Optimal solution; MODI method. Unbalanced transportation problem and Degeneracy.
Assignment models - Formulation – Optimal solution - Variants of Assignment Problem

UNIT III

Sequencing: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.
Inventory: Introduction – Single item – Deterministic models – Purchase inventory modelwith one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be a discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

UNIT IV

Theory of games: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle– m X 2 and 2 X n games -graphical method.
Waiting lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

UNIT V

Replacement: Introduction – Replacement of items that deteriorate with time – when money

value is not counted and counted – Replacement of items that fail completely, group replacement.
Dynamic programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

Text Books:

1. Operations Research - Prem Kumar Gupta and D S Hira/ S Chand Publishing/ 2015
2. Operations Research / S. D.Sharma / KedarNath RamNath Publication/2020

Reference Books:

1. Operations Research / R.Panneerselvam, 3rd Edition/PHI Publications/ 2023
2. Operations Research An Introduction - Hamdy A Taha/8 th Edition/ Prentice Hall/2006
3. Principles of Operations Research: With Applications to Managerial Decisions - Harvey M. Wagner/Prentice-Hall Operations Research/2020
4. Operations Research - Kanthi Swarup, P.K. Gupta, Man Mohan Sultan Chand & Sons/ 2019
5. Operations Research / A.M.Natarajan, P.Balasubramani,A. Tamilarasi / Pearson Education/2006

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENGINEERING MATERIALS FOR SUSTAINABILITY
(OPEN ELECTIVE)

Course Code: GR22A3009 **L/T/P/C: 3/0/0/3**

Pre-requisites: Building materials and construction planning, Concrete Technology

Course Outcomes:
1. Describe the different types of environmental factors effecting materials
2. Report the work in sustainability for research and education
3. Illustrating the broad perspective in thinking for sustainable practices
4. Perform cost/benefit analysis and life-cycle analysis of green buildings.
5. Identify and compare cost and performance of building materials

UNIT I

Sustainability – Introduction, Need and concept of sustainability, Social- environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols – Clean Development Mechanism (CDM), Environmental legislationsin India – Water Act, Air Act

UNIT II

Air Pollution, effects of Air Pollution; Water pollution-sources, Sustainable wastewater treatment, Solid waste-sources, impacts of solid waste, zero waste concept, 3R concept, Global environmental issues-Resource degradation, climatic change, Global warming, Ozone layer depletion, Regional and Local Environmental issues. Carbon credits and carbon trading, carbon foot print.

UNIT III

Green Building Materials, Basic concepts of sustainable habitat, green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainably managed Materials, Depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials; non-renewable Energy of Materials

UNIT IV

Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds like acetone, formaldehyde, BTEX substances, Natural Non-Petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials, Engineering evaluation of these materials

UNIT V

Green Building Planning and Specifications, Environment friendly and cost effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Alternative Construction Methods, Energy Conservation Measures in Buildings,

Waste &Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight, Plumbing and its Effect on Energy Consumption

Text Books:

1. Alternative Building Materials and Technologies (2007) – K S Jagadeesh, B V Venkata Rama Reddy & K S Nanjunda Rao – New Age International Publishers
2. Integrated Life Cycle Design of Structures (2002)– AskoSarja – SPON Press
3. Non-conventional Energy Resources (2012) – D S Chauhan and S K Srivastava – New Age International Publishers

Reference Books:

1. Green Buildings (2007) McGraw hill publication by Gevorkian
2. Emerald Architecture (2008) case studies in green buildings, The Magazine of Sustainable Design
3. Understanding Green Building Guideline (2010): For Students and Young Professionals, Traci Rose Rider, W. W. Norton & Company Publisher.
4. Understanding Green Building Materials (2011) Traci Rose Rider, W. W. Norton & Company Publisher.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GEOGRAPHIC INFORMATION SYSTEMS AND SCIENCE
(OPEN ELECTIVE)

Course Code:GR22A3086 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Surveying and Geomatics

Course Outcomes:
1. Interpret the fundamental concepts of Geographic Information Science and Technology along with different data structures.
2. Demonstrate Map creation and design principles, including thematic map display, employment of map projections and cartographic design.
3. Analyze the types of digital maps for different themes.
4. Apply the spatial analysis to remote sensing data to generate thematic maps.
5. Solve the real life problems associated with geospatial and remote sensing.

UNIT I

Fundamentals of GIS – Information Systems, Modelling Real World Features Data, Data Formats, Applications of GIS, – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Database Management – Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware – Computing, printing and scanning systems; Software – Standard Packages like Arc view, ArcGIS (commercial) & Auto-CAD Map, Map Info etc. 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.

Reference Books:
1. Remote Sensing and Geographical Information systems by M. Anji Reddy JNTU Hyderabad.4thedition, 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, PrenticeHall 4. GIS by Kang – tsung chang, TMH Publications & Co., 2nd edition, 2013.
4. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications, 1st edition,2016.
5. Remote Sensing and its applications by LRA Narayana, University Press 1999.
6. Remote sensing and image interpretation by Thomas Lillesand, 7th Edition, John Wiley&sons,6th edition 2011.
7. Fundamentals of Geographic Information systems by Michael N. Demers, 4th Edition, Wiley Publishers, 2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ENVIRONMENTAL IMPACT ASSESSMENT
(OPEN ELECTIVE)

Course Code:GR22A4011 **L/T/P/C: 3/0/0/3**

Pre-Requisites: Environmental science

Course Outcomes:

1. Identify, predict and evaluate the environmental effects of proposed actions and projects.
2. Explain the appropriate methodologies for environmental impact prediction and assessment.
3. Analyze the importance of Public Participation, Fault Tree Analysis and Consequence analysis in EIA.
4. Understand the activities in environmental auditing.
5. Plan EIA for developmental projects.

UNIT I

Introduction: Concepts of EIA methodologies – Sustainable development- Need for Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – Evolution of EIA: Screening and scoping; Rapid EIA and Comprehensive EIA

UNIT II

Introduction to EIA, Criteria for the selection of EIA Methodology, General Framework for Environmental Impact Assessment, Characterization, and site assessment. Environmental Risk Analysis, Definition of Risk, Matrix Method; Checklist method.

UNIT III

Prediction and Assessment: Public participation Fault tree analysis, Consequence Analysis; Socioeconomic aspects, measures of the effectiveness of pollution control activities.

UNIT IV

Environmental Legislation: Introduction to Environmental Management Systems; Environmental Statement - procedures; Environmental Audit: Cost-Benefit Analysis.

UNIT V

Life Cycle Assessment, Resource Balance, Energy Balance & Management Review - Operational Control - Case Studies on EIA with reference to Indian Scenario.

Text Books:

1. Y Anjaneyulu, and Valli Manikkam, Environmental Impact Assessment Methodologies, BSP Books PVT Ltd., 2nd edition, 2011.
2. R.R. Barthwal, Environmental Impact Assessment, New Age International Private Limited, 2nd edition, 2012.
3. Canter R.L., Environmental Impact Assessment, Mc Graw Hill International Edition, 2nd edition,1997.

Reference Books:

1. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook",

McGraw Hill Inc., New York, 1996.

2. Judith Petts, Handbook of Environmental Impact Assessment Vol. I &II, Blackwell Science,1999.
3. Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
4. Anji Reddy Mareddy, Environmental Impact Assessment: Theory and Practice, Butterworth-Heinemann publisher, 1st Edition, 2017.
5. MoEF & CC, Govt. of India: EIA notification and subsequent amendments