Academic Regulations
Programme Structure
and
Detailed Syllabus

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

(Four Year Regular Programme)

(Applicable for Batches admitted from 2024-25)

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD

Academic Regulations for B.Tech (Regular) under GR24

(Applicable for Batches Admitted from 2024-25)

Under Graduate Degree Programme in Engineering and Technology (UG)

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

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

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

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

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

3. **Programme Pattern:**

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

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

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

d) The total credits for the Programme are 160.

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

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

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

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

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

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

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

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

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

5. Courses to be offered

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

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

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

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

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

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

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

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

6. Attendance Requirements:

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

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

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

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

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

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

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

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

b) Distribution and Weightage of marks

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

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

Assessment Procedure:

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

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

d) Mini Project:

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

Note:

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

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

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

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

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

				marks.

Note:

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

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

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

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

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

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

  CIE is done for 50 marks as follows:

- There shall be two mid-term examinations during the semester conducted for 40 marks consisting of two parts with a total duration of 2 hours: Part A for 20 marks and Part B for 20 marks.
- Part A is an objective paper or a quiz and shall consist of multiple-choice questions, fill-in-the blanks, match the following, etc. for a total of 20 marks.
- Part B is a descriptive paper and shall contain 6 questions out of which, the student needs to answer 4 questions each carrying 5 marks.
- While the first mid-term examination shall be conducted for the first 50% syllabus, the second mid-term examination shall be conducted for the remaining 50% of the syllabus. The average of the two mid-term examinations shall be taken as final marks.
- Two assignments are evaluated for 5 marks each. The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The assignments shall be given by the subject teachers. The average of the two assignments shall be taken as the final marks.
- The remaining 5 marks may be evaluated by conducting viva-voce in the subject or by evaluating the performance of the student in PPT/Poster/Case-Study presentation on a topic in the concerned subject before second mid-term examination**.**

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

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

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

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

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

  A student who is failed in either Real-Time/Field-Based Research Project may reappear once for the evaluation when they are scheduled again; if the student fails again in the

evaluation of 'one such reappearance', the student has to reappear for the same in the subsequent semester, as and when it is offered.

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

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

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

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

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

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

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

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

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

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

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

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

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

7	Fourth year first semester toFourth year second semester	Regular course of study of Fourth year firstsemester.

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

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

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

Computation of SGPA and CGPA:

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

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

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

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

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

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

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

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

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

Equivalence of grade to marks

Marks % = (CGPA -0.5)*10

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

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

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

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

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

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

18. Transitory Regulations

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of GR22 Regulations due to lack of attendance, shall be permitted to join I year I Semester of GR24 Regulations and he is required to complete the study of B.Tech programme within the stipulated period of eight academic years from the date of first admission in I Year.

2. A student who has been detained in any semester of II, III and IV years of GR22 regulations for want of attendance, shall be permitted to join the corresponding semester of GR24 Regulations and is required to complete the study of B.Tech within the stipulated period of eight academic years from the date of first admission in I Year. The GR24 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

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

C. For readmitted students in GR24 Regulations:

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

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

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

Note:

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

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

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

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

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

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

20. General Rules

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

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

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

Council is final.

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

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

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

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

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

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

2. Academic Requirements and Promotion Rules:

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

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

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

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

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

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

1. Objectives

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

4. Registration for the courses in Minor Programme

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

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

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

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

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

5. Minor courses and the offering departments

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Bachupally, Kukatpally, Hyderabad–500090, India.

ELECTRICAL AND ELECTRONICS ENGINEERING
B. Tech (EEE) – GR24 Course Structure

I B. Tech (EEE) - I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext	Total Marks
					L	T	P	Total			
1	Maths	BS	GR24A1001	Linear Algebra and Function Approximation	3	1	0	4	40	60	100
2	Chemistry	BS	GR24A1004	Engineering Chemistry	3	1	0	4	40	60	100
3	EEE	ES	GR24A1010	Fundamentals of Electrical and Electronics Engineering	2	0	0	2	40	60	100
4	CSE	ES	GR24A1006	Programming for Problem Solving	2	0	0	2	40	60	100
5	EEE	ES	GR24A1011	Elements of Electrical and Electronics Engineering Lab	0	0	2	1	50	--	50
6	Chemistry	BS	GR24A1019	Engineering Chemistry Lab	0	0	3	1.5	40	60	100
7	CSE	ES	GR24A1021	Programming for Problem Solving Lab	0	0	3	1.5	40	60	100
8	ME	ES	GR24A1025	Engineering Workshop	1	0	3	2.5	40	60	100
9	ME	ES	GR24A1016	Graphics for Engineers	1	0	4	3	40	60	100
		TOTAL			**12**	**2**	**15**	**21.5**	**370**	**480**	**850**
10	Mgmt	MC	GR24A1028	Design Thinking	2	0	0	0	50	--	50

I B. Tech (EEE) - II Semester

S. No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext	Total Marks
					L	T	P	Total			
1	Maths	BS	GR24A1002	Differential Equations and Vector Calculus	3	1	0	4	40	60	100
2	Physics	BS	GR24A1003	Applied Physics	3	1	0	4	40	60	100
3	English	HS	GR24A1005	English	2	0	0	2	40	60	100
4	CSE	ES	GR24A1017	Data Structures	2	0	0	2	40	60	100
5	EEE	ES	GR24A1014	Electrical Circuit Analysis	2	0	0	2	40	60	100
6	Physics	BS	GR24A1018	Applied Physics Lab	0	0	3	1.5	40	60	100
7	CSE	ES	GR24A1024	Data Structures Lab	0	0	2	1	40	60	100
8	English	HS	GR24A1020	English Language and Communication Skills Lab	0	0	2	1	40	60	100
9	EEE	ES	GR24A1022	Electrical Circuit Analysis Lab	0	0	2	1	40	60	100
		TOTAL			**12**	**2**	**9**	**18.5**	**360**	**540**	**900**

II B.Tech(EEE) - I Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext	Total Marks
					L	T	P	Total			
1	Maths	BS	GR24A2008	Computational Mathematics for Engineers	3	0	0	3	40	60	100
2	EEE	PC	GR24A2023	Sensors Measurements and Instrumentation	2	1	0	3	40	60	100
3	EEE	PC	GR24A2024	Principles of Analog Electronics	3	0	0	3	40	60	100
4	EEE	PC	GR24A2025	DC Machines and Transformers	3	0	0	3	40	60	100
5	EEE	PC	GR24A2026	Electromagnetic Fields	3	0	0	3	40	60	100
6	CSE	PC	GR24A2027	Database for Engineers	2	0	0	2	40	60	100
7	EEE	PC	GR24A2028	Principles of Analog Electronics Lab	0	0	2	1	40	60	100
8	EEE	PC	GR24A2029	DC Machines and Transformers Lab	0	0	2	1	40	60	100
9	EEE	PC	GR24A2030	Sensors Measurements and Instrumentation Lab	0	0	2	1	40	60	100
		TOTAL			**16**	**1**	**6**	**20**	**360**	**540**	**900**
10	CSE	MC	GR24A2007	Java Programming for Engineers	2	0	0	0	50	--	50
11	Mgmt	MC	GR24A2002	Value Ethics and Gender Culture	2	0	0	0	50	--	50

II B.Tech (EEE) - II Semester

S.No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext	Total Marks
					L	T	P	Total			
1	EEE	PC	GR24A2031	Power Generation and Distribution	3	0	0	3	40	60	100
2	EEE	PC	GR24A2032	AC Machines	2	1	0	3	40	60	100
3	EEE	PC	GR24A2033	Control Systems	3	0	0	3	40	60	100
4	EEE	PC	GR24A2034	Principles of Digital Electronics	3	0	0	3	40	60	100
5	EEE	PC	GR24A2035	Microprocessors and Microcontrollers	3	0	0	3	40	60	100
6	EEE	PC	GR24A2036	Principles of Digital Electronics Lab	0	0	2	1	40	60	100
7	EEE	PC	GR24A2037	AC Machines Lab	0	0	2	1	40	60	100
8	EEE	PC	GR24A2038	Control Systems Lab	0	0	2	1	40	60	100
9	EEE	PW	GR24A2106	Real-time Research Project/ Societal Related Project	0	0	4	2	50	--	50
		TOTAL			**14**	**1**	**10**	**20**	**370**	**480**	**850**
10	Chemistry	MC	GR24A2001	Environmental Science	2	0	0	0	50	--	50

III YEAR I SEMESTER

S.No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext	Total Marks
					L	T	P	Total			
1	EEE	PC	GR24A3028	Power Transmis Sion Systems	2	1	0	3	40	60	100
2	EEE	PC	GR24A3029	Power Electronics	3	0	0	3	40	60	100
3	EEE	PC	GR24A3030	Power System Protection	3	0	0	3	40	60	100
4	EEE	PE		Professional Elective I	3	0	0	3	40	60	100
5	EEE	OE		Open Elective I	3	0	0	3	40	60	100
6	EEE	PC	GR24A3036	Power System Protection Lab	0	0	3	1.5	40	60	100
7	EEE	PC	GR24A3037	Power Electronics Lab	0	0	3	1.5	40	60	100
8	EEE	PC	GR24A3038	Microproce ssors and Microcontr ollers Lab	0	0	2	1	40	60	100
9	Engli sh	BS	GR24A3013	Advanced English Communication Skills Lab	0	0	2	1	40	60	100
		TOTAL			**15**	**1**	**8**	**20**	**360**	**540**	**900**
10	Mgmt	MC	GR24A2003	Constitution of India	2	0	0	0	50	--	50

Professional Elective –I			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR24A3031	Wide Band Gap power Devices
2	EEE	GR24A3032	Solar And Wind Energy Systems
3	EEE	GR24A3033	Electrical Machine Design
4	MECH	GR24A3034	Operations Research

Open Elective I			
S.No.	**BOS**	**Course Code**	**COURSE**
1	EEE	GR24A3035	Non-Conventional Energy Sources

III YEAR II SEMESTER

S.No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext	Total Marks
					L	T	P	Total			
1	EEE	PC	GR24A3039	DSP based Electromechanical Systems	3	0	0	3	40	60	100
2	EEE	PC	GR24A3040	Power System Analysis	2	1	0	3	40	60	100
3	Mgnt	HS	GR24A3041	Economics and Accounting for Engineers	3	0	0	3	40	60	100
4	EEE	PE		Professional Elective II	3	0	0	3	40	60	100
5	EEE	OE		Open Elective II	3	0	0	3	40	60	100
6	EEE	PC	GR24A3047	Power System Analysis Lab	0	0	3	1.5	40	60	100
7	EEE	PC	GR24A3048	DSP based Electrical Lab	0	0	3	1.5	40	60	100
8	EEE	PW	GR24A3027	Mini Project with seminar	0	0	4	2	40	60	100
		TOTAL			**14**	**1**	**10**	**20**	**320**	**480**	**800**

Professional Elective -II			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR24A3042	Modelling and Simulation of Power Electronic Converters
2	EEE	GR24A3043	HVDC Transmission Systems
3	EEE	GR24A3044	Advanced Control Systems
4	CSE	GR24A3045	Operating Systems

Open Elective II			
S.No.	**BOS**	**Course Code**	**COURSE**
1	EEE	GR24A3046	Concepts of Control Systems

IV YEAR I SEMESTER

S.No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext	Total Marks
					L	T	P	Total			
1	EEE	PC	GR24A4027	Power Semiconductor Drives	2	1	0	3	40	60	100
2	EEE	PC	GR24A4028	Electric and Hybrid Vehicles	3	0	0	3	40	60	100
3	EEE	PE		Professional Elective III	3	0	0	3	40	60	100
4	EEE	PE		Professional Elective IV	3	0	0	3	40	60	100
5	Mgnt	HS	GR24A4069	Fundamentals of Management and Entrepreneurship	3	0	0	3	40	60	100
7	EEE	OE		Open Elective III	3	0	0	3	40	60	100
8	EEE	PC	GR24A4038	Power Semiconductor Drives Lab	0	0	2	1	40	60	100
9	EEE	PW	GR24A4016	Project Work Phase-I	0	0	12	6	40	60	100
		TOTAL			**17**	**1**	**14**	**25**	**320**	**480**	**800**

Professional Elective -III			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR24A4029	Modern Power Electronics
2	EEE	GR24A4030	High Voltage Engineering
3	EEE	GR24A4031	Digital Control Systems
4	EEE	GR24A4032	Industrial Automation
Professional Elective -IV			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR24A4033	Power Quality and FACTS
2	EEE	GR24A4034	Utilization of Electrical Energy
3	EEE	GR24A4035	Special Electrical Machines
4	ECE	GR24A4036	Introduction to VLSI Design

Open Elective III			
S.No.	**BOS**	**Course Code**	**COURSE**
1	EEE	GR24A4037	Artificial Neural Networks and Fuzzy Logic

IV YEAR II SEMESTER

S.No	BOS	Group	Course Code	Course Name	Credits				Int.	Ext	Total Marks
					L	T	P	Total			
1	EEE	PC	GR24A4039	Power System Monitoring and Control	2	1	0	3	40	60	100
2	EEE	PE		Professional Elective V	3	0	0	3	40	60	100
3	EEE	PE		Professional Elective VI	3	0	0	3	40	60	100
4	EEE	PW	GR24A4026	Project Work Phase-II	0	0	12	6	40	60	100
		TOTAL			**8**	**1**	**12**	**15**	**160**	**240**	**400**

Professional Elective -V			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR24A4040	Advanced Electric Drives
2	EEE	GR24A4041	Energy Storage Systems
3	EEE	GR24A4042	Modern Control Theory
4	EEE	GR24A4043	Industrial IoT
Professional Elective -VI			
S.No	**BOS**	**Course Code**	**Course Name**
1	EEE	GR24A4044	AI and ML applications to Power Electronics
2	EEE	GR24A4045	Electric Smart Grid
3	ECE	GR24A3084	Embedded Systems Design
4	CSE(DS)	GR24A4046	Introduction to 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 and Electronics
1	Wide Band Gap Power Devices	Solar and Wind Energy Systems	Electrical Machine Design	Operations Research
2	Modelling and Simulation of Power Electronic Converters	HVDC Transmission Systems	Advanced Control Systems	Operating Systems
3	Modern Power Electronics	High Voltage Engineering	Digital Control Systems	Industrial Automation
4	Power Quality and FACTS	Utilization of Electrical Energy	Special Electrical Machines	Introduction to VLSI Design
5	Advanced Electric Drives	Energy Storage Systems	Modern Control Theory	Industrial IoT
6	AI and ML applications to Power Electronics	Electric Smart Grid	Embedded Systems Design	Introduction to Big Data Analytics

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OPEN ELECTIVES FOR GR24 REGULATIONS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
LINEAR ALGEBRA AND FUNCTION APROXIMATION

(COMMON TO CSE, ECE, EEE, CE, ME, CSE(DS), CSE(AIML))

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

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

COURSE OUTCOMES

1. 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. Illustrate the concepts of function approximation with measurement of error
5. Develop the skill of finding multivariable function optima

UNIT I
FUNDAMENTALS OF VECTOR AND MATRIX ALGEBRA
Operations on vectors and matrices- Orthogonal projection of vectors- Exact and generalized inverse of a matrix- Rank of a matrix- Linear independence of vectors- Structured square matrices (Symmetric, Hermitian, skew-symmetric, skew-Hermitian, orthogonal and unitary matrices)- Vector and matrix norms

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

UNIT II
MATRIX EIGENVALUE PROBLEM AND QUADRATIC FORMS
Determination of eigenvalues and eigenvectors of a matrix, properties of eigenvalues and eigenvectors (without proof)- Similarity of matrices- Diagonalization of a matrix- Orthogonal diagonalization of a symmetric matrix- Definiteness of a symmetric matrix

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

UNIT III
MATRIX DECOMPOSITION AND LEAST SQUARES SOLUTION OF ALGEBRAIC SYSTEMS
LU decomposition- Cholesky decomposition- Gram-Schmidt orthonormalization process- QR factorization- Eigen decomposition of a symmetric matrix- Singular value decomposition

Least squares solution of an over determined system of equations using QR factorization and the generalized inverse- Estimation of the least squares error

UNIT IV

FUNCTION APPROXIMATION TOOLS IN ENGINEERING

Mean value theorems- Lagrange's mean value theorem, Taylor's theorem (without proof), Approximation off a function by Taylor's series

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

UNIT V

MULTIVARIABLE DIFFERENTIAL CALCULUS AND FUNCTION OPTIMIZATION

Partial Differentiation- Chain rule- Total differentiation- Jacobian- Functional dependence

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

TEXTBOOKS

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
ENGINEERING CHEMISTRY
(Common to all Branches)

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

COURSE OUTCOMES

1. Assess the specification of water regarding its usage in domestic & Industrial scenarios.
2. Learn the working principles of various energy storage devices, and electrochemical reactions involved in corrosion.
3. Analyse the efficacy of polymers in diverse applications.
4. Distinguish various energy sources to prioritize eco-friendly fuels for environmentally sustainable development.
5. Interpret the role of engineering materials in various sectors.

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

UNIT II
BATTERY CHEMISTRY AND CORROSION
Introduction - Classification of **Batteries**- primary, and secondary batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of Zn-air and Lithium-ion battery, Applications of Li-ion battery to electric vehicles.
Fuel Cells - Definition, Construction, working principle and applications of Hydrogen-Oxygen fuel cell and Solid oxide fuel cell, Differences between battery and a fuel cell.
Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods-Cathodic protection – Sacrificial anode and impressed current methods.

UNIT III
POLYMERS
Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples – Nylon 6:6
Plastics: Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite, Compounding and fabrication of plastics - compression moulding and injection moulding. Fiber-reinforced

plastics (FRP).

Conducting Polymers: Characteristics and Classification with examples-mechanism of conduction in trans-polyacetylene and applications of conducting polymers.
Biodegradable Polymers: Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

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

UNIT V
ENGINEERING MATERIALS
Smart materials and their engineering applications: Shape memory materials- Poly L-Lactic acid. Thermoresponse materials- Polyacryl amides, Poly vinyl amides.
Biosensors: Definition, characteristics, classification-, construction & working, applications and advantages of biosensors. Biochips -Definition, advantages, and applications.
Semiconductors: Si and Ge - Preparation, Ultra-purification and Crystal Growth by Zone Refining and Czochralski Crystal Pulling methods, Doping – Epitaxy, Diffusion and Ion-implantation.

TEXTBOOKS

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING
(EEE)

Course Code: GR24A1010 **L/T/P/C: 2/0/0/2**
I Year I Semester

COURSE OUTCOMES

1. Summarize the basic fundamental laws of electric circuits.
2. Distinguish the single phase and three phase circuits.
3. Analyze the basics and principle of PN junction diode.
4. Illustrate the principle and operation of BJT and MOSFET transistors
5. Outline the protection principles using Switchgear components.

UNIT I
DC FUNDAMENTALS

Passive components, Voltage and Current sources, dependent and independent sources, fundamentals of circuit Laws, Source Transformation, Passive components in series and parallel, Delta – star conversion, Nodal and Mesh Analysis.

UNIT II
AC FUNDAMENTALS

Representation of sinusoidal waveforms, average and rms values, phasor representation, real power, reactive power, apparent power, power factor, impedance, Admittance. Introduction to three-phase circuits, types of connection. voltage and current relations in star and delta connections, analysis of balanced and unbalanced circuits, measurement of power by three- and two-wattmeter methods, measurement of reactive power by single wattmeter.

UNIT III
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 principle of Half-wave and full-wave rectifiers.

UNIT IV
TRANSISTORS

BJT Structure, construction, Principle and Operation of BJT, Types NPN, PNP, Common Emitter, Common Base and Common Collector Configurations, Input characteristics and Output Characteristics of a BJT.
MOSFET: Construction, Principle and Operation of Enhancement mode, Depletion mode devices, NMOS, PMOS, CMOS transistors, CMOS Inverter, Inverter characteristics.

UNIT V
ELECTRICAL INSTALLATION COMPONENTS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB (Miniature Circuit Breaker), ELCB (Earth Leakage Circuit Breaker), MCCB (Moulded Case Circuit Breaker),RCCB, Earthing: Plate and pipe earthing ,Types of batteries: Primary and secondary, UPS(Uninterrupted power supply):Components, Calculation of ratings for UPS components to specific load, power factor improvement methods.

TEXTBOOKS

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

REFERENCES

1. "A Textbook of Electrical Technology",-BL Theraja volume-I, S.Chand Publications.
2. "Electronic Devices and circuits" by Jacob Milliman, McGraw-Hill, 1967
3. "Electrical and Electronics Technology", E. Hughes, 10th Edition, Pearson, 2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

PROGRAMMING FOR PROBLEM SOLVING

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

COURSE OUTCOMES

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

UNIT I
INTRODUCTION TO PROGRAMMING

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

Introduction to C Programming Language: Structure of C program, keywords, variables, constants, datatypes, operators, precedence and associativity, expression evaluation, implicit 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 ofarrays. **Searching:** Introduction to searching, Linear search and Binary search.

UNIT III
STRINGS AND FUNCTIONS

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

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

UNIT IV
POINTERS AND STRUCTURES

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

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

unions, typedef.

UNIT V
FILE HANDLING AND PREPROCESSOR IN C

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

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

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

TEXTBOOKS

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)

REFERENCES

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
(Autonomous)
ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB

(EEE)

Course Code: GR24A1011 **L/T/P/C:0/0/2/1**
I Year I Semester

COURSE OUTCOMES

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

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Verification of Ohms Law, KVL and KCL
2. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.
3. Verification of relationship between three phase voltages and currents in star and delta connection.
4. Measurement of Active & Reactive Power for star and delta connected balanced loads.
5. Power factor improvement by using capacitor bank in parallel with inductive load.
6. Measurement of Earth Electrode Resistance.
7. Volt ampere Characteristics of a PN Junction Diode.
8. Single Phase Half & Full wave diode Rectifier**.**
9. Input & Output Characteristics of NPN Bipolar Junction Transistor.
10. Drain Characteristics of MOSFET.
11. Breakdown Characteristics of a Zener Diode.
12. Transfer Characteristics of MOSFET.

TEXTBOOKS

1. “Basic Electrical Engineering”, D.P. Kothari and I.J. Nagrath, Third edition 2010, Tata McGraw Hill.

2. "Electrical Engineering Fundamentals", Vincent Deltoro, Second Edition, Prentice Hall India, 1989.

REFERENCES

1. "A Textbook of Electrical Technology", -BL Theraja volume-I, S.Chand Publications.
2. "Electronic Devices and circuits" by Jacob Milliman, McGraw-Hill, 1967
3. "Electrical and Electronics Technology", E. Hughes, 10th Edition, Pearson, 2010.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
ENGINEERING CHEMISTRY LAB

Course Code: GR24A1019 **L/T/P/C: 0/0/3/1.5**
I Year I Semester

COURSE OUTCOMES

1. Determination of parameters like hardness of water chloride content in water
2. Able to handle instruments like conductometer and potentiometer to find out the concentrations of acids and bases.
3. Estimate the amount of metal ion present in a given sample.
4. Prepare polymers like bakelite, nylon-6, and aspirin in the laboratory.
5. Find out the physical properties of fluids like adsorption, surface tension, and viscosity.

List of Experiments

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROGRAMMING FOR PROBLEM SOLVING LAB

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

COURSE OUTCOMES

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

TASK 1

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

TASK 2

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

TASK 3

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

TASK 4

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

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

TASK 5

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

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TASK 6

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

(ii)

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

(iii)

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

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

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

TASK 7

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

TASK 8

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

TASK 9

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

TASK 10

a. Write a C program to implement factorial of a given integer using recursive and non-recursive functions.

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

TASK 11

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

TASK 12

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

TASK 13

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

TASK 14

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

TASK 15

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

TEXTBOOKS

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

REFERENCE BOOKS

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PrenticeHall of India
2. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)

3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education
4. Herbert Schildt, C: The Complete Reference, McGraw Hill, 4th Edition

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

ENGINEERING WORKSHOP

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

COURSE OUTCOMES

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

TRADES FOR EXERCISES: At least two tasks from each trade

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

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

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

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

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

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

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

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

TEXTBOOKS

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

GRAPHICS FOR ENGINEERS

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

COURSE OUTCOMES

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

TEXTBOOKS

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

DESIGN THINKING

Course Code: GR24A1022 **L/T/P/C: 2/0/0/0**
I Year I Semester

COURSE OUTCOMES

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

UNIT I

REVISITING DESIGN THINKING

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

UNIT II

IDEATION PROCESS

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

UNIT III

DESIGNING CUSTOMER EXPERIENCE

Understanding Innovation through Design Thinking; Enhancing Customer Experience; Service Design and Development Process and Case Studies; Service Experience Cycle and Case Studies .

UNIT IV

SUSTAINABLE DESIGN APPROACHES

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

UNIT V

INTEGRATIVE ENGINEERING DESIGN SOLUTIONS

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

TEXTBOOKS

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

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

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

REFERENCES

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

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

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

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

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

I YEAR II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(COMMON TO CSE, ECE, EEE, CE, ME, CSE(DS), CSE(AIML))

Course Code: GR24A1002 **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 by suggested methods
2. Solve linear differential equations of higher order under various forcing functions
3. Evaluate double and triple integrals and apply them to some problems in geometry and mechanics
4. Apply vector differential operators on scalar and vector fields and apply them to solve some field related problems
5. Apply classical vector integral theorems for fast evaluation of work done around closed curves and flux across closed surfaces

UNIT I
ORDINARY DIFFERENTIAL EQUATIONS OF THE FIRST ORDER

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

UNIT II
ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

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

UNIT III
MULTIPLE INTEGRALS

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

UNIT IV
VECTOR DIFFERENTIATION AND LINE INTEGRATION

Vector differentiation: Scalar and vector point functions, Concepts of gradient, divergence and curl of functions in cartesian framework, solenoidal field, irrotational field, scalar potential

Vector line integration: Evaluation of the line integral, concept of work done by a force field, Conservative fields

UNIT V
SURFACE INTEGRATION AND VECTOR INTEGRAL THEOREMS

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

TEXTBOOKS

1. R.K.Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa publishing house, Fourth edition 2014
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006

4.. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
APPLIED PHYSICS
(Common to all branches)

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

COURSE OUTCOMES

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

UNIT I
QUANTUM PHYSICS AND SOLIDS

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

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

UNIT II
SEMICONDUCTORS AND DEVICES

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

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

UNIT III
MAGNETIC MATERIALS AND SUPERCONDUCTIVITY

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

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

UNIT IV

LASERS AND FIBER OPTICS

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

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

UNIT V

NANOTECHNOLOGY

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

TEXTBOOKS

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
ENGLISH
Common to CSE (SEM-I), and CE, EEE, CSE (AIML), CSE(DS), ECE & ME(SEM-II)

Course Code: GR24A1005 **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. Convey complex ideas clearly and accurately in academic and professional settings

UNIT I

Chapter entitled '***Toasted English*' by R.K.Narayan** from ***"English: Language, Context andCulture"*** published by Orient BlackSwan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of ProperPunctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT II

Chapter entitled **'Appro JRD' by Sudha Murthy** from ***"English: Language, Context and Culture"published*** by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement andSubject-verb Agreement.

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events

– Classifying- Providing Examples or Evidence.

UNIT III

Chapter entitled **'Lessons from Online Learning' by F.Haider Alvi, Deborah Hurst et al** from ***"English: Language, Context and Culture"*** published by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises forPractice.

Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter ofRequisition, Email Etiquette, Job Application with CV/Resume.

UNIT IV

Chapter entitled **'Art and Literature' by Abdul Kalam** from ***"English: Language, Context andCulture"*** published by Orient BlackSwan, Hyderabad.

Vocabulary: Standard Abbreviations in English

Grammar: Redundancies and Clichés in Oral and Written Communication.

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice

Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion - Précis Writing.

UNIT V

Chapter entitled **'Go, Kiss the World' by Subroto Bagchi** from ***"English: Language, Context andCulture"*** published by Orient BlackSwan, Hyderabad.

Vocabulary: Technical Vocabulary and their Usage

Grammar: Common Errors in English (*Covering all the other aspects of grammar which were notcovered in the previous units*)

Reading: Reading Comprehension-Exercises for Practice

Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

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

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

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

TEXTBOOK

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

DATA STRUCTURES

Course Code: GR24A1017 **L/T/P/C:2/0/0/2**

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 operationson 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 outlinehashing 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 ofqueue 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 ofa linked list in memory, operations-insertion, deletion, display, search.

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

UNIT IV

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

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

UNIT V

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

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

Teaching methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

TEXTBOOKS

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
(Autonomous)

ELECTRICAL CIRCUIT ANALYSIS

Course Code: GR24A1014 **L/T/P/C:2/0/0/2**
I Year II Semester

COURSE OUTCOMES

1. Analyze the electric circuits with suitable theorems and coupled circuits.
2. Illustrate the transient response of given DC circuits.
3. Infer electrical circuit responses using Laplace and Inverse Laplace transform.
4. Summarize the concepts of Fourier Series and Fourier transforms.
5. Simplify the network by using two port parameters.

UNIT I
NETWORK THEOREMS AND COUPLED CIRCUITS
Linearity and Superposition, Thevenin's and Norton's theorems, Maximum power transfer theorem and Reciprocity theorem (DC &AC).
Coupled Circuits: Self & Mutual Inductance, Dot convention, Coefficient of Coupling, Analysis of circuits with mutual inductance.

UNIT II
DC TRANSIENTS AND RESONANCE
Solution of first and second order differential equations for Series and Parallel RL, RC, RLC circuits, time constants, steady state and transient response. Current locus diagrams of RL and RC series circuits.
Resonance: Series and parallel circuits, Bandwidth, Q-factor, initial and final conditions in network elements

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

UNIT IV
FOURIER SERIES AND FOURIER TRANSFORM
Representation of continuous-time periodic signals by Fourier series; Dirichlet's conditions; Symmetry conditions, Properties of Fourier series, Trigonometric and Exponential Fourier series.
Fourier transform: Fourier transform of periodic signals, Properties of Fourier transforms. Application to simple networks.

UNIT V
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).

TEXTBOOKS

1. "Fundamentals of Electric Circuits" by C.K.Alexander and M.N.O.Sadiku, McGraw Hill Education,2004.
2. "Engineering Circuit Analysis" by W.H.Hayt and J.E.Kemmerly, McGraw Hill Education,2013.

REFERENCES

1. "Basic Electrical Engineering" by A.Sudhakar and Shyam Mohan, McGraw Hill Education.
2. "Circuit Theory" (Analysis and Synthesis) by A.Chakrabarti, Dhanpat Rai & Co
3. "Networks and Systems" by D Roy Choudhury, New Age International Publications, 1998.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

APPLIED PHYSICS LAB

(Common to all branches)

Course Code: GR24A1018 **L/T/P/C:0/0/3/1.5**

I Year II Semester

COURSE OUTCOMES

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

List of Experiments

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

Note: Any 8 experiments are to be performed.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

DATA STRUCTURES LAB

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

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

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

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

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

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

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

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

TASK 7

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

TASK 8

a. Write a C program to implement Double Linked List operations – create, insert, deleteand 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 Treeusing 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

TEXTBOOK

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
(Autonomous)
ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

Common to CSE (SEM-I), and CE, EEE, CSE(AIML), CSE(DS), ECE & ME(SEM-II)

Course Code: GR24A1020 **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 collaboratively by listening carefully and respect others point of view.
3. Utilize various media of verbal and non-verbal communication with reference to various professional contexts.
4. Recognize the need to work in teams with appropriate ethical, social and professional responsibilities.
5. Speak and pronounce English intelligibly

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

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

Exercise I

CALL Lab:

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

ICS Lab:

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

Exercise II

CALL Lab:

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

ICS Lab:

Understand: Features of Good Conversation – Non-verbal Communication.
Practice: Role-Play- Expressions in Various Situations –Making Requests and Seeking

Permissions- Telephone Etiquette, Rapid Round –Memory Games.

Exercise III

CALL Lab:

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

ICS Lab:

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

Exercise IV

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

ICS Lab:

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

Exercise V

CALL Lab:

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

ICS Lab:

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

Minimum Requirement of infrastructural facilities for ELCS Lab:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

ELECTRICAL CIRCUIT ANALYSIS LAB

Course Code: GR24A1022 **L/T/P/C:0/0/2/1**
I Year II Semester

COURSE OUTCOMES

1. Solve the circuits using various network theorems.
2. Analyze the performance of R-L, R-C and R-L-C circuits and draw the locus diagrams.
3. Measure the self and mutual inductance and determine the coefficient of coupling.
4. Determine the two-port network parameters.
5. Examine the resonance parameters and verify them practically.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Verification of Thevenin's Theorem & Norton's Theorem
2. Verification of Superposition Theorem.
3. Verification of Reciprocity Theorem.
4. Verification of Maximum Power Transfer Theorem.
5. Determination of time constant for series RL and RC circuits.
6. Draw the Locus Diagrams of RL (R-Varying) and RC (R-Varying) Series Circuits.
7. Draw the locus Diagrams of RL (L-Varying) and RC (C-Varying) Series Circuits.
8. Analysis of Series Resonant Circuit.
9. Analysis of Parallel Resonant Circuit.
10. Determination of self, mutual inductances and coefficient of coupling.
11. Determination of Z &Y parameters of a two- port network.
12. Determination of Hybrid & Transmission parameters of a two-port network.

TEXTBOOKS

1. "Fundamentals of Electric Circuits" by C.K.Alexander and M.N.O.Sadiku, McGraw Hill Education,2004.
2. "Engineering Circuit Analysis" by W.H.Hayt and J.E.Kemmerly, , McGraw Hill Education,2013.

REFERENCES

1. "Basic Electrical Engineering" by A.Sudhakar and Shyam Mohan, McGraw Hill Education.
2. "Circuit Theory" (Analysis and Synthesis) by A.Chakrabarti ,Dhanpat Rai & Co
3. "Networks and Systems" by D Roy Choudhury, New Age International Publications,1998.

II YEAR – I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

COMPUTATIONAL MATHEMATICS FOR ENGINEERS

(Common to ECE, EEE, ME & CIVIL)

Course Code: GR24A2008 **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 techniques for univariate and bivariate data using Gaussian and cubic spline methods
3. Apply numerical techniques to find eigen values and corresponding eigenvectors of a matrix
4. Apply numerical techniques in differentiation and integration.
5. Apply finite difference method to solve IVP in ODE and PDE.

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

UNIT II
INTERPOLATION AND CUBIC SPLINE

Interpolation with non-uniform data: Newton divided differences formula, Hermite interpolation, Interpolation with uniform data- Newton and Gauss formulas-Newton's bivariate interpolation for uniform data, Fitting natural cubic spline to data

UNIT III
EIGENVALUES AND EIGENVECTORS

Jacobi iteration method for finding eigenvalues and eigenvectors of a symmetric matrix- Power method and inverse power method for finding the largest and smallest eigenvalues and eigenvectors of a matrix

UNIT IV
NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION

Numerical differentiation using the Newton's forward, backward and central difference formulas. Numerical integration by Trapezoidal rule, Simpson's 1/3rd and $3/8^{th}$ rules, Gauss-Legendre one point, two point and three point rules.

UNIT V
NUMERICAL SOLUTION OF INITIAL AND BOUNDARY VALUE PROBLEMS IN ODE AND PDE

Euler ,Modified Euler method and R-K fourth order methods to solve initial value problems in ODE- Finite differences method to solve boundary value problems in ODE- Solution of Laplace's equation by Jacobi and Successive over relaxation (SOR) methods

TEXTBOOKS

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

REFERENCES

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

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

SENSORS MEASUREMENTS AND INSTRUMENTATION

Course Code: GR24A2023 **L/T/P/C: 2/1/0/3**
II Year I Semester

COURSE OUTCOMES

1. Illustrate the fundamentals and measurement of different electrical quantities.
2. Outline unknown electrical parameters.
3. Summarize Oscilloscopes and discover the usage of Digital meters.
4. Identify working principles of various Sensors/Transducers.
5. Apply Sensors/Transducers of various types in real time applications.

UNIT I

FUNDAMENTALS OF ELECTRICAL MEASUREMENTS

Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, PMMI type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters- electrometer type and attracted disc type – extension of range of E.S. Voltmeters. Instrument Transformers-C.T.s and P.Ts Ratio and Phase angle errors.

UNIT-II

MEASUREMENT OF ENERGY AND OTHER ELECTRICAL QUANTITIES

Single phase & Three phase energy meters, Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type's standardization – applications
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 (Theoretical Approach).

UNIT III

OSCILLOSCOPE AND DIGITAL VOLTMETERS

Data Acquisition system, Components of Cathode Ray Oscilloscope: Time base Generator, Horizontal & Vertical Amplifier, Electrostatic Deflection. Measurement of phase and frequency

INTRODUCTION TO SMART AND DIGITAL METERING: Digital Multi-meter, True RMS meters, Clamp- on meters, Digital Energy Meter, 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. "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
(Autonomous)

PRINCIPLES OF ANALOG ELECTRONICS

Course Code: GR24A2024 **L/T/P/C: 3/0/0/3**
II Year I Semester

COURSE OUTCOMES

1. Explain the basic principles and operation of Operational amplifier.
2. Summarize different Operational Amplifier's applications.
3. Classify various types of filters.
4. Demonstrate the use of Timers and Phase-Locked Loops
5. Differentiate between various types of oscillators circuits

UNIT I
INTEGRATED CIRCUITS

Classification, Introduction to Operational Amplifier, block diagram, 741 OpAmp and its Features, ideal characteristics of op- amp, practical op-amp. Differential mode and common mode operation, Modes of operation-inverting, non-inverting, differential. Inverting amplifier, non-inverting amplifier and Voltage Follower Circuit.
DC Characteristics: Input bias current, Input offset current, input offset voltage and slew rate.

UNIT II
OP-AMP APPLICATIONS

Inverting summing amplifier, Non-Inverting Summing amplifier, Subtractor circuit, differential amplifier, instrumentation amplifier, integrator, differentiator, Voltage to Current and Current to Voltage Converters, Sample & Hold Circuits

UNIT III
FILTERS

Classification of Filters: Active and Passive Filters, Low Pass Filter, High Pass Filter, Narrow Band Pass Filter, Wide Band Pass Filter, Narrow Band Stop Filter, Wide Band Stop Filter, All pass filter.

UNIT IV
TIMERS & PHASE LOCKED LOOPS

Introduction to 555 Timer, Functional Diagram, Monostable Multivibrator and Astable Multivibrator Operations and Applications, IC565 PLL-Block Schematic, principle and Applications

UNIT V
OSCILLATORS

Basic principle of an Oscillator, RC Phase shift and Wein bridge Oscillator, Schmitt Trigger Circuit.

TEXTBOOKS

1. "Linear Integrated Circuits", D.Roy Choudhary & Shail B Jain, New Age International Publishers, 2nd edition 2004.

2. “Op-Amps & Linear ICs”, – Ramakanth A. Gayakwad, PHI, 2003.

REFERENCES

1. “Electronics Analog and Digital”, by I. J. Nagrath, PHI Learning Pvt. Ltd., 2013 Edition.
2. “Electronics Principles”, by Malvino, Mc. Graw Hill, Third edition. 2000.
3. “Analysis and Design of Analog Integrated Circuits”, P. R. Gray, R. G. Meyer and S. Lewis, John Wiley & Sons, 2001.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

DC MACHINES AND TRANSFORMERS

Course code: GR24A2025 **L/T/P/C: 3/0/0/3**
II Year I Semester

COURSE OUTCOMES

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

UNIT I
INTRODUCTION

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 produced by 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.

UNIT V

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

REFERENCES

1. "Performance and design of AC machines", by M. G. Say, CBS Publishers, 2002.
2. "Principles of Electric Machines", by PC Sen Second Edition.
3. "Electric Machinery and Transformers", Bhag S. Guru and Huseyin R. Hiziroglu OUP Higher Education Division Publishers, 2000.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
ELECTROMAGNETIC FIELDS

Course Code: GR24A2026 **L/T/P/C: 3/0/0/3**
II Year I Semester

COURSE OUTCOMES
1. Interpret the Electric Field Intensity with respect to free space.
2. Solve the Current Density Equation and Capacitance of different materials.
3. Evaluate Magnetic Field Intensity and Force in Magnetic Fields.
4. Analyze the Maxwell's Equations in Time Varying Fields, Displacement current.
5. Summarize the Electro-Magnetic wave equations & its 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-Electric Dipole-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 infinitely long 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, Good conductors-power and the poynting vector, Reflection of a plane wave at normal incidence, oblique incidence.

TEXTBOOKS

1. "Principles of Electromagnetics", by Matthew N.O.Sadiku, Oxford University Publication, Fourth Edition, 2014.
2. "Engineering Electromagnetics", by W.Hayt, John A.Buck McGraw Hill Education, 2012.

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

DATABASE FOR ENGINEERS

Course Code: GR24A2027 **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 Basic DDL 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.

TEXTBOOKS

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

REFERENCES

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
(Autonomous)

PRINCIPLES OF ANALOG ELECTRONICS LAB

Course Code: GR24A2028 **L/T/P/C: 0/0/2/1**
II Year I Semester

COURSE OUTCOMES

1. Demonstrate the working of Operational Amplifiers.
2. Design Operational Amplifiers as inverting and non-inverting amplifier.
3. Perform mathematical operations using Operational Amplifier
4. Analyze the characteristics of Low Pass and High Pass Filters.
5. Examine the application of 555 timer.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Implement Inverting Amplifier using Operational Amplifier
2. Determine the gain of Non-Inverting Amplifier using Operational Amplifier
3. Design of Operational Amplifier as proportional Amplifier
4. Construct an Operational Amplifier based proportional Amplifier.
5. Implement Subtractor Circuit using Operational Amplifier
6. Develop a differentiator Circuit using Operational Amplifier
7. Implement mathematical Integrator Circuit using Operational Amplifier
8. Develop a mathematical Differentiator Circuit using Operational Amplifier
9. Construct the Low Pass Filter circuit to plot the frequency characteristics.
10. Analyze the High Pass Filter circuit to plot the frequency characteristics.
11. Design an inverter using operational amplifier.
12. Construct 555 timer to generate a square wave.

TEXTBOOKS

1. "Linear Integrated Circuits", D.Roy Choudhary & Shail B Jain, New Age International Publishers, 2nd edition 2004.
2. "Op-Amps & Linear ICs", – Ramakanth A. Gayakwad, PHI, 2003.

REFERENCES

1. "Electronics Analog and Digital", by I. J. Nagrath, PHI Learning Pvt. Ltd., 2013 Edition.
2. "Electronics Principles", by Malvino, Mc. Graw Hill, Third edition. 2000.
3. "Analysis and Design of Analog Integrated Circuits", P. R. Gray, R. G. Meyer and S. Lewis, John Wiley & Sons, 2001.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
DC MACHINES AND TRANSFORMERS LAB

Course Code: GR24A2029 **L/T/P/C: 0/0/2/1**
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. Explain and control of different DC Machines.
4. Distinguish the performance of different machines using different testing methods.
5. Determine the parameters of equivalent circuit of single-phase transformer and 3-phase to 2-phase conversion or vice-versa.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Swinburne's Test and Speed Control of a D.C Shunt Motor
2. Brake Test on a DC Shunt Motor
3. Brake Test on a DC Compound Motor
4. Open Circuit Characteristics of a D.C. Shunt Generator
5. Load test on a D.C. Shunt Generator
6. Load test on a D.C. Series Generator
7. Load test on a D.C. Compound Generator
8. Hopkinson Test
9. Fields Test
10. Separation of Core Losses of a DC machine
11. OC, SC and Load tests on Single Phase Transformer
12. Scott connection.

TEXTBOOKS

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

REFERENCES

1. "Performance and design of AC machines", by M. G. Say, CBS Publishers, 2002.
2. "Principles of Electric Machines", by PC Sen Second Edition.
3. "Electric Machinery and Transformers", Bhag S. Guru and Huseyin R. Hiziroglu OUP Higher Education Division Publishers, 2000.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

SENSORS MEASUREMENTS AND INSTRUMENTATION LAB

Course Code: GR24A2030 **L/T/P/C:0/0/2/1**
II year I semester

COURSE OUTCOMES

1. Determine the unknown electrical parameters using various types of bridges.
2. Construct basic programs for computer-controlled data acquisition, measurement, and transfer of data across the sensor network for different types of sensors.
3. Analyze and interpret the experimental data by monitoring and capturing.
4. Experiment on various sensor output configurations using measuring instruments.
5. Measure physical and electrical quantities using Sensors/Transducers.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Measurement of unknown Resistance by Kelvin double Bridge.
2. Measurement of unknown Inductance by Anderson's Bridge.
3. Measurement of unknown Capacitance by Desauty's Bridge.
4. Measurement One-cycle data of a periodic waveform from a DSO.
5. Voltage and Current Detection Circuitry using AT mega microcontroller.
6. Temperature, Pressure and Humidity Detection Circuitry.
7. Measurement of displacement with the help of LVDT.
8. Measurement of distance with the help of Ultrasonic Sensor.
9. Measurement of Flow rate using Flow sensor.
10. Measurement of moist level using soil moisture sensor and rainfall sensor.
11. Calibration and Testing of single-phase Energy meter.
12. Measurement of three-dimensional coordinates using accelerometer sensor.

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
(Autonomous)

JAVA PROGRAMMING FOR ENGINEERS

Course Code: GR24A2007 **L/T/P/C: 2/0/0/2**
II Year I 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 and String 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, multiThreading- using isalive() and join(), Synchronization, suspending and resuming Threads, Communication between Threads.

TEXTBOOKS

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

REFERENCES

1. Object Oriented Programming through Java, P.Radha Krishna, UniversitiesPress.
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
(Autonomous)

VALUE ETHICS AND GENDER CULTURE

Course Code: GR24A2002 **L/T/P/C: 2/0/0/0**

II Year I Semester

COURSE OUTCOMES

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

UNIT I

VALUES AND SELF-DEVELOPMENT

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

- ❖ A Case study on values and self-development

UNIT II

PERSONALITY AND BEHAVIOUR DEVELOPMENT

Positive thinking, punctuality, avoiding fault finding, Free from anger, Dignity of 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 towards Gender, Social Construction of Gender.

- ❖ A Case study/ video discussion on attitudes towards gender

UNIT V

GENDER-BASED VIOLENCE

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

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

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.

REFERENCES

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

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

POWER GENERATION AND DISTRIBUTION

Course Code: GR24A2031 **L/T/P/C: 3/0/0/3**
II Year II Semester

COURSE OUTCOMES

1. Illustrate the basic concepts of Conventional Power Generation.
2. Explain the environmental benefits of renewable sources of power generation.
3. Examine the impact of government policies, market trends on economics of power generation.
4. Compare the performance and suitability of DC and AC distribution systems for different applications.
5. Analyze the performance of different types of substation layouts and their specific requirements.

UNIT I
CONVENTIONAL POWER GENERATION

The History of Electricity in India, Conventional Sources (Qualitative): Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant.

UNIT II
NON CONVENTIONAL POWER GENERATION

Non-Conventional Sources (Qualitative): Ocean Energy, Tidal Energy, Wave Energy, wind Energy, Fuel Cells, and Solar Energy, Cogeneration and energy conservation and storage.

UNIT III
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 IV
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 V

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.

TEXTBOOKS

1. "A Text Book on Power Systems Engineering", A Chakrabarti, M L Soni, P V Gupta & US Bhatnagar Dhanpat Rai & Co. Pvt..Ltd.
2. "Generation, Distribution and Utilization of Electrical Energy", C.L. Wadhwa Second Edition, New AgeInternational,2009.

REFERENCES

1. "Electrical Power systems", C.L.Wadhwa New age Publishers 7th Edition 2017.
2. "The Transmission and Distribution of Electrical Energy", H.Cotton & H. Barber- Third Edition, ELBS, B.I.Pub.,1985.
3. "Power generation technologies", Paul Breeze Third Edition, Elsevier Publishers 2019.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
AC MACHINES

Course Code: GR24A2032 **L/T/P/C: 2/1/0/3**
II Year II Semester

COURSE OUTCOMES
1. Illustrate the concepts of rotating magnetic fields.
2. Interpret the need for electrical Induction Machines.
3. Identify the working of single and three phase AC machines.
4. Analyze 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 parallel operation, steady state power-angle characteristics.

UNIT IV
SYNCHRONOUS MOTORS
Synchronous Motor: Principle of operation, Phasor diagrams, torque and torque angle, effect of 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.

TEXTBOOKS

1. "Electric Machinery", by A.E.Fitzgerald and C.Kingsley, McGraw Hill Education,2013.
2. "Performance and design of AC machines", by M.G.Say CBSPublishers,2002.

REFERENCES

1. "Electrical Machinery", by P.S.Bimbhra Khanna Publishers,2011.
2. "Electric Machines", by I.J.Nagrath and D.P. Kothari, McGraw Hill Education,2010.
3. "Alternating Current Machines", by A.S.Langsdorf, McGraw Hill Education,1984.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
CONTROL SYSTEMS

Course Code: GR24A2033 **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 concept of time response, steady state response, errors.
3. Formulate Routh-Hurwitz table, root locus for the linear time-invariant systems.
4. Outline the stability of the system using Nyquist and Bode plots.
5. Develop control system models for state space models, to express state transition matrix and calculation of variables.

UNIT I

CONCEPTS OF CONTROL SYSTEMS AND TRANSFER FUNCTION REPRESENTATION

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. “Control Systems”, by A. Anand Kumar 2 nd edition, PHI Learning Private Limited

2. “Automatic Control Systems”, by B.C.Kuo 8th edition, 2003, John Wiley and Son’s

REFERENCES

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

2. “Control Systems Engineering”, by John Wiley by NISE 3 rd Edition.

3. “Modern Control Engineering”, by Katsuhiko Ogata Prentice Hall of India Pvt Ltd, 3rd edition,1998.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
PRINCIPLES OF DIGITAL ELECTRONICS

Course Code: GR24A2034 **L/T/P/C: 3/0/0/3**
II Year II Semester

COURSE OUTCOMES

1. Summarize the working of logic gates with applications, design of logic gates with diodes and transistors.
2. Develop the applications using Combinational logic circuits by minimizing the function using K-Map.
3. Make use of different types of counters for applications.
4. Examine types of Memories and application of ROM as PLDs.
5. Model Analog to Digital and Digital to Analog Converter.

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.

UNIT IV
MEMORIES AND PLDs
Memory organization and operation, expanding memory size, classification and characteristics of memories, ROM, EPROM, E^2PROM and RAM.
PROGRAMMABLE LOGIC DEVICES: ROM as a Programmable Read Only Memory (PROM), Programmable Array Logic (PAL) and Programmable Logic Array (PLA).

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, Flash type A/D converter, Successive approximation type A/D converter, Counter Type A/D converter, Specifications of A/D converters.

TEXTBOOKS

1. "Fundamentals of Digital Circuits", Anand. Kumar, Prentice Hall India, 2016.
2. "Digital logic and Computer design", M. M. Mano,Pearson Education India, 2016.

REFERENCES

1. “A Textbook of Digital Electronics”, R.S. Sedha, S.Chand, 2005
2. "Modern Digital Electronics", R. P. Jain, McGraw Hill Education, 2009.
3. “Fundamentals of Logic Design’, Charles H. Roth, Jr., Larry L. Kinney, Raghunandan G. H, Cengage, 1st Edition, 2020

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

MICROPROCESSORS AND MICROCONTROLLERS

Course Code: GR24A2035 **L/T/P/C:3/0/0/3**

II Year II Semester

COURSE OUTCOMES

1. Summarize the internal architecture of 8086 Microprocessor.
2. Analyze assembly level programs of 8086 Microprocessors.
3. Illustrate the internal architecture of 8051.
4. Build 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

8086 Architecture- 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 Function Signals, 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, and Counters

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.

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.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

PRINCIPLES OF DIGITAL ELECTRONICS LAB

Course Code: GR24A2036 **L/T/P/C: 0/0/2/1**

II Year II Semester

COURSE OUTCOMES

1. Make use of function realization using logic gates.
2. Design Combinational logic circuits.
3. Analyze the types of Flip-Flops used in registers.
4. Develop Sequential logic circuits.
5. Construct a parity checking circuit.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Design and verification of basic logic gates.
2. Simplify the given Boolean expression realize them using universal gates.
3. Construct half and full adder circuit using basic logic gates.
4. Develop a half subtractor/full subtractor circuit using basic logic gates.
5. Construct a parallel adder circuit using basic logic gates.
6. Design and implementation of subtractor
7. Develop a Multiplexer using basic logic gates.
8. Design and implementation of Decoder
9. Construct a Magnitude comparator using basic logic gates.
10. Design and verify Odd and Even Parity.
11. Implementation and verification of truth table for R-S, J-K, D and T flip-flop.
12. Experiment with J-K flip-flop as D flip-flop.

TEXTBOOKS

1. "Fundamentals of Digital Circuits", A. Kumar, Prentice Hall India, 2016.
2. "Digital logic and Computer design", M. M. Mano, Pearson Education India, 2016.

REFERENCES

1. "A Textbook of Digital Electronics", R.S. Sedha, S.Chand, 2005
2. "Modern Digital Electronics", R. P. Jain, McGraw Hill Education, 2009.
3. "Switching Theory and Logic Design", Godse, Technical Publication, 2010.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

AC MACHINES LAB

Course Code: GR24A2037 **L/T/P/C: 0/0/2/1**

II Year II Semester

COURSE OUTCOMES

1. Assess the performance of different machines using different testing methods.
2. Determine the parameters of equivalent circuit of single-phase induction motor.
3. Make use of various methods to find regulation of an Alternator.
4. Analyze various characteristics of three phase induction motor.
5. Experiment with synchronous machine to find direct and quadrature axis reactance.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Sumpner's test.
2. Heat run test on transformer.
3. Hysteresis loss determination.
4. Brake Test on Slip Ring Induction Motor.
5. No load and Blocked Rotor Tests on Squirrel Cage Induction Motor.
6. Equivalent Circuit of a Single-Phase Induction Motor.
7. Regulation of an Alternator by Synchronous Impedance Method and MMF Method.
8. Determination of X_d and X_q of a Salient Pole Synchronous Machine from Slip Test.
9. V and inverted V curves of a 3-Phase Synchronous Motor.
10. Induction Generator.
11. Rotor-resistance starter for Slip Ring Induction Motor.
12. Star-delta starter for Squirrel Cage Induction Motor.

TEXTBOOKS

1. "Electric Machinery", A.E.Fitzgerald and C.Kingsley, McGraw Hill Education,2013.
2. "Performance and design of AC machines", M.G. Say CBSPublishers,2002.

REFERENCES

1. "Electrical Machinery", P.S.Bimbhra Khanna Publishers,2011.
2. "Electric Machines", I.J.Nagrath and D.P. Kothari, McGraw Hill Education,2010.
3. "Alternating Current Machines", A.S.Langsdorf, McGraw Hill Education,1984.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

CONTROL SYSTEMS LAB

Course Code: GR24A2038 **L/T/P/C: 0/0/2/1**

II Year II Semester

COURSE OUTCOMES

1. Make use of simulation packages for simple control system programs.
2. Examine the characteristics of synchros.
3. Analyze the root locus and bode plots.
4. Develop the transfer function of DC motor/generator.
5. Interpret the performance of servomotor and PID controller.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Obtain the Transfer function from zeros and poles and vice versa.
2. Find the Step response, Ramp response and Impulse response for a given transfer function.
3. Draw Root Locus from a Transfer function.
4. Draw Bode Plot and Nyquist Plot from a Transfer function.
5. Derive State Model from a Transfer function.
6. Determine Transfer function of DC motor/Generator.
7. Derive Zeros and poles from state model.
8. Obtain the Time Response of second order system of a given transfer function.
9. Study of Characteristics of DC Servomotor.
10. Design a PID Controller for a given Control System.
11. Characteristics of Synchros.
12. Study of Characteristics of AC Servomotor

TEXTBOOKS

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

REFERENCES

1. "Control Systems Engineering", I. J. Nagrath and M. Gopal New Age International (P) Limited Publishers, 2nd edition
2. "Control Systems Engineering", by John Wiley by NISE 3 rd Edition.
3. "Modern Control Engineering", by Katsuhiko Ogata Prentice Hall of India Pvt Ltd, 3rd edition,1998.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

REAL-TIME RESEARCH PROJECT/ SOCIETAL RELATED PROJECT

Course Code: GR24A2106 **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 Obtain the category of the solution with help of Real time studies.
3. Analyse and Discuss the field problems using software tools /Modes/simulations and experimental investigations.
4. Implement the solution of problem statement.
5. Prioritize the reports and deliver the final work with presentation.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
ENVIRONMENTAL SCIENCE

Course Code: GR24A2001 **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 safeguarding the environment
3. Evolve an individual vision of harmonious interaction with the natural world.
4. Appraise the quality of the environment to create a healthy atmosphere
5. Familiarize with the individual responsibilities towards the 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
- 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.

III YEAR -I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
POWER TRANSMISSION SYSTEMS

Course Code: GR24A3028 **L/T/P/C: 2/1/0/3**
III Year I Semester

Course Outcomes

1. Calculate the inductance and capacitance of single-phase and three-phase lines with various conductor configurations.
2. Compute the ABCD parameters and voltage regulation for different types of transmission lines.
3. Analyze the effect of mechanical vibrations on conductors and evaluate the role of vibration dampers.
4. Apply appropriate techniques to improve voltage distribution across suspension insulator strings in overhead transmission lines.
5. Examine how different compensation methods affect the ability of overhead lines to carry load under various conditions.

UNIT I

TRANSMISSION LINE PARAMETERS

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.

UNIT II

PERFORMANCE OF LINES

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 III

MECHANICAL DESIGN OF OVERHEAD TRANSMISSION LINES AND CORONA

Tension and sag calculations, Factors affecting Sag, Sag template, Stringing charts, vibrations and vibration damper.

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 IV

OVERHEAD LINE INSULATORS & INSULATED CABLES

Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing 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 a single core and three core cables. Overhead lines versus underground cables, types of cables.

UNIT V

REACTIVE POWER COMPENSATION

Introduction methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase-modifiers. Concepts of Load compensation Load ability characteristics of overhead lines uncompensated transmission line Symmetrical line Radial line with asynchronous load Compensation of lines.

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. A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, "A Text book on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.
3. John J. Grainger & W.D. Stevenson, "Power System Analysis", Mc Graw Hill International,1994.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
POWER ELECTRONICS

Course Code: GR24A3029 **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; Gate drive circuits for MOSFET and IGBT, R, RC, UJT firing circuits for thyristor; line and forced commutation circuits of a thyristor; thyristor protection-snubber circuit design.

UNIT II
AC-DC CONVERTERS

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifiers 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, power factor and Numerical Problems, Effect of load and source inductances on performance of converters

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, class-A, class-B, class-C, class-D & class-E choppers

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
(Autonomous)
POWER SYSTEM PROTECTION

Course Code: GR24A3030 **L/T/P/C: 3/0/0/3**
III Year I Semester

COURSE OUTCOMES

1. Explain why power system protection is needed and classify different types of protective relays.
2. Evaluate the suitability of overcurrent and distance protection schemes for different parts of a power system.
3. Identify appropriate protection techniques for generators, transformers, and busbars in power systems.
4. Compare quadrilateral and elliptical relay characteristics and explain which type is suitable for different protection needs.
5. Apply appropriate circuit breaker and fuse selection techniques based on system requirements and fault conditions.

UNIT I
PROTECTIVE RELAYS

Introduction, Need for power system protection, effects of faults, evolution of protective relays, zones of protection, primary and backup protection, essential qualities of protection, classification of protective relays and schemes, current transformers, potential transformers, basic relay terminology.

UNIT II
OVER CURRENT AND DISTANCE PROTECTION

Over-Current Protection: Time-current characteristics, current setting, over current protective schemes, directional relay, protection of parallel feeders, protection of ring mains, Phase fault and earth fault protection, Combined earth fault and phase fault protective scheme, Directional earth fault relay.
Distance Protection: Impedance relay, reactance relay, MHO relay, input quantities for various types of distance relays, Effect of arc resistance, Effect of power swings, effect of line length and source impedance on the performance of distance relays, selection of distance relays, MHO relay with blinders.

UNIT III
ZONES PROTECTION

Pilot Relaying Schemes: Wire Pilot protection, Carrier current protection.

AC Machines and Bus Zone Protection: Protection of Generators, Protection of transformers, Buszone protection, frame leakage protection.

UNIT IV
STATIC AND MICROPROCESSOR BASED RELAYS

Static Relays: Amplitude and Phase comparators, Duality between AC and PC, Static amplitude comparator, integrating and instantaneous comparators, static phase comparators, coincidence type of phase comparator, static over current relays, static directional relay, static differential relay, static distance relays, Multi input comparators, concept of Quadrilateral and Elliptical relay characteristics.

Microprocessor Based Relays: Advantages, over current relays, directional relays, distance relays.

UNIT V
CIRCUIT BREAKERS

Circuit Breakers: Introduction, arcing in circuit breakers, arc interruption theories, re-striking and recovery voltage, resistance switching, current chopping, interruption of capacitive current, oil circuit breaker, air blast circuit breakers, SF6 circuit breaker, operating mechanism, selection of circuit breakers, high voltage DC breakers, ratings of circuit breakers, testing of circuit breakers.

Fuse: Introduction, fuse characteristics, types of fuses, application of HRC fuses, discrimination

TEXTBOOKS

1. Badriram and D.N. Vishwakarma, Power System Protection and Switchgear, TMH 2001.
2. U. A. Bakshi, M. V. Bakshi: Switchgear and Protection, Technical Publications, 2009.

REFERENCES

1. Sunil S. Rao, 'Protective Switch Gear', Khanna Publishers, New Delhi, 13th Edition, 2008.
2. L. P. Singh “Protective relaying from Electromechanical to Microprocessors”, New Age
3. C.L.Wadhwa “ Electrical Power systems :New age Publishers 7th Edition 2017.
4. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education, 2003.

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

Course Code: GR24A3031 **L/T/P/C: 3/0/0/3**
III Year I Semester

COURSE OUTCOMES

1. Comparison of Conventional and wideband gap power devices.
2. Characterization of GAN Devices.
3. Modelling of SIC Devices
4. Demonstration of GAN based power electronics circuits in E-mobility
5. Classification of SIC based power electronics circuits in high voltage applications

UNIT I
INTRODUCTION OF DEVICES
MOSFET - structure and characteristics, MOSFET drain current, MOSFET transconductance and output conductance, MOSFET on-state resistance. The insulated gate bipolar transistor (IGBT) IGBT structure and characteristics - IGBT at turn-off and turn on, IGBT latch-up. Introduction of Wind bandgap devices SiC, GaN, C (Diamond), necessity of wind band Gap, advantage of wide band gap semiconductors. Introduction to LT Spice Software.

UNIT II
MODELLING AND CHARACTERIZATION OF GAN DEVICES
Fabrication of GaN Devices, Characterization and modelling GaN devices, Switching Characteristics, Advantages of GaN over si power semiconductors. Characterisation of GaN Devices using LTSpice Software.

UNIT III
MODELLING AND CHARACTERIZATION OF SIC DEVICES
Fabrication of SiC Devices, Characterization and modelling SiC devices, Switching Characteristics, Advantages of SiC over silicon power semiconductors. Characterisation of SiC Devices using LTSpice Software.

UNIT IV
APPLICATIONS OF GAN DEVICES
Consumer applications, Industrial applications, energy converters, e-mobility devices. LED Driver simulation using LTSpice Software.

UNIT V
APPLICATIONS OF SIC DEVICES
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, Power converter simulations for electric and hybrid vehicles using LTSpice Software.

TEXTBOOKS

1. Mohan, Undeland and Robbins, "Power Electronics: Converters, Applications and Design", John's Wiley and Sons.
2. B. W. Williams, "Power Electronics: Devices, Drivers, Applications, and Passive Components", TMH.
3. 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 Band gap Power Semiconductor Devices", IET ENERGY ENGINEERING.

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

Course Code: GR24A3032 **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 the power generation and characteristics of the wind system.
5. Analyze the 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, incorporation 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, incorporation 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
(Autonomous)
ELECTRICAL MACHINE DESIGN
(PROFESSIONAL ELECTIVE-I)

Course Code: GR24A3033 **L/T/P/C: 3/0/0/3**
III Year I Semester

COURSE OUTCOMES
1 Explain the construction and performance characteristics of electrical machines.
2. Distinguish the various factors which influence the design.
3. Analyze Electrical, magnetic and thermal loading of electrical machines.
4. Explain the principles of electrical machine design and carry out a basic design of an ac machine
5. Summarize, use of modelling aspects of machines.

UNIT I
INTRODUCTION OF ELECTRICAL MACHINE DESIGN
Introduction 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
DESIGN OF TRANSFORMERS
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
DESIGN OF 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
DESIGN OF SYNCHRONOUS MACHINE
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 OF ELECTRICAL MACHINES

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
(Autonomous)
OPERATIONS RESEARCH
(PROFESSIONAL ELECTIVE-I)

Course Code: GR24A3034 **L/T/P/C: 3/0/0/3**
III Year I Semester

COURSE OUTCOMES

1. To formulate and solve linear programming problems using simplex and duality approaches for resource allocation.
2. To apply non-linear optimization techniques (single and multi-variable unconstrained methods) to practical engineering and management problems.
3. To analyze and solve transportation and assignment models for effective decision-making in logistics and resource allocation.
4. To evaluate inventory control systems and queuing models to optimize stock management and service efficiency.
5. To apply replacement and dynamic programming models for long-term decision-making in capital budgeting, maintenance, and system optimization.

UNIT I
INTRODUCTION & LINEAR PROGRAMMING
Introduction: Development, Definition, Characteristics and Phases of Operations Research, Types of models: Operations Research models – Applications: Linear Programming Problem (LPP) formulation, Graphical solution method, Simplex method – Artificial variables techniques (Two–phase method, Big-M method), Duality principle

UNIT II
NON-LINEAR PROGRAMMING
Introduction – Difference between linear and nonlinear programming, applications in engineering & management; **Single-variable unconstrained optimization**: Uni-modal functions, Elimination methods – Bisection/interval halving, Fibonacci method, Golden Section method; **Multi-variable unconstrained optimization**: Gradient of a function, optimality condition, Gradient methods – Steepest Descent Method, Conjugate Gradient Method (Fletcher–Reeves)

UNIT III
TRANSPORTATION & ASSIGNMENT MODELS
Transportation models: Formulation, Methods for finding feasible solution and optimal solution, Unbalanced transportation problems, degeneracy; **Assignment models**: Formulation, Optimal solution, Variants of Assignment Problem (e.g., unbalanced, maximization, traveling salesman problem)

UNIT IV
INVENTORY & QUEUING MODELS
Inventory models: Single-item deterministic models, Purchase inventory models with one price break and multiple price breaks, Shortages not allowed, Stochastic models – demand as discrete or continuous

variable, Instantaneous production, instantaneous demand and continuous demand (no setup cost)
Queuing models: Introduction, Single-channel system: Poisson arrivals, exponential service times, infinite/finite population, Multi-channel systems: Poisson arrivals, exponential service times with infinite population

UNIT V
REPLACEMENT & DYNAMIC PROGRAMMING
Replacement models: Replacement of items that deteriorate with time (with and without time value of money), Replacement of items that fail completely, Group replacement policy
Dynamic programming: Introduction – Bellman's Principle of Optimality Applications: capital budgeting, shortest path problem, linear programming problem

TEXTBOOKS
1. Operations Research/ Prem Kumar Gupta, Dr. D.S. Hira
2. Operations Research / S. D.Sharma-Kedarnath
3. Operation Research /J.K.Sharma/MacMilan.

REFERENCES
1. Operations Research / R.Pannerselvam,PHI Publications.
2. Introduction to O.R /Taha/PHI
3. Operations Research / Wagner/ PHI Publications.
4. Introduction to O.R/Hiller and Libermann (TMH).
5. Operations Research /A.M.Natarajan, P.Balasubramani,A. Tamilarasi/Pearson Education.
6. Operations Research: Methods and Problems / Maurice Saseini, ArhurYaspan and Lawrence Friedman
7. O.R/Wayne L.Winston/Thomson Brooks/cole

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
POWER SYSTEM PROTECTION LAB

Course Code: GR24A3036 **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 models.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Characteristics of Over Current relay for Phase and Earth fault.
2. Characteristics of Induction Disc type Relay.
3. Testing of Differential Relay.
4. Characteristics of Over and Under Voltage Relay
5. Testing of Negative sequence Relay.
6. To determine Efficiency and Regulation of 3 Phase Transmission model.
7. Determination of ABCD parameters for short, medium, and long lines.
8. Ferranti effect of a Transmission line.
9. Reactive power compensation of a Transmission line.
10. Zones Protection.
11. Short circuit analysis.
12. Tripping sequence of protective devices.

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
(Autonomous)
POWER ELECTRONICS LAB

Course Code: GR24A3037 **L/T/P/C: 0/0/3/1.5**
III Year I Semester

COURSE OUTCOMES

1. Analyse the characteristics of different switching devices and generate the pulses using different PWM Techniques.
2. Investigate the operation of single-phase and Three-phase controlled Rectifiers.
3. Interpret the performance of a DC-DC Converters in open loop.
4. Evaluate the operation of the single-phase and three-phase Inverters.
5. Examine the performance of AC voltage controllers and Cycloconverters.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Characteristics of SCR, IGBT, MOSFET.
2. Analysis of Single-phase Half Controlled Converter with R-load.
3. Analysis of Single-phase Fully Controlled Converter with R-load.
4. Open-loop analysis of Buck Converter.
5. Open-loop analysis of Boost Converter.
6. Analysis of Single-phase Full Bridge Inverter with R & RL load.
7. Analysis of Single-phase Cyclo-converter with R & RL load.
8. Analysis of Three-Phase Fully Controlled Converter.
9. Analysis of IGBT-based Three-phase Inverter.

In addition to the above experiments, any one from the following list shall be demonstrated.
Simulation of

10. Analysis of Single-Phase AC Voltage Controller.
11. Analysis of Three-Phase Half-Controlled Converter.
12. PWM pulse Generation for Boost Converter using dspace Controller.

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
(Autonomous)
MICROPROCESSORS AND MICROCONTROLLERS LAB

Course Code: GR24A3038 **L/T/P/C: 0/0/2/1**
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

Any ten experiments should be conducted.

1. Program for16-bit arithmetic operations for 8085/8086 microprocessors.
2. Program for sorting an array for 8085/8086 microprocessor.
3. Program for string manipulations for 8085/8086 microprocessor.
4. Interfacing LED's using 8051 microcontrollers.
5. Interfacing LCD & Keypad using 8051microcontrollers.
6. Switches and LED's interfacing to ATmega microcontrollers.
7. LCD/OLED interfacing to ATmega microcontrollers.
8. Serial Communication with ATmega microcontrollers.
9. Device control using ATmega microcontrollers.
10. DC Motor control using ATmega microcontrollers.
11. : Bluetooth interfacing with ATmega microcontrollers.
12. Sensor (Proximity/PIR) interfacing with ATmega microcontrollers.

TEXTBOOKS

1. Advanced Microprocessors and Peripherals, A.K.Ray and K.M.Bhurchandani, 2ndEdition, 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, AjayV.Deshmukh, TataMcGraw-HillEducation,2005.
3. The 8051 Microcontroller, KennethJ.Ayala,3rd Edition, CengageLearning,2010.

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

Course Code: GR24A3013 **L/T/P/C: 0/0/2/1**
III Year I Semester

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

1. Syllabus:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

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

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

3. **Activities on Presentation Skills -** Starting a conversation – responding appropriately and relevantly – using the right language and body language – Role Play in different situations including Seeking Clarification, Making a Request, Asking for and Refusing Permission, Participating in a Small Talk – Oral presentations (individual and group) through JAM sessions- PPTs – Importance of Presentation Skills – Planning, Preparing, Rehearsing and Making a Presentation – Dealing with Glossophobia or Stage Fear — Understanding Nuances of Delivery - Presentations through Posters/Projects/Reports – Checklist for Making a Presentation and Rubrics of Evaluation.
4. **Activities on Group Discussion (GD):** Types of GD and GD as a part of a Selection Procedure - Dynamics of Group Discussion- Myths of GD - Intervention, Summarizing - Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas –

Do's and Don'ts - GD Strategies — Exercises for Practice.

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

2. Minimum Requirement:

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

- Spacious room with appropriate acoustics
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- One PC with latest configuration for the teacher
- T. V, a digital stereo & Camcorder
- Headphones of High quality

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

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

4. Books Recommended:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
CONSTITUTION OF INDIA

Course Code: GR24A2003 **L/T/P/C: 2/0/0/0**

III Year I Semester

COURSE OUTCOMES

1. Students will be able to know the importance of Constitution and Government
2. Students will be able to become Good Citizens and know their fundamental rights, duties and principles.
3. Students will learn about the role of PM, President, Council of Ministers etc and it will help students learn about Local Administration.
4. The students understand the importance of Election Commission and the Students will become aware of 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.

TEXTBOOKS

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

III YEAR -II SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
DSP BASED ELECTROMECHANICAL SYSTEMS

Course Code: GR24A3039 **L/T/P/C: 3/0/0/3**
III Year II Semester

COURSE OUTCOMES

1. Explain the role and architecture of DSPs in electromechanical motion control systems.
2. Develop mathematical models of DC, induction, and synchronous machines for DSP-based implementation.
3. Implement DSP-based control algorithms such as Field-Oriented Control, Direct Torque Control, and PWM techniques.
4. Integrate sensors, signal conditioning, and digital filtering methods for real-time DSP drive systems.
5. Evaluate advanced DSP-based motion control strategies, including sensorless, adaptive, and predictive control, for industrial applications.

UNIT I
INTRODUCTION TO DSP IN MOTION CONTROL
Overview of Digital Signal Processing (DSP) concepts in motion control - Advantages of DSP-based control over conventional control - Review of discrete-time signals, sampling, and quantization - DSP architectures for motor control applications - Introduction to Texas Instruments DSP platforms for motion control.

UNIT II
MATHEMATICAL MODELLING OF ELECTRICAL MACHINES
Mathematical modelling of DC motors, induction motors, and synchronous motors - Space vector representation of AC machines - Park's and Clarke's transformations - Discrete-time modelling of electromechanical systems - Implementation of machine models in DSP environment.

UNIT III
DSP IMPLEMENTATION OF MOTOR CONTROL ALGORITHMS
Control strategies for electric machines: position, speed, and torque control - DSP-based vector control (Field Oriented Control) - Direct Torque Control (DTC) implementation in DSP - Implementation of PWM algorithms in DSP: SPWM, SVPWM.

UNIT IV
DSP-BASED DRIVE SYSTEM COMPONENTS
Interface of sensors with DSP: encoders, resolvers, Hall sensors - DSP-based A/D and D/A

conversions for drive systems - Digital implementation of filters in motion control: low-pass, notch, and Kalman filters - Real-time interrupts and event management in DSP-based drives.

UNIT V

ADVANCED MOTION CONTROL TECHNIQUES AND APPLICATIONS

Sensorless control methods using DSP - Adaptive control and parameter estimation in DSP environment - DSP implementation of sliding mode and predictive control techniques - Applications: DSP-based control of brushless DC motors (BLDC) - High-performance induction motor drive systems using DSP.

TEXTBOOKS

1. **Toliyat, Hamid A., and Steven G. Campbell.** *DSP-Based Electromechanical Motion Control*. 1st ed., CRC Press, 2004.
2. **Bose, Bimal K.** *Modern Power Electronics and AC Drives*. 1st ed., Pearson Education, 2002.
3. **Ned Mohan, Tore M. Undeland, William P. Robbins** *Power Electronics: Converters, Applications, and Design* (3rd Edition) John Wiley & Sons, 2003.

REFERENCES

1. **Krause, Paul C., Oleg Wasynczuk, Scott D. Sudhoff, and Steven Pekarek.** *Analysis of Electric Machinery and Drive Systems*. 3rd ed., Wiley-IEEE Press, 2013.
2. **Ramesh Babu, A.** *Digital Signal Processing* (4th Edition) Scitech Publications (India) Pvt. Ltd., 2018.
3. **Buso, Sergio, and Paolo Mattavelli.** *Digital Control in Power Electronics*. 2nd ed., Morgan & Claypool Publishers / Springer, 2022.
4. **Texas Instruments.** *TMS320C2000 Microcontroller Family: Technical Reference Manual*.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
POWER SYSTEM ANALYSIS

Course Code: GR24A3040 **L/T/P/C: 2/1/0/3**
III Year II Semester

COURSE OUTCOMES

1. Solve load flow equations using the Gauss-Seidel method for a 3-bus system under different bus conditions.
2. Examine the computational efficiency of different load flow techniques including DC load flow.
3. Apply Zbus formulation techniques and interpret the behavior of power systems under fault conditions using symmetrical and unsymmetrical fault analysis.
4. Implement the power angle equation to determine system stability under steady-state conditions.
5. Analyze the dynamic behavior of power systems under fault conditions using the point-by-point and modified Euler's methods.

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
(Autonomous)
ECONOMICS AND ACCOUNTING FOR ENGINEERS

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

COURSE OUTCOMES

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

UNIT I

INTRODUCTION & DEMAND ANALYSIS: DEFINITION AND SCOPE

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

UNIT II

PRODUCTION & COST ANALYSIS: PRODUCTION FUNCTION

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

UNIT III

MARKETS AND FORMS OF BUSINESS ORGANIZATIONS

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

UNIT IV

INTRODUCTION TO FINANCIAL ACCOUNTING: ACCOUNTING CONCEPTS AND CONVENTIONS

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

UNIT V

CAPITAL BUDGETING

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

TEXTBOOKS

1. Managerial Economics – International Edition, 2019, by Christopher Thomas (Author), S. Charles Maurice (Author), McGraw-Hill Education
2. Managerial Economics & Business Strategy, Michael R. Baye, Jeffrey T. Princ, McGraw-Hill Education, 2021 (10th Edition)
3. Managerial Economics, Mark Hirschey, Cengage Learning, 2016 (13th Edition)
4. Managerial Economics: Analysis, Problems and Cases - P. L. Mehta, Edition, 13. Publisher, Sultan Chand, 2016.
5. Managerial Accounting, Carl S. Warren, James M. Reeve, Jonathan Ducha, Cengage Learning, 2021
6. Managerial Accounting: Tools for Business Decision Making (9th Edition), Jerry J. Weygandt, Paul D. Kimmel, Donald E. Kieso, Wiley, 2021
7. Managerial Economics Aryasri: Managerial Economics and Financial Analysis, TMH, 2009.

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
(Autonomous)
MODELLING AND SIMULATION OF POWER ELECTRONIC CONVERTERS
(PROFESSIONAL ELECTIVE-II)

Course Code: GR24A3042 **L/T/P/C: 3/0/0/3**
III Year II Semester

COURSE OUTCOMES

1. Explain the need of simulation tools for power electronic devices.
2. Develop mathematical models for different power electronic converters.
3. Simulate various power converters using LT_PSPICE and Virtual lab.
4. Analyze power electronic circuits for different loads.
5. Integrate Power electronic converters real time with the DSP and SCI Lab.

UNIT I
INTRODUCTION ABOUT SIMULATIONTOOLS
Need for Simulation - Challenges in simulation - Classification of simulation programmes, Overview of LT_SPICE, SCI Lab and Need for interactive modelling.

UNIT II
MODELLING & SIMULATION OF POWER SEMICONDUCTOR DEVICES
Modelling and simulation of diode, SCR, TRIAC, IGBT and Power Transistors-numerical methods to power electronic switches-simulation of gate/base drive circuits and snubber circuits (using LT-SPICE and PSPICE).

UNIT III
MODELLING & SIMULATION OF RECTIFIERS AND CHOPPERS
Mathematical modelling and simulation of single phase and three phase semi and fully controlled rectifiers with R, R-L and R-L-E Loads using Matlab/Simulink Mathematical modelling and simulation of buck, boost and buck-boost converters with R, R-L and R-L-E Loads using LT-Spice

UNIT IV
MODELLING & SIMULATION OF INVERTERS AND AC TO AC CONVERTERS
Mathematical modelling and simulation of single phase and three phase half and full bridge inverterwith R, R-L and R-L-E Loads using LT_SPICE.
Modelling and Simulation of different AC to AC converters with R, R-L and R-L-E Loads using LT-Spice. Modelling and simulation of high frequency inverters with different PWM techniques**.**

UNIT V
REAL TIME SIMULATION

Power electronics converters using embedded coder toolbox. Generation of EPWM, configuration of ADC, Configuration of DAC. Real time simulation of single phase and three phaseinverters using TI processor and embedded coder toolbox..

TEXTBOOKS

1. Narayanaswamy P.R. Iyer “Power Electronic Converters- Interactive ModellingUsing Simulink”, CRC Press, 2018.
2. M.H.Rashid," SPICE for circuits and Electronics using PSPICE", Prentice Hall, 2011.
3. Robert Ericson, "Fundamentals of Power Electronics", Springer Publication.

REFERENCES

1. Issa Batarseh, "Power Electronic Circuits", John Wiley, July 2006.

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

Course Code: GR24A3043 **L/T/P/C: 3/0/0/3**
III Year II Semester

COURSE OUTCOMES
1. Differentiate between HVDC and HVAC transmission systems in terms of performance and applications.
2. Analyze the operation of rectifier and inverter circuits used in HVDC systems.
3. Explain various control strategies employed in HVDC transmission.
4. Select appropriate filters for harmonic mitigation in HVDC systems.
5. Evaluate the impact of different types of faults on HVDC system performance.

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 CONVERTERS 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 extinction 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 the 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 their effects. Advantages and Problems with Ground Return.

TEXTBOOKS

1. HVDC transmission by S Kamakshaiah and V. Kamaraju, Tata McGraw-Hill 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
(Autonomous)
ADVANCED CONTROL SYSTEMS
(PROFESSIONAL ELECTIVE-II)

Course Code: GR24A3044 **L/T/P/C: 3/0/0/3**
III Year II Semester

COURSE OUTCOMES

1. Apply pole placement and Ackerman's formula to design state feedback controllers and observers for improving system stability.
2. Analyze nonlinear system behaviours and evaluate stability using describing function and phase-plane analysis methods.
3. Interpret Lyapunov's stability concepts and apply the second method to determine system stability in linear and nonlinear systems.
4. Develop phase-plane trajectories and perform describing function analysis to predict system response and limit cycles.
5. Solve optimal control problems using Pontryagin's optimum policy, bang-bang control, and Hamilton–Jacobi principle.

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
(Autonomous)
OPERATING SYSTEMS

Course Code: GR24A3045 **L/T/P/C: 3/0/0/3**
III Year II Semester

COURSE OUTCOMES

1. Interpret 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 ofOperating 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, Diskscheduling, 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.

TEXT BOOKS

1. Operating System Principles, 7th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley AsiaStudent Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall ofIndia.

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
POWER SYSTEM ANALYSIS LAB

Course Code: GR24A3047 **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 the power system.
4. Determine the transient stability of a given power system.
5. Choose a suitable protection scheme for transmission line protection.

LIST OF EXPERIMENTS

Any ten experiments should be conducted.

1. Computation of line parameters.
2. Determination of String Efficiency of Suspension Insulators with and without the Effect of Shunt Capacitance
3. Modeling and Analysis of String Efficiency Improvement Using Longer Cross Arm and Guard Ring Methods
4. Formation of bus Admittance matrix.
5. a) Load Flow solution using Newton Raphson method in polar coordinates.
   b) Load Flow solution using Newton Raphson method in rectangular coordinates.
6. Unsymmetrical fault Analysis: LG, LL, LLG Fault.
7. Z–Bus Building Algorithm.
8. a) Obtain Symmetrical Components of a set of Unbalanced currents.
   b) Obtain the original Unbalanced phase voltages from Symmetrical Components
9. Transient Stability Analysis
10. Power flow solution of power system model.
11. Economic load dispatch using linear programming method
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.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
DSP BASED ELECTRICAL LAB

Course Code: GR24A3048 **L/T/P/C: 0/0/3/1.5**
III Year II 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
Any ten experiments should be conducted.

1. Watchdog with CPU Timer interrupts.
2. Square of a given number using for loop.
3. Factorial of a given number using for loop.
4. Configuring GPIO port pins of DSP board.
5. Toggling onboard LEDs of DSP board.
6. Acquisition of signal from ADC.
7. Interfacing an external LED using DSP board.
8. Generation of simple PWM pulses at 1 kHz.
9. Generation of gate signals for Single-phase full bridge inverter.
10. Generation of enhanced PWM pulses with a dead band.
11. An example to run a program in FLASH memory.
12. 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.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

MINI PROJECT WITH SEMINAR

Course Code: GR24A3027 **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
(Autonomous)
POWER SEMICONDUCTOR DRIVES

Course Code: GR24A4027 **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 DC drives.
3. Illustrate speed control techniques of an induction motor drive for real time applications.
4. . classification of CSI and VSI based Synchronous Motor Drives
5. Compare closed loop and open loop control of advanced electric drives

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
CONTROL OF DC DRIVES

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). 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).

UNIT III
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). Static rotor resistance control – slip power recovery – static scherbius drive – static Kramer drive – their performance and speed torque characteristics – advantages -applications – problems.

UNIT IV

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)

UNIT V

ADVANCED ELECTRICAL DRIVES

Introduction to Permanent magnet and SRM Drives – Open loop and closed loop control Permanent magnet brushless DC motor (PMBLDC) and Permanent magnet synchronous motor (PMSM). Open loop and Closed loop control Switched reluctance motor (SRM).

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.
3. T.J.E.Miller, "Brush less Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 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
(Autonomous)
ELECTRIC AND HYBRID VEHICLES

Course Code: GR24A4028 **L/T/P/C: 3/0/0/3**
IV 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
(Autonomous)
MODERN POWER ELECTRONICS
(PROFESSIONAL ELECTIVE -III)

Course Code: GR24A4029 **L/T/P/C: 3/0/0/3**
IV Year I 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 of 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
(Autonomous)
HIGH VOLTAGE ENGINEERING
(PROFESSIONAL ELECTIVE -III)

Course Code: GR24A4030 **L/T/P/C: 3/0/0/3**
IV Year I Semester

COURSE OUTCOMES

1. Explain the breakdown mechanisms in solid, liquid, and gaseous insulations.
2. Identify different types of breakdown processes under high voltage conditions.
3. Explain methods used for generating high voltages and currents.
4. Apply standard techniques to measure high D.C., A.C., and impulse voltages and currents.
5. Analyze testing procedures on high-voltage equipment as per standard practices.

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
(Autonomous)
DIGITAL CONTROL SYSTEMS
(PROFESSIONAL ELECTIVE -III)

Course Code: GR24A4031 **L/T/P/C: 3/0/0/3**
IV Year I Semester

COURSE OUTCOMES

1. Explain the discrete representation of continuous systems and mathematical modelling of sample & hold circuits.
2. Analyze the stability of discrete-time systems using Jury test and bilinear transformation methods.
3. Apply state-space models to evaluate controllability, observability, and stability of discrete systems.
4. Develop digital controllers, observers, and compensators for discrete-time systems.
5. Solve optimal digital control problems using state-space concepts and eigenvalue Assignment.

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

(Autonomous)

INDUSTRIAL AUTOMATION

(PROFESSIONAL ELECTIVE -III)

Course Code : GR24A4032 **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. Illustrate Architecture, I/O Modules, and programming structure of PLC for industrial automation.
3. Summarize 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.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
POWER QUALITY AND FACTS
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR24A4033 **L/T/P/C: 3/0/0/3**
IV Year I Semester

COURSE OUTCOMES

1. Describe the basic types and differentiate the functions of FACTS controllers.
2. Classify FACTS devices and explain the operation of shunt compensators.
3. Summarize the working principles and features of series compensators.
4. Identify common power quality issues in distribution systems.
5. Distinguish the operation of DVR and DSTATCOM for power quality improvement.

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 System
s 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
(Autonomous)
UTILIZATION OF ELECTRICAL ENERGY
(PROFESSIONAL ELECTIVE -IV)

Course Code: GR24A4034 **L/T/P/C: 3/0/0/3**
IV Year I Semester

COURSE OUTCOMES

1. Describe the types of electric drives and characteristics for various industrial loads and applications.
2. Compare different electric heating and welding techniques based on their advantages, principles, and applications.
3. Apply the laws of illumination and design suitable lighting systems using various light sources and control methods.
4. Analyze speed-time curves and braking methods used in electric traction systems.
5. Calculate tractive effort, energy consumption, and analyze the effect of traction parameters such as adhesion and braking.

UNIT I
ELECTRIC DRIVES
Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT II
ELECTRIC HEATING & ELECTRIC WELDING
Advantages and methods of electric heating, resistance heating, induction heating, and dielectric heating. Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

UNIT III
ILLUMINATION
Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light. Discharge lamps, MV and SV lamps comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT IV
ELECTRIC TRACTION – I
System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking – plugging, rheostatic braking and regenerative braking. Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

UNIT V

ELECTRIC TRACTION – II

Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation adhesive weight and coefficient of adhesion.

TEXTBOOKS

1. Utilization of Electrical Energy - by E. Opens haw Taylor, University Press.
2. Art & Science of Utilization of Electrical Energy - by Par tab, Dhanpat Ravi & Sons.

REFERENCES

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2. Generation, Distribution and Utilization of Electrical Energy - by C.L. Wadhwa New Age International (P) Limited, Publishers, 1997.

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

Course Code: GR24A4035 **L/T/P/C: 3/0/0/3**
IV Year I Semester

COURSEOUTCOMES

1. Summarize Various Special Electrical Machines
2. List the various control aspects of Permanent magnet brush less D.C.Motors.
3. Identify Various Power Controllers.
4. Analyze the Variable Reluctance and hybrid motors.
5. Interpret the Different 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 D.C 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‘,Clarend on Press, London, 1988

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
INTRODUCTION TO VLSI DESIGN

Course Code: GR24A4036 **L/T/P/C: 3/0/0/3**
IV Year I Semester

COURSE OUTCOMES

1. Explain the fundamentals of MOS transistors and IC fabrication processes.
2. Analyse the electrical characteristics of MOS and CMOS circuits, including inverter behaviour.
3. Apply design rules, stick diagrams, and layouts for basic logic circuits.
4. Evaluate the design of simple subsystems such as adders, shifters, and memory blocks.
5. Demonstrate an understanding of semi-custom design approaches (FPGA, CPLD) and basic IC testing principles.

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

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

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

UNIT IV
DATA PATH SUBSYSTEMS
Data path Subsystems, Array Subsystems: Subsystem Design, Shifters, Adders- Ripple Carry, Carry Look ahead Adder, Carry Select Adder, Basics of SRAM and ROM

UNIT V
SEMI CUSTOM IC DESIGN AND OVERVIEW OF TESTING
Introduction to PLAs, PALs, FPGAs, CPLDs, Standard cell design approach, Need for testing, Basic test principles.

TEXTBOOKS

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

FUNDAMENTALS OF MANAGEMENT AND ENTREPRENEURSHIP

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

COURSE OUTCOMES

1. Student gain knowledgeable about management thoughts, motivation theories and also capable of applying this knowledge in practical, real-world situations.
2. The students with a comprehensive understanding of the essential functions of management and equip them with the skills necessary to perform these functions effectively in career.
3. The students can explore the functional areas of management such as human resources, production and marketing management practices in their domain areas.
4. The student will be exposed to the basic concepts of entrepreneurship and its development process and also lights on the financial agencies supporting entrepreneurship in India
5. The student will be able to evaluate business ideas and attain hands on experience in designing and developing a business plan / model.

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

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

UNIT III
HUMAN RESOURCES AND MARKETING MANAGEMENT
Concepts of HRM, HR planning, Recruitment & Selection methods, Training and Development methods, Performance Appraisal methods, Marketing concept, Marketing Mix, and Marketing Strategies based on Product Life Cycle.

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

UNIT V
ENTREPRENEURSHIP AND BUSINESS PLAN DEVELOPMENT
Characteristics and skills of an entrepreneur, Types of entrepreneurs, small business in Indian economy. Financial aspects: sources of rising capital, Procedure for setting up an enterprise, Schemes of Central

level & State level - T Hub, Other institutional initiatives for entrepreneurial development. Risk Reduction strategies, Strategies for growth. Writing the business plan and functional plans.
Activity: Student need to submit their own business plan for the identified business area.

TEXTBOOKS

1. Fundamentals of management by Stephen P Robbins; Mary K Coulter; David A DiCenzo, Pearson 2019 (11th Edition)
2. Management: A Practical Introduction, Angelo Kinicki, Brian Williams, McGraw-Hill Education, 2018 (9th Edition)
3. Essentials of Management, Harold Koontz, Heinz Weihrich, Mark V. Cannice, McGraw-Hill Education, 2015 (10th Edition)
4. Fundamentals of Management, Ricky W. Griffin, Cengage Learning, 2020 (10th Edition)
5. Principles and Practice of Management, L. M. Prasad, Sultan Chand & Sons, 2012
6. Entrepreneurship- Robert D Hisrich, Michael P Peters, Dean A Shepherd, TMH.2009

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
POWER SEMICONDUCTOR DRIVES LAB

Course Code: GR24A4038 **L/T/P/C: 0/0/2/1**
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

Any ten experiments should be conducted.

1. Firing angle control of thyristor-based DC drive connected to DC motor.
2. Closed loop speed control of DC motor using PI, PID, PD controllers.
3. Response of DC motor for Step, Ramp and Parabolic input signals.
4. Speed control of DC motor using armature voltage control with PI, PID controllers.
5. Open loop V/F control of AC motor.
6. Closed loop speed control of AC motor with step, ramp, parabolic inputs using PI, PID controllers.
7. Closed loop speed control of AC motor coupled with DC generator using PI, PID controllers.
8. Speed Control of SRM (Switched Reluctance Motor) in Forward Motoring and Reverse Motoring Mode.
9. Speed Control of PMBLDC Motor in Forward Motoring, Reverse Motoring and Forward Breaking Mode.
10. Speed Control of PMSM in Forward Motoring Mode.
11. Closed loop control of Semi Converter fed separately Excited DC motor.
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 AND TECHNOLOGY
(Autonomous)
PROJECT WORK PHASE-I

Course Code: GR24A4016 **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
(Autonomous)
POWER SYSTEM MONITORING AND CONTROL

Course Code: GR24A4039 **L/T/P/C: 2/1/0/3**
IV Year II Semester

COURSE OUTCOMES

1. Evaluate the effect of transmission line losses on generation cost optimization using appropriate mathematical models.
2. Analyze the steady-state and dynamic behavior of single-area and two-area load frequency control systems.
3. Explain the processes of data acquisition, monitoring, event processing, and control functions in power systems.
4. Interpret power exchange mechanisms and pricing trends within vertically integrated and competitive electricity markets.
5. Summarize the roles of various stakeholders in implementing DSM, managing network charges, and complying with regulatory norms.

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 Service Management: Type and start capability service, Provisions of ancillary services, Markets for ancillary services, Co-optimization of energy and reserve services, Loss of opportunity cost, International practices of 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.
3. D. Kirschen and G. Strbac, Fundamentals of Power System economics, John Wiley & Sons Ltd,2019, 2nd Edition.

REFERENCES

1. S. Hunt,, Making competition work in electricity, John Wiley & Sons, Inc., 2002, 1st Edition.
2. Ashikur Bhuiya: Power System Deregulation: Loss Sharing in Bilateral Contracts and Generator Profit Maximization, VDM Verlag Publisher, 2008 .

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
ADVANCED ELECTRIC DRIVES
(PROFESSIONAL ELECTIVE -V)

Course Code: GR24A4040 **L/T/P/C: 3/0/0/3**
IV Year II Semester

COURSE OUTCOMES

1. Explain vector control strategies for Induction motor drives.
2. Illustrate 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 PMBLDCM 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

(Autonomous)

ENERGY STORAGE SYSTEMS

(PROFESSIONAL ELECTIVE -V)

Course Code: GR24A4041 **L/T/P/C: 3/0/0/3**

IV Year II Semester

COURSE OUTCOMES

1. Explain the need, classification, and applications of various energy storage systems.
2. Analyze the operation and performance parameters of electrochemical, mechanical, thermal, and electrical storage systems.
3. Compare storage technologies based on technical, economic, and operational factors.
4. Design integration strategies for ESS in renewable-rich and smart grid environments.
5. Evaluate emerging storage solutions and their potential impact on future power systems.

UNIT I

INTRODUCTION TO ENERGY STORAGE SYSTEMS

Need for energy storage in modern power systems – challenges and opportunities - Classification of energy storage technologies - Applications: grid stability, renewable integration, peak shaving, and ancillary services - Performance metrics: efficiency, energy density, power density, response time, lifetime and cost.

UNIT II

ELECTROCHEMICAL ENERGY STORAGE SYSTEMS

Batteries: working principles, types – lead-acid, lithium-ion, sodium-sulphur, flow batteries - Battery performance characteristics and degradation mechanisms - Battery Management Systems (BMS) – monitoring, control, safety - Case studies of battery deployment in grid and renewable applications.

UNIT III

MECHANICAL AND THERMAL ENERGY STORAGE SYSTEMS

Pumped hydro storage – principle, design, operation - Compressed Air Energy Storage (CAES) – configurations, efficiency improvements - Flywheel energy storage – rotor design, magnetic bearings, high-speed operation - Thermal energy storage – sensible, latent, and thermochemical storage - Applications in load leveling and renewable energy smoothing.

UNIT IV

ELECTRICAL ENERGY STORAGE TECHNOLOGIES

Supercapacitors – working principle, equivalent circuit, applications - Superconducting Magnetic Energy Storage (SMES) – operation, cryogenic systems, applications - Comparison of electrochemical, mechanical, thermal, and electrical storage systems - Hybrid energy storage systems.

UNIT V

INTEGRATION, CONTROL, AND EMERGING STORAGE SOLUTIONS

Energy Storage System (ESS) integration in microgrids and smart grids - Control strategies for ESS: state of charge (SOC) management, power dispatch, frequency/voltage support - Communication, monitoring, and control architectures for large-scale ESS - Emerging storage solutions: hydrogen storage, metal-air batteries, solid-state batteries - Future trends, policy, and market mechanisms for ESS adoption.

TEXTBOOKS

1. Wu, Fu-Bao; Yang, Bo; Ye, Ji-Lei, *Grid-scale Energy Storage Systems and Applications*, Elsevier-Academic Press, 2019.
2. Hu, Zechun, *Energy Storage for Power System Planning and Operation*, Wiley, 2020.

REFERENCES

1. Dhameja, Sandeep. *Electric Vehicle Battery Systems.* Newnes, USA, 2002.
2. Eicker, U., Energy Storage Systems – Fundamentals, Classification and a Technical Comparison, Springer, 2019.
3. Chen, Haisheng, *Energy Storage: Technologies and Applications,* Artech House, 2023.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
MODERN CONTROL THEORY
(PROFESSIONAL ELECTIVE -V)

Course Code: GR24A4042 **L/T/P/C: 3/0/0/3**
IV Year II Semester

Course Outcomes:

1. Develop a state feedback model of the system.
2. Distinguish full order and reduced order state observers.
3. Illustrate robust controllers for tracking and disturbance rejection.
4. Explain continuous and discrete time linear state regulators.
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. M. Vidyasagar, Nonlinear Systems

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
INDUSTRIAL IOT
(PROFESSIONAL ELECTIVE -V)

Course Code: GR24A4043 **L/T/P/C: 3/0/0/3**
IV Year II Semester

COURSE OUTCOMES

1. Explain the fundamental concepts of Industrial IoT, Industry 4.0, and cyber-physical systems.
2. Illustrate the layered architecture of IIoT and differentiate among various industrial communication protocols and reference models.
3. Apply knowledge of industrial sensors, actuators, and gateways to design basic data acquisition and communication setups for IIoT systems.
4. Analyze the role of data analytics, cloud/fog/edge computing, and machine learning in optimizing industrial processes.
5. Evaluate IIoT security challenges and propose suitable solutions through case studies in manufacturing, healthcare, and energy sectors.

UNIT I
FOUNDATIONS OF IIOT AND INDUSTRY 4.0
Introduction to IoT and Industrial IoT, scope and significance, IoT versus IIoT and IT–OT convergence, evolution of Industry 4.0 and role of cyber-physical systems, characteristics and advantages of IIoT, interoperability and scalability challenges, applications in manufacturing, energy, healthcare and logistics, case studies highlighting industrial transformations.

UNIT II
IIOT ARCHITECTURE AND TECHNOLOGIES
IIoT layered architecture including perception, network and application layers, Industrial Internet Reference Architecture (IIRA), communication technologies such as Ethernet, Wi-Fi and LPWAN, role of gateways, middleware and edge devices, industrial communication protocols including MQTT, OPC UA, Modbus and PROFIBUS, cloud computing models and services in IIoT, business models and value creation enabled by IIoT adoption.

UNIT III
SENSORS, DEVICES AND DATA ACQUISITION
Industrial sensors including temperature, vibration, pressure and proximity sensors, smart sensors and sensor fusion, actuators and control devices, data acquisition systems and real-time monitoring, embedded boards such as Arduino, Raspberry Pi and ESP32 for IIoT applications, networking interfaces and device integration, case examples of sensor-driven industrial automation and control.

UNIT IV

IIOT ANALYTICS, EDGE/FOG COMPUTING AND SECURITY

Data analytics in IIoT including descriptive, predictive and prescriptive methods, big data frameworks such as Hadoop and Spark, machine learning applications for predictive maintenance, edge and fog computing concepts for low-latency data handling, cybersecurity challenges in IIoT environments, access control, authentication and intrusion detection techniques, blockchain and AI-enabled approaches for enhancing IIoT security.

UNIT V

APPLICATIONS AND CASE STUDIES

Applications of IIoT in smart manufacturing and smart factories, energy sector applications such as smart grids and predictive energy management, healthcare applications including remote monitoring and wearable devices, oil and gas industry and process automation, logistics, inventory management and supply chain optimization, safety and quality control in industrial environments, case studies of successful IIoT implementations, future scope including digital twins, Industry 5.0 and human–machine collaboration.

TEXTBOOKS

1. S. Misra, C. Roy, and A. Mukherjee, 2020 “Introduction to Industrial Internet of Things and Industry 4.0”, CRC Press.
2. Simone Cirani, Gianluigi Ferrari, Marco Picone, and Luca Veltri, “Internet of Things: Architectures, Protocols and Standards” WILEY.

REFERENCES

1. Andrew Minteer, “Analytics for the Internet of Things (IoT): Intelligent analytics for your intelligent devices”.

GOKARAJURANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
AI AND ML APPLICATIONS TO POWER ELECTRONICS
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR24A4044 **L/T/P/C: 3/0/0/3**
IV Year II Semester

COURSE OUTCOMES

1. Describe the importance of designing the System with AI and Machine Learning.
2. Learn Support Vector Machines and its Regression.
3. Distinguish the various Neural Networks Architectures.
4. Categorize Fuzzy rule base and neuro-fuzzy systems.
5. Analyze various power electronic systems using neural & fuzzy systems.

UNIT I
INTRODUCTION
Towards Intelligent Machines, Well-Posed Machine Learning Problems, Examples of Applications-Machine Vision, Biometric Recognition & Handwriting recognition, load forecasting and Control & Automation. Time Series Forecasting, Datasets for Unreastically Simple and Realistic Problems, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured/Unstructured. Forms of Learning, Machine Learning and Data Mining, Basic LinearAlgebra in Machine Learning Techniques.

UNIT II
SUPPORT VECTOR MACHINES
Learning with Support Vector Machines, Perceptron Algorithm, Linear Soft Margin Classifier for Overlapping Classes, Nonlinear Classifier, Regression by Support Vector Machines, Variants of Basic SVM Techniques.

UNIT III
NEURAL NETWORKS
Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptrons, Linear Neuron andthe Widrow-Hoff Learning Rule, Error-Correction Delta Rule, Multi-Layer Perceptron Networks, Radial Basis Functions Networks.

UNIT IV
FUZZY INFERENCE SYSTEMS
Cognitive Uncertainty and Fuzzy Rule-Base, Fuzzy Quantification of Knowledge, Fuzzy Rule-Base and Approximate Reasoning, Takagi-Sugeno Fuzzy Mode, Neuro-Fuzzy Inference Systems.

UNIT V
APPLICATIONS
Neural Network Topologies for space vector pulse width modulation of three level inverter, Neural Network based feedback signal estimator performance – Torque & Rotor Flux, Neural Network topology for stator flux estimator, Neuro-fuzzy based efficiency optimization control, Neuro-Fuzzy Controller based Direct Torque Control

TEXTBOOKS

1.Applied Machine Learning – M. Gopal, Mc Graw Hill.

REFERENCES

1.Power Electronics & Motor Drives – Advances & Trends, Bimal K Bose, 2ndEdition, Academic Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
ELECTRIC SMART GRID
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR24A4045 **L/T/P/C: 3/0/0/3**
IV Year II Semester

COURSE OUTCOMES

1. Determine the functions of smart grid components and explain how they differ from traditional power grid elements.
2. Identify different communication and measurement technologies like PMUs and smart meters used in smart grids.
3. Apply load flow methods to analyze power flow in a smart grid.
4. Analyze voltage and angle stability problems in smart grid systems.
5. Explain the impact of renewable energy and storage systems on smart grid operation.

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
(Autonomous)

EMBEDDED SYSTEMS DESIGN
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR24A3084 **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. Remember the fundamentals of RTOS-based embedded system design and synchronization techniques.
5. Analyze various task communication and synchronization mechanisms in RTOS-based systems.

UNIT I
INTRODUCTION TO EMBEDDED SYSTEMS
Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

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

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

UNIT IV
RTOS BASED EMBEDDED SYSTEM DESIGN
Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

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

TEXTBOOKS

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

REFERENCES

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

INTRODUCTION TO BIG DATA ANALYTICS
(PROFESSIONAL ELECTIVE -VI)

Course Code: GR24A4046 **L/T/P/C: 3/0/0/3**
IV Year II Semester

COURSE OUTCOMES
1. Explore the fundamentals of Big Data, the Hadoop ecosystem, and HDFS for managing large-scale energy datasets.
2. Demonstrate the use of data ingestion tools to efficiently handle structured and unstructured data from smart grids and IoT devices.
3. Develop distributed data processing solutions using MapReduce and Pig for energy data analytics.
4. Apply Hive and HBase to query, manage, and analyse real-time energy datasets.
5. Utilize Apache Spark for advanced energy forecasting, monitoring, and large-scale data analysis.

UNIT I
INTRODUCTION TO BIG DATA AND HADOOP
Types of Digital Data in EEE applications. Definition of Big Data and the 5 V's, Advantages of Big Data in smart grids, IoT devices, and renewable energy systems. Characteristics of Hadoop, RDBMS vs Hadoop, Core Components of Hadoop Ecosystem (HDFS, YARN, Hive, HBase, Pig, Sqoop, Flume).

UNIT II
DATA MANAGEMENT IN HDFS
Handling large-scale energy datasets using HDFS, Characteristics of HDFS. HDFS Components: Name Node, Data Node. HDFS High Availability & Replication (reliability for grid/sensor data). Basic HDFS Commands.

Data Ingestion into Big Data Systems
Importance of data ingestion in IoT-enabled power systems & SCADA logs.

UNIT III
APACHE SQOOP
Role in transferring RDBMS data (billing, SCADA, sensors) to Hadoop. Importing & Exporting datasets.

Apache Flume: Collecting streaming data from smart meters, sensors, and transformer logs. Flume Architecture (Source, Channel, Sink).

UNIT IV

DISTRIBUTED PROCESSING WITH MAPREDUCE AND PIG

Need for distributed processing in energy data analytics, Overview of YARN (basic idea only).
MapReduce: Concept of Key-Value processing, Phases with an example from power consumption analysis, Shuffle and Sort (basic idea).
Pig: Introduction to Pig scripting. Simple & Complex Data Types. Common Operators (Load, Filter, Group, Join)

UNIT V

APACHE HIVE AND NOSQL DATABASE (HBASE)

Hive: Features of Hive, Hive Architecture (simplified). HiveQL basics for analysing energy datasets. Tables (Managed & External).
HBase: Introduction to NoSQL. HBase for real-time smart grid monitoring. HBase vs RDBMS.
Apache Spark: Introduction to Apache Spark, Components of Apache Spark (Spark Core, Spark SQL). Applications of Spark in load forecasting, renewable energy prediction, fault detection.

TEXTBOOKS

1. Tom White, Hadoop: The Definitive Guide, 4th Edition, O'Reilly Media, 2015.
2. Seema Acharya and Subhasini Chellappan, Big Data and Analytics, Wiley India, 2015.
3. Sridhar Alla, Big Data Analytics with Hadoop 3, Packt Publishing, 2018.

REFERENCES

1. Anand Rajaraman, Jeffrey D. Ullman, Mining of Massive Datasets, Cambridge University Press, 3rd Edition, 2020.
2. Chuck Lam, Hadoop in Action, Manning Publications, 2011.
3. Vignesh Prajapati, Big Data Analytics with R and Hadoop, Packt Publishing, 2013.
4. Smarter Grid Solutions, Big Data Analytics in Smart Grids, Springer, 2017.
5. Sumit Gupta, Practical Big Data Analytics: Processing, Analysis, and Visualization for Smart Grid Applications, Packt Publishing, 2016.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

PROJECT WORK PHASE-II

Course Code: GR24A4026 **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
HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOUR
(OPEN ELECTIVE)

Course Code: GR24A3010 **L/T/P/C: 3/0/0/3**

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

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

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

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

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

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

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

REFERENCE BOOKS:
1. Luthans, Fred, Organizational Behaviour, McGraw-Hill, New York.
2. Gregory, Moorhead and Ricky W. Griffin, Managing Organizational Behaviour, Thomson South

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

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

Course Code: GR24A3024 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2. Locate and apply case law and common law to current legal dilemmas in the technology field.
3. Apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
4. Understand cybercrime and ethical practices and the student will be able to know and learn web technologies and related issues.
5. In position to interface with various issues pertaining to Intellectual Property, copy rights, patents rights etc. and provide an overview of cybercrime and framework.

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

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

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

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

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

TEXT BOOKS:
1. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
2. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012)
3. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)
4. Jonthan Rosenoer, Cyber Law, Springer, New York, (1997).

REFERENCE BOOKS:
1. Sudhir Naib, The Information Technology Act, 2005: A Handbook.
2. S. R. Bhansali, Information Technology Act, 2000
3. University Book House Pvt. Ltd. Jaipur (2003).

4. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi.

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

Course Code: GR24A4013 **L/T/P/C: 3/0/0/3**

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

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

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

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

UNIT-IV: Private and Public Sector, Public Sector:
Role and growth, Achievements of the public sector, Private Sector – Importance Problems, New foreign Trade Policy.

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

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

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INDIAN KNOWLEDGE SYSTEM
(OPEN ELECTIVE)

Course Code: GR24A3023 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Understand nature, scope and related fields of Indian knowledge system.
2. Demonstrate the scientific literature available in ancient Indian traditions
3. Understanding the application of Bharatiya Jnana Parampara
4. Understand Indian approach towards Wellbeing
5. Appreciate vast contribution of ancient Indian researchers, engineers, scientists and architects to the modern world

UNIT-I: Introduction to Indian Knowledge Systems:
Meaning, Nature, Scope and Salient Aspects of Bharatiya Jnana Parampara - Introduction to Vedas, Upanishads, Vidya, Kala, Jnana, Shastra - Practices and Continuity of Tradition

UNIT-II: Overview of History of Indian Education and Scientific Literature:
Gurukul System - Role of Sanskrit in Natural Language Processing - Scientific Literature – Vedic. Literature - Available Scientific Treatises - Interlinkings

UNIT-III: Introduction to Scientific Theories from Pure Sciences from Ancient Indian Knowledge Systems:
Overview of theories from available ancient Indian Literature about Physics, Chemistry and Mathematics - Interlinking's and applications

UNIT-IV: Introduction to Ancient Indian Wellness Systems:
Concept of Wellness – Yoga System - Ayurveda System - Ancient Indian Aesthetics Achievements of the public sector, Private Sector – Importance Problems, New foreign Trade Policy.

UNIT-V: Development of Engineering, Science, Technology & Fine Arts in India:
Various Industries - Silk, Cotton and Ship Building - Evolution of Indian Fine Arts – Cave and Temp Architecture, Vastu - Vidya, Sculpture, Forts and Stepwells, Observatories and Paintings - Music and Natyakala - Cultural Traditions & Folk Arts.

Pedagogy for Teachers: Apart from Classroom Instruction, the following Methods are Suggested.
1. Project based activities and learning.
2. Presentation and case studies.
3. Film screening and book reviews.
4. Visit to historical places, archives centre, research centre or library nearby.

Note: Activities mentioned above are only suggestive. Teacher-educators should encourage students to be innovative.

TEXT BOOKS:
1. B. Mahadevan, Bhat Vinayak and Nagendra Pavan R.N., (2022) 'Introduction to Indian Knowledge Systems: Concepts and Applications' PHI learning PVT, New Delhi ISBN [9789391818203]
2. Dharmapal (1971) 'Indian Science and Technology in the Eighteenth Century'. Other India Press, Goa.
3. Kapil Kapoor, Singh Avdhesh Kumar, (2005) 'Indian Knowledge Systems' D.K. Printworld (P) Ltd. ISBN 10: 8124603367 / ISBN 13: 9788124603369

4. Chakradeo, Ujwala, Temples of Bharat, Aayu Publications, New Delhi, 2024.
5. D.N. Bose, S.N. Sen and B. V. Subbarayappa, A Concise History of Science in India, Indian National Science Academy, New Delhi, 2009.
6. Datta B. and A. N. Singh, History of Hindu Mathematics: Parts I and II, Asia Publishing House, Bombay, 1962.
7. Kapoor, K. (2021), Indian Knowledge System: Nature, Philosophy, Character in Indian Knowledge System, vol. 1, Pub. Indian Institute of Advanced Studies, Shimla
8. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Philosophical Systems, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.
9. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Knowledge: Framework and Classification, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.

VIDEO RESOURCES:

1. Introductory lectures by Prof. Gauri Mahulikar
2. Introductory lectures by Prof. Kapil Kapoor

WEBSITES:

- https://iksin dia.org/index.php
- Official Website of IKS- Indian Knowledge System
- https://www.youtube.com/watch?v=uKcf-hSlcUE
- Address by Prof Kapil Kapoor | Indian Institute of Advanced Study (FDP 2021)
- https://www.youtube.com/watch?v=MDJTXNiH2_A
- Mukul Kanitkar on Bharatiya Knowledge System
- https://www.youtube.com/watch?v=uARMhv97pjk
- https://www.youtube.com/watch?v=oTwgf56GbsA
- Scientific History of India | Mukul Kanitkar Lecture in DTU
- https://youtu.be/gNJNmPJqXJc?si=WFBbuUT65mLZzpOW
- Ancient India's Scientific Achievements & Contribution in Mathematics, Astronomy, Science & Medicine

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
A PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(OPEN ELECTIVE)

Course Code: GR24A4012 **L/T/P/C: 3/0/0/3**

Course Outcomes:
1. Study of Shrimad- Bhagwad-Gita wiil help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neethishatakam will help in developing versatile personality of students
4. To develop self-developing attitude towards work without self-aggrandizement and to develop suffering free meditative mind
5. To develop tranquil attitude in all favorable and unfavorable situations and to develop high spiritual intelligence

UNIT-I: Neetisatakam-Holistic development of personality
- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT-II: Neetisatakam-Holistic development of personality
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT-III: Approach to day to day work and duties
- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV: Statements of basic knowledge
- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:
- Classification, Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOKS/ REFERENCE BOOKS:
1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING MATERIALS FOR SUSTAINABILITY

(OPEN ELECTIVE)

Course Code: GR24A3009 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:

1. Describe the different types of environmental factors effecting materials
2. Report the work in sustainability for research and education
3. Illustrating the broad perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course
4. Perform cost/benefit analysis and life-cycle analysis of green buildings.
5. Identify the balance affordability, functionality, and environmental responsibility to create sustainable and effective building designs.

UNIT-I: Sustainability:

Introduction, need, and concept of sustainability, Social- environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols – Clean Development Mechanism (CDM), Environmental legislations in India – Water Act, Air Act

UNIT-II: Environmental management standards:

ISO 14000 series, Life Cycle Analysis (LCA) – Scope and Goal, Bio-mimicking, Environment Impact Assessment (EIA) – Procedures of EIA in India

UNIT-III:

Green Building Materials, Basic concepts of sustainable habitat, green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainably managed Materials, Depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials; Embodied Energy of Materials

UNIT-IV:

Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds (VOC's), Natural Non-Petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials, Engineering evaluation of these materials

UNIT-V:

Green Building Planning and Specifications**,** Environment friendly and cost effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Alternative Construction Methods, Energy Conservation Measures in Buildings, Waste &Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight, Plumbing and its Effect on Energy Consumption

TEXT BOOKS:

1. Alternative Building Materials and Technologies – By K S Jagadeesh, B V Venkata Rama Reddy & K S Nanjunda Rao – New Age International Publishers, 2007
2. Integrated Life Cycle Design of Structures – By AskoSarja – SPON Press, 2011
3. Non-conventional Energy Resources – By D S Chauhan and S K Srivastava – New Age International Publishers, 2021

REFERENCE BOOKS:

1. Emerald Architecture: case studies in green buildings, The Magazine of Sustainable Design, 2008
2. Understanding Green Building Guidelines: For Students and Young Professionals, Traci Rose Rider, W. W. Norton & Company Publisher.2009
3. Understanding Green Building Materials, Traci Rose Rider, W. W. Norton & Company Publisher.2011
4. Green Buildings (McGraw hill publication): by Gevorkian, 2006

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
GEOGRAPHIC INFORMATION SYSTEMS AND SCIENCE
(OPEN ELECTIVE)

Course Code: GR24A3022 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Interpret the fundamental concepts of Geographic Information Science and Technology along with different data structures.
2. Demonstrate Map creation and design principles, including thematic map display, employment of map projections and cartographic design.
3. Analyze the types of digital maps for different themes.
4. Apply the spatial analysis to remote sensing data to generate thematic maps.
5. Solve the real-life problems associated with geospatial and remote sensing.

UNIT-I:
Fundamentals of GIS – Information Systems, Modelling Real World Features Data, Data Formats, Applications of GIS, – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Database Management – Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware – Computing, printing and scanning systems; Software – Standard Packages like Arc view, ArcGIS (commercial) & Auto-CAD Map, Map Info etc. QGIS open software- Salient features.

UNIT-II:
Topology – Types of Errors, Editing and Error Rectification, Types of Topology, Modeling topological Relationships, Tolerances.

UNIT-III:
Map – mapping concepts, analysis with paper-based maps, limitations, Computer Automated Cartography– History and Developments, GIS- Definition, advantages of digital maps.

UNIT-IV:
Spatial Analysis and Modelling – Proximity Analysis, Overlay Analysis, Buffer Analysis, Network Analysis, Spatial Auto Correlation, Gravity Modelling, DTM/DEM, Integration with Remote Sensing data

UNIT-V:
GIS Project Planning and Implementation – Under Standing the Requirements, Phases of Planning, Specifications, Data Procurement, Tendering, Human Resources, Back Up, Monitoring Progress

TEXT BOOKS:
1. Concepts & Techniques of GIS by C. P. Lo Albert, K. W. Yonng, Prentice Hall (India) Publications, 2nd edition, 2016.
2. Fundamental of GIS by Mechanical designs John Wiley &Sons, 4th edition, 2008.
3. Principals of Geographic Information Systems – Peter Beur and Rachael A.Mc Donnell, Oxford Publishers 2016.
4.
REFERENCE BOOKS:
1. Remote Sensing and Geographical Information systems by M. Anji Reddy JNTU Hyderabad.4th Edition 2014, B. S. Publications.
2. Introduction to Geographic Information Systems by Kang-tsung Chang, Tata McGraw-Hill Publishing

Company Limited- 2008.
3. Remote sensing of the environment –An earth resource perspective by John R Jensen, Prentice Hall 4. GIS by Kang – tsung chang, TMH Publications & Co., 2nd edition, 2013.
4. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications, 1st edition,2016.
5. Remote Sensing and its applications by LRA Narayana, UniversityPress 1999.
6. Remote sensing and image interpretation by Thomas Lillesand, 7th Edition, John Wiley & sons,6th Edition 2011.
7. Fundamentals of Geographic Information systems by Michael N. Demers, 4th Edition, Wiley Publishers, 2012.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
PLUMBING -WATER AND SANITATION
(OPEN ELECTIVE)

Course Code: GR24A4011 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:
1. Coordinate plumbing works from inception to completion with Owners, Architects, other consultants, and contractors.
2. Select proper plumbing materials and systems.
3. Read and interpret plumbing drawings.
4. Supervise code based plumbing installations. Understand methods to conserve water and energy, Protect health and safety of end users.
5. Enjoy better job opportunities and career options

UNIT-I: Introduction to Plumbing and Sanitation Importance of Codes, Architectural and Structural Coordination Codes and Standards: Scope, purpose; codes and standards in the building industry, UIPC-I (Uniform Illustrated Plumbing Code-India), NBC (National Building Code) and other codes, Local Municipal Laws, approvals, general regulations, standards, water supply, sewerage system, drainage system, workmanship, water conservation, protection of pipes and structures, waterproofing. of GIS – Information Systems, Modelling Real World Features Data, Data Formats, Applications of GIS, – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Database Management – Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware – Computing, printing and scanning systems; Software – Standard Packages like Arc view, ArcGIS (commercial) & Auto-CAD Map, Map Info etc. QGIS open software- Salient features.
Architectural and Structural coordination: Provisions for plumbing systems, coordination during the planning stage, various agencies involved and their roles, space planning for plumbing systems, water tanks, pump room, centralized hot water systems, toilet locations.

UNIT-II: Plumbing Terminology:
Definitions, use/purpose of the following. ***Plumbing Fixtures:*** accessible, readily accessible, aerated fittings, bathroom group, carrier, flood level rim, floor sink, flush meter valve, flush tanks, lavatories, macerating toilet, plumbing appliances, plumber. ***Traps:*** indirect waste, vent, blow off, developed length, dirty arm, indirect waste, receptors, slip joints, trap, and vent. ***Drainage:*** adapter fitting, adjusted roof area, air break, air gap, area drain, base, bell and spigot joint, building drain, branch, (DFU) Drainage Fixture Units, grease interceptor, joints, roof drain, smoke test, stack. ***Water supply:*** angle valve, anti-scald valve, backflow, bypass, check valve, cross connection, gate valve, gray water, joints.

UNIT-III: Plumbing Fixtures and Fittings:
Definitions of plumbing fixtures, fittings, appliances and appurtenances; maximum flow rates, water closets, urinals, flushing devices, washbasins, bath/shower, toilets for differently abled, kitchen sinks, water coolers, drinking fountain, clothes washer, dish washer, mop sink, overflows, strainers, prohibited fixtures, floor drains, floor, location of valves, hot water temperature controls, installation standard dimensions in plan and elevation.

UNIT-IV:
Traps, Interceptors, Indirect Waste and Vents Traps required, trap arms, developed length, trap seals, venting to traps, trap primers, prohibited traps, building traps. Discharge for indirect waste piping, nature of contents or systems, proper methods to install indirect waste piping, air gap and air break, sink traps,

dish washers. Vent requirement, purpose of venting, trap seal protection, materials, vent connections, **Sanitary Drainage and Storm Drain** Preamble, one pipe and two pipe systems, different pipe materials and jointing methods, special joints, hangers and supports, protection of pipes and structures, alternative materials, workmanship, prohibited fittings and practices.

Water Supply, Gray and Reclaimed Water: Preamble, one pipe and two pipe systems, different pipe materials and jointing methods, special joints, hangers and supports, protection of pipes and structures, alternative materials, workman ship, prohibited fittings and practices, change in direction of flow, T and Y fittings, Storm drain required, prohibited connections, subsoil drains, sub-drains, gutters, channels or scuppers, roof drains, catchment, collect/capture storm water, discharging storm water, Rain Water Harvesting (RWH) definition, need, catchment, conduits, settlement tanks, treatment, possible uses, recharging pits, NBC requirements.

UNIT-V:

Water Supply, Gray and Reclaimed Water (Preamble, sources of water, potable and non-potable water, reclaimed water, calculating daily water requirement and storage, hot and cold water distribution system. pipe materials and jointing methods, alternative materials, hangers and supports, workmanship, prohibited fittings and practices, protection of pipes and Plumbing (Water and Sanitation) structures, pressure controls, unions, thermal expansion, types of valves, Definition of gray water, approvals, specifications and drawings, safety, total gray water discharge, holding tanks, valves and piping.

Introduction to water treatment plant (WTP) and STP: Introduction to Net Zero concept, need to reduce and reuse, rating of Water Efficient Plumbing fixtures and fittings, 24x7 water supply, metering and sub-metering, typical daily water and wastewater calculations for a project.

TEXT BOOKS:

1. Elements of Water Pollution Control Engineering, O.P. Gupta, Khanna Book Publishing, New Delhi. Edition ·1, 2019.
2. Plumbing Engineering" Author: R. G. Saran Publisher: S. K. Kataria & Sons Latest Edition: 2022 (Revised Edition)
3. "Water Supply and Sanitary Engineering" Authors: G. S. Birdie and J. S. Birdie Publisher: Dhanpat Rai Publishing Company Latest Edition: 2022 (33rd Revised Edition)
4. "Plumbing: Design and Installation" Author: L. G. Wade Publisher: Cengage Learning Latest Edition: 2019 (4th Edition)

REFERENCE BOOKS:

1. "Plumbing Engineering Design Handbook" (Volumes I & II) Publisher: American Society of Plumbing Engineers 2022 Edition (Volume 1: Fundamentals; Volume 2: Systems)
2. Water Efficiency and Sanitation Standard published by IPA Indian Plumbing Association (IPA) and IAPMO International Association of Plumbing and Mechanical Officials (India) Water Pollution, Berry, CBS Publishers, 2023 edition.
3. 'A Guide to Good Plumbing Practices', a book published by IPA, 2016 edition.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

NON-CONVENTIONALENERGYSOURCES

(OPEN ELECTIVE)

Course Code: GR24A3035 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:

1. Recall the concepts of Solar Energy and Solar collectors.
2. Illustrate the PVSolar system with energy backup.
3. Analyze the basic physics of wind power generation.
4. Determine the energy generation from biomass, biogas, and geothermal energy.
5. Discuss Tidal power systems and fuel cells.

UNIT-I: Solar Radiation:

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

UNIT-II: Photo Voltaic System:

Photo voltaic cells-Equivalent circuit- V-I Characteristics- Photovoltaic modules-constructional details-design considerations-Tracking-Maximum power point tracking–algorithms-PV solar system design with energy backup-Solar Thermo electric Conversion.

UNIT-III: Wind Energy:

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

UNIT-IV: Biogas and Geothermal Energy:

Various fuels-Sources- Conversion technologies–Dry Processes-Biogas generation–Aerobic and anaerobic digestion- Factors affecting the generation of biogas –Classification of biogas plants- Different Indian digesters- Digester design considerations- Gasification process-Gasifiers- Applications. Geothermal Energy-sources-Hydro thermal convective-Geo-pressure resources- Petro-thermal systems(HDR)-Magma Resources-Prime Movers

UNIT-V: Tidal Energy:

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

TEXT BOOKS:

1. John Twidell & Wier, Renewable Energy Resources,CRCPress,2009.
2. D.P.Kothari, Singal, Rakesh, Ranjan, Renewable Energy Sources and Emerging Technologies, PHI, 2009.

REFERENCE BOOKS:

1. G.D.Rai–Non-Conventional Energy sources, Khanna publishers.

2. B.H.Khan,“Non-ConventionalEnergyResources”,2ndedition,TataMcGraw-Hill,New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

CONCEPTSOF CONTROLSYSTEMS
(OPEN ELECTIVE)

Course Code: GR24A3046 **L/T/P/C: 3/0/0/3**

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

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

UNIT-I: Basic Concepts of Control System:

Terminology - plant, process, system, disturbances, controlled variable, manipulated variable etc., Block diagram of basic control system, application areas with examples. Classifications of control systems

UNIT-II: Mathematical Modelling of Systems:

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

UNIT-III: Time Response Analysis:

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

UNIT-IV: Stability:

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

UNIT-V: Frequency Response Analysis:

Need of frequency response analysis, Sinusoidal response of linear system, methods used in frequency response, Bode Plot, Frequency domain specifications.

TEXT BOOKS:

1. IJNagrath, M.Gopal, Control System Engineering,New Age International Publishers, Fifth edition.
2. NormanSNise, Control system engineering, JohnWiley& Sons,Inc.,Sixth edition

REFERENCE BOOKS:

1. RichardC.Dorf, Robert HBishop, Modern control systems, Pearson Education International, Twelfth edition.
2. ANagoorKani, Control Systems, CBS Publishers. Jon. S. Wilson; "Sensor Technology Hand Book", Elsevier Inc., 2005.

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

Course Code: GR24A4037 **L/T/P/C: 3/0/0/3**

Course Outcomes: On completion of the course, the student will be able to
1. Outline importance of BNN, ANN and its learning techniques and architectures.
2. Summarize the algorithms for various applications using Back propagation networks.
3. Interpret the concept of Fuzzy and Crispsets.
4. Model Fuzzy membership Function and rules for Applications.
5. Analyze the parameters of Genetic Algorithm.

UNIT-I: NEURALNETWORKS I (Introduction &Architecture):
Neuron, Nerve structure and synapse, Biological Neural network, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques.
to Information Theory, Shanon Capacity, Multimedia Data, Data Processing, Boolean Logics,
Information Content, Entropy, Source Coding, Channel Coding, Modulation Schemes, Internet.

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

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

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

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

TEXT BOOKS:
1. JMZurada,"An Introduction to ANN",JaicoPublishing House.
2. Neural Networks, Fuzzy Logic, And Genetic Algorithms: Synthesis and Applications -byS. Rajasekaran, G. A. Vijayalakshmi Pai, PHI publishers.

REFERENCE BOOKS:
1. HungT.Nguyen,Nadipuram R.Prasad,CarolL. Walker andElbertA.Walker,"AFirstCourse in Fuzzy and Neural Control" Chapman & Hall, CRC.
2. Driankov,Dimitra,"AnIntroductiontoFuzzyControl",NarosaPublication.
3. TimothyJRoss, "Fuzzy Logic with Engg. Applications",McGraw.Hill.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INDUSTRIAL AUTOMATION AND CONTROL

(OPEN ELECTIVE)

Course Code: GR24A3056 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:

1. Explain the major automation theories, approaches and methodologies used in manufacturing.
2. Apply the knowledge for implementing the automated flow lines.
3. Employ the assembly systems and line balancing for automation
4. Implement the knowledge of material handling and storage systems in current industries.
5. Design adaptive control system for automated manufacturing.

UNIT-I: Introduction:

Introduction to automation, principles, reasons, types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding, tool changing and machine tool control transfer the automaton.

UNIT-II: Automated flow lines:

Methods of work part transport transfer, Mechanical buffer storage control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT-III: Assembly system and line balancing:

Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT-IV: Automated material handling and storage systems:

Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems. Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT-V: Adaptive control systems:

Introduction, adaptive control with optimization, adaptive control with constraints, application of adaptive control in machining operations. Consideration of various parameters such as cutting force, temperatures, vibration and acoustic emission in the adaptive controls systems.

TEXT BOOKS:

1. Mikell P.Groover, Automation, Production Systems, and Computer- integrated Manufacturing, prentice Hall, 2014
2. Serope Kalpakjian and Steven R. Schmid, edition, Pearson, 2013

REFERENCE BOOKS:

1. Automation, Production Systems, and Computer-Integrated Manufacturing. (2016). India: Pearson India.
2. Bolz, R. W. (2012). Manufacturing Automation Management: A Productivity Handbook. United States: Springer US.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OPERATIONS RESEARCH
(OPEN ELECTIVE)

Course Code: GR24A3034 **L/T/P/C: 3/0/0/3**

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

1. Formulate and solve linear programming problems using simplex and duality approaches for resource allocation.
2. Apply non-linear optimization techniques (single and multi-variable unconstrained methods) to practical engineering and management problems.
3. Analyze and solve transportation and assignment models for effective decision-making in logistics and resource allocation.
4. Evaluate inventory control systems and queuing models to optimize stock management and service efficiency.
5. Apply replacement and dynamic programming models for long-term decision-making in capital budgeting, maintenance, and system optimization.

UNIT-I: Introduction & Linear Programming:

Introduction: Development, Definition, Characteristics and Phases of Operations Research, Types of models: Operations Research models – Applications: Linear Programming Problem (LPP) formulation, Graphical solution method, Simplex method – Artificial variables techniques (Two–phase method, Big-M method), Duality principle

UNIT-II: Non-Linear Programming:

Introduction – Difference between linear and nonlinear programming, applications in engineering & management; **Single-variable unconstrained optimization**: Uni-modal functions, Elimination methods – Bisection/interval halving, Fibonacci method, Golden Section method; **Multi-variable unconstrained optimization**: Gradient of a function, optimality condition, Gradient methods – Steepest Descent Method, Conjugate Gradient Method (Fletcher–Reeves)

UNIT-III: Transportation & Assignment Models:

Transportation models: Formulation, Methods for finding feasible solution and optimal solution, Unbalanced transportation problems, degeneracy; **Assignment models**: Formulation, Optimal solution, Variants of Assignment Problem (e.g., unbalanced, maximization, traveling salesman problem)

UNIT-IV: Inventory & Queuing Models:

Inventory models: Single-item deterministic models, Purchase inventory models with one price break and multiple price breaks, Shortages not allowed, Stochastic models – demand as discrete or continuous variable, Instantaneous production, instantaneous demand and continuous demand (no setup cost)

Queuing models: Introduction, Single-channel system: Poisson arrivals, exponential service times, infinite/finite population, Multi-channel systems: Poisson arrivals, exponential service times with infinite population

UNIT-V: Replacement & Dynamic Programming:

Replacement models: Replacement of items that deteriorate with time (with and without time value of money), Replacement of items that fail completely, Group replacement policy

Dynamic programming: Introduction – Bellman's Principle of Optimality Applications: capital budgeting, shortest path problem, linear programming problem

TEXT BOOKS:

1. Operations Research/ Prem Kumar Gupta, Dr. D.S. Hira
2. Operations Research / S. D.Sharma-Kedarnath
3. Operation Research /J.K.Sharma/MacMilan.

REFERENCE BOOKS:

1. A.K. Operations Research / R.Pannerselvam,PHI Publications.
2. Introduction to O.R /Taha/PHI
3. Operations Research / Wagner/ PHI Publications.
4. Introduction to O.R/Hiller and Libermann (TMH).
5. Operations Research /A.M.Natarajan, P.Balasubramani,A. Tamilarasi/Pearson Education.
6. Operations Research: Methods and Problems / Maurice Saseini, ArhurYaspan and Lawrence Friedman
7. O.R/Wayne L.Winston/Thomson Brooks/cole

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMPOSITE MATERIALS
(OPEN ELECTIVE)

Course Code: GR24A3066 **L/T/P/C: 3/0/0/3**

Course Outcomes: On completion of the course, the student will be able to
1. Identify the types of composite materials and their characteristic features
2. Explain the methods employed in composite fabrication.
3. Differentiate the strengthening mechanisms of composite and its corresponding effect on performance
4. Analyze the various criterions for isotropic, anisotropic and composite materials, prediction of laminates failure.
5. Examine experimental techniques utilized for failure mode of composites.

UNIT-I:
Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke's law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness

UNIT-II:
Manufacturing of composite materials, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes

UNIT-III:
Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria.

UNIT-IV:
Von Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai- Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates

UNIT-V:
Analysis of laminated plates- equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies.

TEXT BOOKS:
1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill,1994.
2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill,1998.

REFERENCE BOOKS:
1. Clyne, T. W. and Withers, P. J., "Introduction to Metal Matrix Composites", Cambridge University Press, 1993.
2. Strong, A.B., "Fundamentals of Composite Manufacturing", SME, 1989.
3. Sharma, S.C., "Composite materials", Narosa Publications, 2000.
4. Broutman, L.J. and Krock,R.M., " Modern Composite Materials", Addison-Wesley, 1967.

5. Introduction to Composite Materials Design by Ever J. Barbero 3rd Edition 2017

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DIGITAL ELECTRONICS FOR ENGINEERING

(OPEN ELECTIVE)

Course Code: GR24A3076 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:

1. Get basic knowledge on logic gates, Universal gates and their switching logics.
2. Realize Boolean expressions using NAND/NOR gates and reduce them using K map.
3. Know all types of combinational and sequential circuits.
4. Acquire knowledge on realization of logic families using diodes and transistor, and also on different types of integrated circuits.
5. Understand the characteristics and applications of operational amplifiers in different modes of operation.

UNIT-I: Number Systems:

Number systems, Complements of Numbers, Codes- Weighted and Nonweighted codes and its properties. Boolean Algebra: Basic Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT-II: Minimization of Boolean functions:

Karnaugh Map Method - Up to four Variables, Don't Care Map Entries, Tabular Method, Combinational Logic Circuits: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.

UNIT-III: Sequential Circuits Fundamentals:

Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Fundamentals of shift registers, ripple and decade counters.

UNIT-IV: Realization of Logic Gates Using Diodes & Transistors:

AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL, CML and CMOS Logic Families and its Comparison, standard TTL NAND Gate Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tristate outputs, CMOS transmission gate.

UNIT-V: Integrated Circuits:

Classification, chip size and circuit complexity, basic information of op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC Characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

TEXT BOOKS:

1. Switching and Finite Automata Theory - ZviKohavi& Niraj K. Jha, 3rd Edition, Cambridge, 2010.
2. Modern Digital Electronics – R. P. Jain, 3rd Edition, 2007- Tata McGraw-Hill
3. Linear Integrated Circuits, D. Roy Chowdhury, New Age International(p) Ltd.
4. Op-Amps & Linear ICs, Ramakanth A. Gayakwad, PHI

REFERENCE BOOKS:

1. Digital Design- Morris Mano, PHI, 4th Edition,2006

2. Operational Amplifiers & Linear Integrated Circuits, R.F. Coughlin & Fredrick F. Driscoll, PHI
3. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications, Denton J. Daibey, TMH.

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

Course Code: GR24A3085 **L/T/P/C: 3/0/0/3**

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

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

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

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

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

UNIT-V: Overview of various smart sensors:
Digital temperature sensor (DS1621, TMP36GZ), Humidity sensor (DHT11, DHT22), Gas sensor (MQ2,MQ8), Pressure sensors (BMP180), Accelerometers (ADXL335); Structural health monitoring sensors, Introduction to MEMS and Flexible sensors.

TEXT BOOKS:
1. B. C. Nakra, K.K. Choudhury, "Instrumentation, Measurement and Analysis"-3rd Edition, Tata McGraw, 2009
2. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Applications", 3rd Edition.,

REFERENCE BOOKS:
1. Er. R.K. Rajput, "Electronic Measurements and Instrumentation", S. Chand & Company Ltd. 3rd Edition.
2. A.K.Sawhney, "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai.
3. Bentley, John P., "Principles of Measurement Systems", 4th Edition, Pearson/Prentice Hall, 2005
4. Jon. S. Wilson; "Sensor Technology Hand Book", Elsevier Inc., 2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
COMMUNICATION TECHNOLOGIES
(OPEN ELECTIVE)

Course Code: GR24A4078 **L/T/P/C: 3/0/0/3**

Course Outcomes: On completion of the course, the student will be able to
1. Understand the information theory and its coding styles.
2. Acquire knowledge on wireless communications and services.
3. Understand the various mobile networks and generations
4. Acquire knowledge on optical communications.
5. Know about network security through encryption and decryption.

UNIT-I: Information Theory:
Introduction to Information Theory, Shanon Capacity, Multimedia Data, Data Processing, Boolean Logics, Information Content, Entropy, Source Coding, Channel Coding, Modulation Schemes, Internet.

UNIT-II: Wireless Communication Technologies:
Introduction to Wireless Communication Technologies, WLAN, Wifi, Bluetooth, Other Wireless PAN And WAN Technologies, Satellite Communications, Broadcast Services.

UNIT-III: Cellular Mobile Networks:
Introduction to Cellular Mobile Networks, GSM(2G), UMTS (3G), LTE(4G), 5G Mobile Networks, Mobile Network Planning Aspects.

UNIT-IV: Optical Communication:
Introduction to Optical Communications, Optical Fiber, FTTC, FTTH, FTTBS, Free Space Optical Link, Channel Model with Different Factors, Deep Space Optical Communications.

UNIT-V: Network Security and Management:
Introduction to Network Security and Management, Symmetrical Encryption, Asymmetrical Encryption, Authentication, Hash-Value, Integrity Check, Telecommunications Management Network, SNMP, Functionalities of Network Management, Trends and Future Development.

TEXT BOOKS:
1. Shun-Ping Chen, “Fundamentals of Information and Communication Technologies” 2020
2. B.P. Lathi, “Communication systems”- BS Publications, 2006..

REFERENCE BOOKS:
1. Simon Haykin, John Wiley “Digital Communications” 2005.
2. Herbert Taub, Donald L Schilling Gautham Saha “Principles of Communication systems” 3rd edition McGraw-Hill 2008.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA SCIENCE FOR ENGINEERS

(OPEN ELECTIVE)

Course Code: GR24A3092 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:

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

UNIT-I:

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

UNIT-II:

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

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UNIT-III:

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

UNIT-IV:

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

UNIT-V:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA ANALYTICS USING OPEN SOURCE TOOLS
(OPEN ELECTIVE)

Course Code: GR24A3103 **L/T/P/C: 3/0/0/3**

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

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

UNIT-I: Graphics:

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

UNIT-II: Modeling Data:

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

UNIT-III: Mining Data:

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

UNIT-IV: Applications:

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

UNIT-V: Programming Environments and Data analytics:

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

TEXT BOOKS:

1. Philipp K. Janert, Data Analysis with Open Source Tools, O'Reilly Media, Inc, November2010: First Edition

REFERENCE BOOKS:

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

2. Chambers, John, Software for Data Analysis Programming with R, Springer, 2008
3. Trevor Hastie Robert Tibshirani Jerome Friedman, The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Springer, 2014
4. Mark Gardener, Beginning R: The Statistical Programming Language, Wiley, 2013
5. Upadhyaya and A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

AUGMENTED REALITY AND VIRTUAL REALITY

(OPEN ELECTIVE)

Course Code: GR24A4096 **L/T/P/C: 3/0/0/3**

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

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

UNIT-I:

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

UNIT-II:

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

UNIT-III:

Virtual Reality: The Three I's of Virtual Reality, A Short History of Early Virtual Reality, Early Commercial VR Technology , VR Becomes an Industry, The Five Classic Components of a VR System.

Input Devices: Trackers, Navigation, and Gesture Interfaces: Three-Dimensional Position Trackers, Navigation and Manipulation Interfaces

UNIT-IV:

Output Devices: Graphics, Three-Dimensional Sound, and Haptic Displays : Graphics Displays, Sound Displays, Haptic Feedback.

Human Factors in VR: Methodology and Terminology, User Performance Studies, VR Health and Safety Issues, VR and Society

UNIT-V:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. LaValle, "Virtual Reality", Cambridge University Press, 2016.

2. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
3. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.
4. Anand R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT
(OPEN ELECTIVE)

Course Code: GR24A4115 **L/T/P/C: 3/0/0/3**

Course Pre-Requisite(s): Fundamentals of Management, Operations Research
Course Outcomes: After completing this course, students will be able to:
1. Understand concepts of services and its significance in the economy and society and distinguish it from goods.
2. Understand the service strategy, design, and development.
3. Comprehend ways to design services and able to understand service guarantee, recovery, and failures.
4. Forecast the service demand, supply and facilitate various methods to operate and manage services.
5. Understand the service productivity and how innovation can be approached from services point of view.

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

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

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

UNIT-IV:
Simple Forecasting Demand for Services: A review of different types of forecasting methods for demand forecasting.
Managing Capacity and Demand: Strategies for matching capacity and demand, Psychology of waiting, Application of various tools used in managing waiting line in services.
Managing Facilitating Goods: Review of inventory models, Role of inventory in services Managing service supply relationship: Understanding the supply chain/hub of service, Strategies for managing suppliers of service
Vehicle Routing Problem: Managing after sales service, understanding services that involve transportation of people and vehicle, Techniques for optimizing vehicle routes.

UNIT-V:
Service Innovation: Services Productivity, Need for Services Innovation
Student Project:

Option 1: Choose any service organization around and present it from the perspective of: nature of service, classification of service, blueprint or service design analysis, service quality, and any additional perspective you would like to add.
Option 2: Choose any latest research paper in services and explain your understanding and feedback on the same.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

IT PROJECT MANAGEMENT
(OPEN ELECTIVE)

Course Code: GR24A4116 **L/T/P/C: 3/0/0/3**

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

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

UNIT-I:

Project Overview and Feasibility Studies- Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal

Project Scheduling: Project Scheduling, Introduction to PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculation and its importance, Cost reduction by Crashing of activity.

UNIT-II:

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

UNIT-III:

Agile Project Management: Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum, Lean, DevOps and IT Service Management (ITIL).

Other Agile Methodologies: Introduction to XP, FDD, DSDM, Crystal

UNIT-IV:

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

UNIT-V:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MARKETING RESEARCH AND MARKETING MANAGEMENT

(OPEN ELECTIVE)

Course Code: GR24A4117 **L/T/P/C: 3/0/0/3**

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

1. Understand the significance of marketing management concepts, marketing environment, consumer behaviour elements and strategies related to STP.
2. Understand various product management strategies and importance of branding, packing.
3. Comprehend the dynamics of marketing mix elements such as pricing, distribution, and promotion mix elements to leverage marketing concepts for effective decision making.
4. Demonstrate analytical skills in identification and resolution of problems pertaining to marketing management and marketing research and uses of various statistical tools in marketing research.
5. Understanding about the concepts of internet marketing and the fundamentals of business- to-business marketing strategy, CRM strategies.

UNIT-I:

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector.

Marketing Planning & Environment: Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social

Understanding the consumer: Determinants of consumer behavior, Factors influencing consumer behavior

Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning

UNIT-II:

Product Management: Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging.

UNIT-III:

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

UNIT-IV:

Marketing Research: Introduction, Type of Market Research, Scope, Objectives & Limitations Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research

Data Analysis: Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis

UNIT-V:

Internet Marketing: Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing

Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets.

Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy

Home Assignments:

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Marketing Management – Rajan Saxena.
2. Marketing Management – S.A. Sherlekar.
3. Service Marketing – S.M. Zha.
4. Journals – The IUP Journal of Marketing Management, Harvard Business Review.
5. Research for Marketing Decisions by Paul Green, Donald, Tull.
6. Business Statistics, A First Course, David M Levine at al, Pearson Publication.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BASICS OF JAVA PROGRAMMING

(OPEN ELECTIVE)

Course Code: GR24A3133 **L/T/P/C: 3/0/0/3**

Course Outcomes: After completing this course, students will be able to:

1. Apply OOP principles by writing Java programs using data types, operators, and control structures.
2. Analyze Java programs by implementing classes, constructors, arrays, and inheritance, and differentiate overloading and overriding.
3. Demonstrate modular design with packages, interfaces, and abstract classes, and evaluate exception handling.
4. Implement multithreading and synchronization and utilize collections for efficient data management.
5. Design modern Java applications using JavaFX, Spring Boot, and Hibernate/JPA

UNIT-I:

Object Oriented Thinking: Introduction, Need of object-oriented programming, principles of object-oriented languages, Applications of OOP, history of JAVA, Java Virtual Machine, Java features, Program structures, Installation of JDK.

Variables, Primitive data types, Identifiers- Naming Conventions, Keywords, Literals, Operators- Binary, Unary and Ternary, Expressions, Primitive Type conversion and casting, flow of control- branching, conditional, loops.

UNIT-II:

CLASSES, INHERITANCE, POLYMORPHISM:

Classes and Objects: Classes, Objects, creating objects, methods, constructors- constructor overloading, cleaning up unused objects- Garbage collector, class variable and methods- static keyword, this keyword, arrays, Command line arguments, Nested Classes

Strings: String, String Buffer, String Tokenizer

Inheritance and Polymorphism: Types of Inheritance, deriving classes using extends keyword, super keyword, Polymorphism – Method Overloading, Method Overriding, final keyword, abstract classes.

UNIT-III:

INTERFACES, PACKAGES, EXCEPTIONS

Interfaces: Interface, Extending interface, interface Vs Abstract classes.

Packages: Creating Packages, using Packages, Access protection, java I/O package. Exceptions

Introduction, Exception handling Techniques: try…catch, throw, throws, finally block, user defined Exception.

UNIT-IV:

MULTI-THREADING, COLLECTIONS

java.lang.Thread, the main Thread, creation of new Threads, Thread priority, multithreading- using isalive() and join(), Synchronization, suspending and resuming Threads, Communication between Threads. Exploring java.io, Exploring java.util

Collections: Overview of Collection Framework : Array List, LinkedList, Vector, HastSet, Tree Set, HashMap, Hash Table, Tree Map, Iterator, Comparator

UNIT-V:

Introduction to Spring Framework Overview of the Spring ecosystem, concepts of Inversion of Control

(IoC) and Dependency Injection (DI), Spring Boot basics for rapid application development, and building a simple REST API with Spring Boot.
Data Access with Java Introduction to JDBC, an overview of JPA (Java Persistence API), using Hibernate with Spring Data JPA, and creating a simple CRUD application as an example.

Teaching Methodologies:
Power Point Presentations
Tutorial Sheets
Assignments

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

REFERENCE BOOKS:
1. Object Oriented Programming through Java, P.Radha Krishna, Universities Press.
2. Thinking in Java, Bruce Eckel, Pearson Education
3. Programming in Java, S.Malhotra and S.Choudhary, Oxford University Press

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INTRODUCTION TO DBMS
(OPEN ELECTIVE)

Course Code: GR24A3141 **L/T/P/C: 3/0/0/3**

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

1. Demonstrate the concepts of data mining, its applications
2. Apply data preprocessing techniques such as cleaning, integration, transformation, and reduction.
3. Implement clustering algorithms and evaluate their performance using similarity measures
4. Analyze association rules using Apriori and other frequent pattern mining techniques.
5. Examine outlier detection methods and justify their applications in real-world scenarios.

UNIT-I:

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

UNIT-II:

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

UNIT-III:

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

UNIT-IV:

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

UNIT-V:

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

Teaching Methodologies:

Power Point Presentations
Tutorial Sheets
Assignments

TEXT BOOKS:

1. "Data base Management Systems", Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rdEdition
2. "Data base System Concepts", Silberschatz, Korth, McGraw hill, V Edition.

3. “Introduction to Database Systems”, C.J.Date Pearson Education.

REFERENCE BOOKS:

1. “Database Management Systems”, P. Radha Krishna HI-TECH Publications 2005.
2. “Database Management System”, Elmasri Navate, Pearson Education.
3. “Database Management System”, Mathew Leon, Leo

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INTRODUCTION TO DATA MINING

(OPEN ELECTIVE)

Course Code: GR24A4124 **L/T/P/C: 3/0/0/3**

Prerequisites: Students are expected to have knowledge of transactional and relational databases, probability, and statistics.

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

1. Demonstrate the concepts of data mining, its applications
2. Apply data preprocessing techniques such as cleaning, integration, transformation, and reduction.
3. Implement clustering algorithms and evaluate their performance using similarity measures
4. Analyze association rules using Apriori and other frequent pattern mining techniques.
5. Examine outlier detection methods and justify their applications in real-world scenarios.

UNIT-I:

Introduction: Why Data mining, What is Data Mining, What Kinds of Data Can Be Mined, What Kinds of Patterns Can Be Mined, Which Technologies are used, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining.

UNIT-II:

Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction.

UNIT-III:

Association Rule Mining: Introduction to association rule mining. Apriori algorithm and other frequent pattern mining techniques. Measuring the strength of association rules.

UNIT-IV:

Classification: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, k-Nearest-Neighbor Classifiers.

UNIT-V:

Clustering: Introduction to clustering and similarity measures.
Clustering algorithms: k-means, hierarchical clustering, density-based clustering.
Evaluating clustering results: silhouette score, Davies-Bouldin index.

Teaching Methodologies:

Power Point Presentations
Tutorial Sheets
Assignments

TEXT BOOKS:

1. Data Mining Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, Third Edition, 2012.
2. Introduction to Data Mining Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education.

REFERENCE BOOKS:

1. Data Mining Techniques – Arun K. Pujari, Second Edition, Universities Press.

2. Data Warehousing in the Real World, Sam Aanhory and Dennis Murray, Pearson Edn Asian

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INTRODUCTION TO OPERATING SYSTEMS

(OPEN ELECTIVE)

Course Code: GR24A3143 **L/T/P/C: 3/0/0/3**

Prerequisite: Students should have prior knowledge of:

- Basics of Programming, and
- Fundamentals of Data Structures and Algorithms, such as stacks, queues, and linked lists.

Course Outcomes: After completing this course, students will be able to:

1. Explain the objectives, structure, and functions of an operating system, including process, memory, storage, and security management, and demonstrate how OS services interact with users and hardware.
2. Apply process management concepts such as process states, scheduling algorithms, and interprocess communication; design and solve synchronization problems using semaphores, monitors, and classical solutions.
3. Analyze memory management strategies such as paging, segmentation, and swapping, and evaluate virtual memory techniques including demand paging, page replacement, and thrashing control.
4. Implement basic file operations and explain file system structure, directory management, allocation methods, and disk scheduling techniques for efficient storage management.
5. Identify, prevent, and recover from deadlocks; apply system protection principles and access control mechanisms to safeguard resources and files in different operating system environments.

UNIT-I: Introduction:

Overview, Objectives, User view, System view, Operating system definition, Computer System Organization, Computer System Architecture, OS Structure, OS Operations, Process Management, Memory Management, Storage Management, Protection and Security.

Operating System services, User and OS Interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, OS Structure.

UNIT-II: Process and CPU Scheduling:

Process concepts: The Process, Process State, Process Control Block, Threads, Process Scheduling-Scheduling Queues, Schedulers, Context Switch, Operations on Processes, System calls-fork(), exec(), wait(), exit(), Interprocess communication.

Process Scheduling: Basic concepts, Scheduling Criteria, Scheduling algorithms, Multiple- Processor Scheduling, Real-Time Scheduling, Thread scheduling. Process Synchronization, Critical Section Problem, Peterson's solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.

UNIT-III: Memory Management and Virtual Memory:

Memory Management Strategies - Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table.

Virtual Memory Management - Background, Demand Paging, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing.

UNIT-IV: Storage Management and File System:

Storage Management - File System, Concept of a File, System calls for File Operations – open (), read (), write (), close (), seek (), unlink (), Access methods - Directory and Disk Structure, File System Mounting, File Sharing, Protection.

File System Structure, File System Implementation, Directory Implementation, Allocation methods, Free-space Management, Efficiency, and Performance. Mass Storage Structure – Overview, Disk Structure, Disk Attachment, Disk Scheduling.

UNIT-V: Deadlocks and Protection:

Deadlocks - System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Protection – System Protection, Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Access Control, Revocation of Access Rights, Capability-based Systems, Language-based Protection.

TEXT BOOKS:

1. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, PHI, 2019.
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, 7th Edition, Wiley, 2006.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum, Modern Operating Systems, 5th Edition, PHI, 2022.
2. Gary J. Nutt, Operating Systems: A Modern Perspective, 3rd Edition, Addison-Wesley, 2004.
3. R. Elmasri, A.G. Carrick, D. Levine, Operating Systems, First Edition, McGraw Hill, 2009.
4. Charles Crowley, Operating System: A Design-oriented Approach, Irwin Publishing, First Edition, 1996.

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INTERNET OF THINGS

(OPEN ELECTIVE)

Course Code: GR24A3145 **L/T/P/C: 3/0/0/3**

Prerequisite:

The fundamental knowledge in C programming, Data Structures and Operating Systems

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

1. Understand IoT architecture and fundamental networking protocols and models.
2. Develop Arduino-based IoT applications integrating sensors and actuators.
3. Program Raspberry Pi using Python for cloud-connected IoT solutions.
4. Analyse various IoT applications including smart home and industrial systems.
5. Apply cloud and edge computing for IoT data analytics.

UNIT-I:

Introduction to IoT and Sensor Networks: Introduction to Internet of Things (IoT), Characteristics and Applications of IoT, IoT Architecture and Reference Models(IETF, ITU-T), Physical Design of IoT- Devices, Gateways, and Data Centers, Functional Blocks of IoT- Sensing, Actuation, Communication, Enabling Technologies: RFID, Wireless Sensor Networks.

Networking and Communication Protocols: MQTT, CoAP, ZigBee, HTTP Sensor Networks- Types, Topologies, and Protocols, Introduction to IoT Security and Privacy Fundamentals.

UNIT-II:

Machine to Machine (M2M) and Embedded Programming for IoT: Machine-to-Machine Communications Overview, Difference between IoT and M2M, Interoperability in IoT, Standards and Protocols.

Arduino: Introduction to Arduino Programming for IoT, Integration of Sensors and Actuators with Arduino, Hands-on Exercises- Sensor Data Acquisition and Actuator Control, Basic Communication Protocols, Implementation on Arduino-IoT Device Interoperability, Challenges and Solutions.

UNIT-III:

Raspberry Pi with Python Programming for IoT: Introduction to Python Programming , Basics, Overview of Raspberry Pi and its Role in IoT, Interfacing Raspberry Pi with Sensors and Actuators (UART, SPI, I2C).

Data Acquisition and Processing: Data Acquisition and Local Processing, Sending Data to Cloud Platforms, Implementation of IoT Projects Using Raspberry Pi.

Case Studies: Smart Home Automation, Healthcare Monitoring, Environmental Sensing.

UNIT-IV:

IoT Applications: Smart Homes-Smart Home Origin, Technologies, Implementation,

Smart Grids- Characteristics, Benefits, Architecture, Components, Smart Cities-Characteristics, Frameworks, Challenges, Industrial IoT-Requirements, Design Considerations, Applications.

UNIT-V:

Cloud and Edge Computing Models with IoT Use Cases: Introduction to Cloud Computing and Cloud Storage Models, Edge and Fog Computing Concepts for IoT, Web Servers and Cloud Platforms for IoT (AWS IoT, Azure IoT, etc.).

IoT Use Cases: Smart Cities, Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT

TEXT BOOKS:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”, 2015.
3. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan. Trollope, David Hanes, Patrick Gassetete, Jerome Henry, Pearson Education Limted, 2017.

REFERENCE BOOKS:

1. Terokarvinen, kemo, karvinen and villeyvaltokari, “Make sensors”: 1st edition, Maker Media, 2014.
2. Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice, 2010.
3. Charles Bell, Beginning Sensor networks with Arduino and Raspberry Pi, Apress, 2013.
4. Fei Hu, Security and Privacy in Internet of Things (IoTs), CRC Press, Taylor & Francis Group, 2020.
5. S. Sahoo, S. Sahoo, S. Mishra, Software-Defined Networking for Future Internet Technology: Concepts and Applications, Routledge, 2022.

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SCRIPTING LANGUAGES

(OPEN ELECTIVE)

Course Code: GR24A4134 **L/T/P/C: 3/0/0/3**

Prerequisites: Basic knowledge of programming concepts (loops, functions, arrays) and fundamentals of databases.

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

1. Understand PHP basics including variables, constants, control structures, arrays, and functions for web application development.
2. Apply MySQL database concepts with PHP to design, query, and manage relational databases securely.
3. Implement advanced PHP features such as authentication, file upload, email handling, and encryption in dynamic websites.
4. Design and develop Perl programs using arrays, hashes, subroutines, and advanced features like file system interaction, modules, and object-oriented constructs.
5. Apply Python programming concepts including functions, built-in modules, exception handling, and OOP paradigms for web and general-purpose scripting.

UNIT-I: PHP Basics:

Basics - Features, Data types, Variables, Constants, Expressions, String interpolation, Control structures, Embedding PHP Code in Web pages.

Functions: Creating a Function, Function Libraries, Arrays, Strings and Regular Expressions.

UNIT-II: MySQL Basics:

Introduction: Database Concepts, Overview of MySQL database, Installation. Connection establishment and Accessing MySQL Server, Querying the database. Data Definition Language. Functions and Logical operators, Access Privilege System.

UNIT-III: Advanced PHP Programming:

PHP and Web Forms, Files, PHP Authentication and Methodologies - File-based, Database-based, IP-based. Uploading Files with PHP, Sending Email, PHP Encryption Functions, Mcrypt package.

UNIT-IV: PERL:

Names and Values, Variables, Scalar Expressions, Control Structures, Arrays, List, Hashes, Strings, Pattern and Regular Expressions, Subroutines.

Advanced PERL: Finer points of Looping, Pack and unpack, File system, Data structures, Packages, Modules, Objects, Interfacing to the Operating System.

UNIT-V: Python:

Introduction, Syntax and Indentation, Statements, Functions, Built-in-Functions, Basics of Object-Oriented Paradigm, Modules and Packages, Exception Handling.

TEXT BOOKS:

1. David Barron, The World of Scripting Languages, Wiley India Pvt. Ltd., 1st Edition, 2003.
2. Jason Gilmore, Beginning PHP and MySQL, From Novice to Professional, Apress (Dreamtech India), 3rd Edition, 2008.
3. Steve Holden and David Beazley, Python Web Programming, New Riders Publications, 1st Edition, 2001.

REFERENCE BOOKS:

1. James Lee and Brent Ware, Open Source Web Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP, Addison-Wesley (Pearson Education), 1st Edition, 2003.
2. Julie Meloni and Matt Telles, PHP 6 Fast & Easy Web Development, Cengage Learning, 1st Edition, 2008.
3. Ivan Bayross and Sharanam Shah, PHP 5.1, The X Team, SPD Publications, 1st Edition, 2006.