# Academic Regulations
# Programme Structure
# and
# Detailed Syllabus

## Bachelor of Technology (B.Tech)
## in
## COMPUTER SCIENCE AND ENGINEERING
## ( DATA SCIENCE )

(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 themerit 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 $\geq 5$).
**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:**

<table>
<tr><th>S.No</th><th>Component of Assessment</th><th>Marks Allotted</th><th>Type of Assessment</th><th>Scheme of Examinations</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Theory</td><td>40</td><td>Internal Examination & Continuous Evaluation</td><td>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<br>i) Subjective – 20 marks<br>ii) Objective – 10 marks<br>2) Continuous Evaluation is for each unit using<br>i) Assignment – 05 marks<br>ii) Quiz / Subject Viva- voce / PPT / Poster Presentation / Case Study on a topic in the concerned subject – 05 marks</td></tr>
<tr><td>60</td><td>Semester end examination</td><td>The semester-end examination is for a duration of 3 hours</td></tr>
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| | | | | |
|---|---|---|---|---|
| 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.<br>**i) Internal Exam-10 marks**<br>**ii) Viva voce – 10 marks**<br>**iii) Continuous Assessment-10 marks**<br>**iv) G-Lab on Board(G-LOB) (Case study inter threading of all experiments of lab) / Laboratory Project / Prototype Presentation / App Development -10 marks** |
| | | 60 | Semester end examination | The semester-end examination is for a duration of 3 hours.<br>**i) write-up (algorithm / flowchart / procedure) as per the task / experiment / program - 10 marks**<br>**ii) task/experiment/program-15 marks**<br>**iii) evaluation of results -15 marks**<br>**iv) write-up (algorithm / flowchart / procedure) for another task / experiment / program- 10 marks**<br>**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<br>2) Day-to-Day activity -15 marks<br>3) Continuous Evaluation using<br>• **Assignment – 05 marks**<br>**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<br>**i) Continuous Assessment – 15 marks**<br>• Abstract Presentation - 3 marks<br>• Architectural Design Presentation - 3 marks<br>• Modules Presentation - 3 marks<br>• Execution Cycle 1 Presentation - 3 marks<br>• Execution Cycle 2 Presentation - 3 marks<br>**ii) Report – 5 marks**<br>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**.<br>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<br>**i) Continuous Assessment – 15 marks**<br>• Abstract Presentation - 3 marks<br>• Architectural Design Presentation - 3 marks<br>• Modules Presentation - 3 marks<br>• Execution Cycle 1 Presentation - 3 marks<br>• Execution Cycle 2 Presentation – 3 marks<br>**ii) Report – 5 marks**<br>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**.<br>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 to Second year first semester | **(i)** Regular course of study of First year second semester.<br>**(ii)** Must have secured at least 50% credits up to First year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 3 | Second year first semester to Second year second semester | Regular course of study of Second year first semester. |
| 4 | Second year second semester to Third year first semester | **(i)** Regular course of study of Second year second semester<br>**(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.<br>**(ii)** Must have secured at least 60% credits upto Third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 7 | Fourth year first semester to Fourth year second semester | Regular course of study of Fourth year first semester. |

**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)** **$S_k$** 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 **$S_k$**, where **$k \geq 2$**.

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

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

**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.<br>(ii) Must have secured at least 50% credits up to Second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not. |
| 3 | Third year first semester to Third year second semester. | Regular course of study of Third year first semester. |
| 4 | Third year second semester to Fourth year first semester. | (i) Regular course of study of Third year second semester.<br>(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 | Regular course of study of Fourth year |

| | | |
|---|---|---|
| | Fourth year second semester. | first semester. |

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

| S. No | Class Awarded | CGPA Secured |
|---|---|---|
| 1 | First Class with Distinction | CGPA >= 8.00 with no F or below grade/ detention anytime during the Programme |
| 2 | First Class | CGPA >= 8.00 with rest of the clauses of S.no 1 not satisfied |
| 3 | First Class | CGPA $\geq$ 7.00 and CGPA <8.00 |
| 4 | Second Class | CGPA $\geq$ 6.00 and CGPA <7.00 |
| 5 | Pass Class | CGPA $\geq$ 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. Ph: (040)65864440**

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

## B.Tech – CSE (DS) - GR24 Course Structure

## I B. Tech-CSE (DS) - I Semester

| S.No | BOS | Group | Course Code | Course Name | L | T | P | Credits | Int. | Ext. | 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 | ME | ES | GR24A1007 | Fundamentals of Electrical Engineering | 2 | 1 | 0 | 3 | 40 | 60 | 100 |
| 4 | CSE | ES | GR24A1006 | Programming for Problem Solving | 2 | 0 | 0 | 2 | 40 | 60 | 100 |
| 5 | Chemistry | BS | GR24A1019 | Engineering Chemistry Lab | 0 | 0 | 3 | 1.5 | 40 | 60 | 100 |
| 6 | EEE | ES | GR24A1023 | Fundamentals of Electrical Engineering Lab | 0 | 0 | 2 | 1 | 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 | CSE | ES | GR24A1009 | Elements of Computer Science and Engineering | 1 | 0 | 0 | 1 | 50 | -- | 50 |
| **TOTAL** | | | | | **12** | **3** | **11** | **20.5** | **370** | **480** | **850** |
| 10 | MGMT | MC | GR24A1028 | Design Thinking | 2 | 0 | 0 | 0 | 50 | -- | 50 |

**I B. Tech-CSE (DS) – II Semester**

| S.No | BOS | Group | Course Code | Course Name | L | T | P | Credits | Int. | Ext. | 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 | ME | ES | GR24A1016 | Graphics for Engineers | 1 | 0 | 4 | 3 | 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 | CSE | ES | GR24A1027 | Python Programming | 1 | 0 | 0 | 1 | 50 | -- | 50 |
| **TOTAL** | | | | | **12** | **2** | **11** | **19.5** | **370** | **480** | **850** |

**II B.Tech CSE (DS) – I Semester**

| S.No | BOS | Group | Course Code | Course Name | L | T | P | Credits | Int. | Ext. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CSE (DS) | PC | GR24A2084 | Data Science | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | CSE | PC | GR24A2071 | Java Programming | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 3 | MGMT | HS | GR24A2004 | Economics and Accounting for Engineers | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | CSE | PC | GR24A2077 | Discrete Mathematics | 2 | 1 | 0 | 3 | 40 | 60 | 100 |
| 5 | CSE | PC | GR24A2072 | Database Management Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | CSE (DS) | PC | GR24A2085 | Data Science Lab | 0 | 0 | 3 | 1.5 | 40 | 60 | 100 |
| 7 | CSE | PC | GR24A2073 | Java Programming Lab | 0 | 0 | 4 | 2 | 40 | 60 | 100 |
| 8 | CSE | PC | GR24A2074 | Database Management Systems Lab | 0 | 0 | 3 | 1.5 | 40 | 60 | 100 |
| **TOTAL** | | | | | **14** | **1** | **10** | **20** | **320** | **480** | **800** |
| 9 | MGMT | MC | GR24A2002 | Value Ethics and Gender Culture | 2 | 0 | 0 | 0 | 50 | -- | 50 |

## II B. Tech – CSE (DS) - II Semester

| S.No | BOS | Group | Course Code | Course Name | L | T | P | Total | Int. | Ext | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CSE | PC | GR24A2075 | Computer Organization | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | CSE | PC | GR24A2076 | Operating Systems | 2 | 1 | 0 | 3 | 40 | 60 | 100 |
| 3 | CSE | PC | GR24A2079 | Design and Analysis of Algorithms | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | CSE | PC | GR24A2078 | Full Stack Web Development | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | MATHS | BS | GR24A2006 | Applied Statistics for Engineers | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | CSE | PC | GR24A2080 | Full Stack Web Development Lab | 0 | 0 | 3 | 1.5 | 40 | 60 | 100 |
| 7 | CSE | PC | GR24A2081 | Operating Systems Lab | 0 | 0 | 3 | 1.5 | 40 | 60 | 100 |
| 8 | CSE (DS) | PC | GR24A2106 | Real-time Research Project / Societal Related Project | 0 | 0 | 4 | 2 | 50 | -- | 50 |
| | **TOTAL** | | | | **14** | **1** | **10** | **20** | **330** | **420** | **750** |
| 9 | HS | MC | GR24A2001 | Environmental Science | 2 | 0 | 0 | 0 | 50 | -- | 50 |

## III B. Tech CSE (DS) – I Semester

| S.No | BOS | Group | Course Code | Course Name | L | T | P | Credits | Int | Ext | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CSE | PC | GR24A3087 | Computer Networks | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | CSE (AIML) | PC | GR24A3129 | Data Warehousing and Data Mining | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 3 | CSE (DS) | PC | GR24A3138 | Data Visualization | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | | PE | | Professional Elective-I | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | | OE | | Open Elective-I | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | CSE (AIML) | PC | GR24A3134 | Data Warehousing and Data mining Lab | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 7 | CSE | PC | GR24A3094 | Computer Networks Lab | 0 | 0 | 3 | 1.5 | 40 | 60 | 100 |
| 8 | CSE (DS) | PC | GR24A3144 | Data Visualization Lab | 0 | 0 | 3 | 1.5 | 40 | 60 | 100 |
| 9 | English | PC | GR24A3013 | Advanced English Communication Skills Lab | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| **TOTAL** | | | | | **15** | **0** | **10** | **20** | **360** | **540** | **900** |
| 10 | MGMT | MC | GR24A2003 | Constitution of India | 2 | 0 | 0 | 0 | 50 | -- | 50 |

| PROFESSIONAL ELECTIVE – I | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | CSE (AIML) | PE | GR24A3130 | Artificial Intelligence |
| 2 | CSE | PE | GR24A3099 | Cloud Computing |
| 3 | CSE | PE | GR24A3100 | Mobile Application Development |
| 4 | CSE | PE | GR24A3089 | Graph Theory |

## III B. Tech CSE (DS) – II Semester

| S. No. | BOS | Group | Course Code | Course Name | L | T | P | Credits | Int. | Ext. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CSE (AIML) | PC | GR24A3082 | Machine Learning | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | CSE | PC | GR24A3096 | Automata and Compiler Design | 2 | 1 | 0 | 3 | 40 | 60 | 100 |
| 3 | CSE(DS) | PC | GR24A3137 | Big Data Analytics | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | | PE | | Professional Elective-II | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | | OE | | Open Elective-II | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | CSE (AIML) | PC | GR24A3093 | Machine Learning Lab | 0 | 0 | 3 | 1.5 | 40 | 60 | 100 |
| 7 | CSE (DS) | PC | GR24A3142 | Big Data Analytics Lab | 0 | 0 | 3 | 1.5 | 40 | 60 | 100 |
| 8 | CSE(DS) | 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** | **Group** | **Course Code** | **Course** |
| 1 | CSE | PE | GR24A3098 | Software Engineering |
| 2 | CSE (DS) | PE | GR24A3139 | Information Retrieval Systems |
| 3 | CSE | PE | GR24A3097 | DevOps |
| 4 | CSE | PE | GR24A3140 | Blockchain Technology |

## IV B. Tech CSE (DS) – I Semester

| S.No. | BOS | Group | Course Code | Course Name | L | T | P | Credits | Int. | Ext. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CSE(DS) | PC | GR24A4104 | Business Intelligence | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | CSE (AIML) | PC | GR24A3101 | Neural Networks and Deep Learning | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 3 | | PE | | Professional Elective-III | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | | PE | | Professional Elective-IV | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5 | | OE | | Open Elective- III | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 6 | CSE(DS) | PC | GR24A4135 | Business Intelligence Lab | 0 | 0 | 4 | 2 | 40 | 60 | 100 |
| 7 | CSE (AIML) | PC | GR24A4126 | Deep Learning Lab | 0 | 0 | 4 | 2 | 40 | 60 | 100 |
| 8 | CSE(DS) | PW | GR24A4016 | Project Work- Phase I | 0 | 0 | 12 | 6 | 40 | 60 | 100 |
| **Total** | | | | | **15** | **0** | **20** | **25** | **320** | **480** | **800** |

| PROFESSIONAL ELECTIVE – III | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | CSE | PE | GR24A4089 | Cryptography and Network Security |
| 2 | CSE (DS) | PE | GR24A4131 | Computer Vision and Robotics |
| 3 | CSE (AIML) | PE | GR24A3125 | Natural Language Processing |
| 4 | CSE (DS) | PE | GR24A4132 | Semantic Web |

| PROFESSIONAL ELECTIVE – IV | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | CSE (DS) | PE | GR24A4133 | Information Storage and Management |
| 2 | CSE | PE | GR24A3090 | Principles of Programing Languages |
| 3 | CSE | PE | GR24A4103 | Design Patterns |
| 4 | CSE | PE | GR24A4095 | Software Testing Methodologies |

## IV B. Tech CSE (DS) – II Semester

| S.No. | BOS | Group | Course Code | Course Name | L | T | P | Total | Int. | Ext. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Mgmt | HS | GR24A4069 | Fundamentals of Management and Entrepreneurship | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 2 | | PE | | Professional Elective-V | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 3 | | PE | | Professional Elective-VI | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 4 | CSE (DS) | PW | GR24A4026 | Project Work-Phase II | 0 | 0 | 12 | 6 | 40 | 60 | 100 |
| **Total** | | | | | **9** | **0** | **12** | **15** | **160** | **240** | **400** |

| PROFESSIONAL ELECTIVE – V | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | CSE | PE | GR24A4098 | Real Time Operating Systems |
| 2 | CSE | PE | GR24A4099 | Cyber Security |
| 3 | CSE (AIML) | PE | GR24A3091 | Quantum Computing |
| 4 | CSE (AIML) | PE | GR24A4100 | Robotic Process Automation |

| PROFESSIONAL ELECTIVE – VI | | | | |
|---|---|---|---|---|
| **S. No.** | **BOS** | **Group** | **Course Code** | **Course** |
| 1 | CSE | PE | GR24A4101 | Distributed Systems |
| 2 | CSE | PE | GR24A4091 | Image and Video Processing |
| 3 | CSE (AIML) | PE | GR24A4130 | Introduction to Drones |
| 4 | CSE | PE | GR24A4105 | Software Process and Project Management |

## PROFESSIONAL ELECTIVES – 4 THREADS

| S. No. | Theory and Algorithms | Applications | Data Science and Machine Intelligence | Software and Technology |
|---|---|---|---|---|
| 1 | Artificial Intelligence | Mobile Application Development | Graph Theory | Cloud Computing |
| 2 | DevOps | Software Engineering | Information Retrieval Systems | Blockchain Technology |
| 3 | Natural Language Processing | Cryptography and Network Security | Computer Vision and Robotics | Semantic Web |
| 4 | Information Storage and Management | Principles of Programming Languages | Design Patterns | Software Testing Methodologies |
| 5 | Real Time Operating Systems | Cyber Security | Quantum Computing | Robotic Process Automation |
| 6 | Distributed Systems | Image and Video Processing | Introduction to Drones | Software Process and Project Management |

**OPEN ELECTIVES FOR GR24 REGULATIONS:**

| THREAD 1 | THREAD 2 | OFFERED BY |
|---|---|---|
| 1. Human Resource Development and Organizational Behavior<br>2. Cyber Law and Ethics<br>3. Economic Policies in India<br>4. Indian knowledge system<br>5. Personality Development through Life Enlightenment skills | Engineering Materials for Sustainability | **CE** |
| | Geographic Information Systems and Science | |
| | Plumbing (Water and Sanitation) | |
| | Non-Conventional Energy Sources | **EEE** |
| | Concepts of Control Systems | |
| | Artificial Neural Networks and Fuzzy Logic | |
| | Industrial Automation and Control | **ME** |
| | Operations Research | |
| | Composite Materials | |
| | Digital Electronics for Engineering | **ECE** |
| | Sensor Technology | |
| | Communication Technologies | |
| | Data Science for Engineers | **CSE** |
| | Data Analytics using open-source tools | |
| | Augmented Reality and Virtual Reality | |
| | Services Science and Service Operational Management | **CSBS** |
| | IT Project Management | |
| | Marketing Research and Marketing Management | |
| | Basics for java programming | **CSE (AIML)** |
| | Introduction to DBMS | |
| | Introduction to Data Mining | |
| | Introduction to Operating System | **CSE (DS)** |
| | Internet of Things | |
| | Scripting Languages | |

# I Year
# I Semester

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**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**
At the end of the course, the student will be able to
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-1**
**Fundamentals of Vector and Matrix algebra**
Operations on vectors and matrices- Orthogonal projection of vectors- Exact and generalized inverse of a matrix- Rank of a matrix- Linear independence of vectors- Structured square matrices (Symmetric, Hermitian, skew-symmetric, skew-Hermitian, orthogonal and unitary matrices)- Vector and matrix norms
Solution of a linear algebraic system of equations (homogeneous and non-homogeneous) using Gauss elimination

**UNIT-II**
**Matrix eigenvalue problem and Quadratic forms**
Determination of eigenvalues and eigenvectors of a matrix, properties of eigenvalues and eigenvectors (without proof)- Similarity of matrices- Diagonalization of a matrix- Orthogonal diagonalization of a symmetric matrix- Definiteness of a symmetric matrix
Quadratic Forms- Definiteness and nature of a quadratic form- Reduction of a quadratic form to the canonical form using an orthogonal transformation

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

**UNIT-IV**

**Function approximation tools in engineering**

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

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

**UNIT-V**

**Multivariable differential calculus and Function optimization**

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

**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

**Reference Books:**

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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**ENGINEERING CHEMISTRY**
**(COMMON TO CSE, ECE, EEE, CE, ME, CSE(DS), CSE(AIML))**

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

## Course Outcomes

After completion of the course, the student should be able to

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


**Reference Books:**


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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**FUNDAMENTALS OF ELECTRICAL ENGINEERING**
**(CSE, CSE(AIML), CSE(DS) and ECE)**

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

## COURSE OUTCOMES

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

## UNIT I
## NETWORK ELEMENTS & LAWS

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

## UNIT II
## NETWORK THEOREMS

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

## UNIT III
## AC CIRCUITS

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

## UNIT IV
## BASICS OF ELECTRICAL MACHINES

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

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

**UNIT V**

**ELECTRICAL INSTALLATIONS**

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

**TEXTBOOKS**


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


**REFERENCES**


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

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

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

**Course Outcomes**

1. Design algorithms and flowcharts for problem solving and illustrate the 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 withinstructures, array of structures, nested structures, passing structures to functions, unions, typedef.

**UNIT V File handling and Preprocessor in C:**

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

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

**Teaching methodologies:**

- Power Point Presentations
- Tutorial Sheets
- Assignments

**TEXT BOOKS**


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


**REFERENCE BOOKS**


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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**ENGINEERING CHEMISTRY LAB**

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

**I year I Semester**

## Course Outcomes

The experiments will make the student gain skills on:

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.

## Reference Books


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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**FUNDAMENTALS OF ELECTRICAL ENGINEERING LAB**
**(CSE, CSE (AIML), CSE (DS) and ECE)**

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

## COURSE OUTCOMES

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

## LIST OF EXPERIMENTS

**Any ten experiments should be conducted.**

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

## TEXTBOOKS


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


## REFERENCES


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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**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 using basics of C language.
2. Develop programs by choosing appropriate control structures.
3. Select and apply the concept of arrays and strings for problem solving.
4. Demonstrate problem solving using modular programming and pointers.
5. Solve the problems using structures, files and pre-processor directives.

**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:
b. Using third variable
c. Without using third variable
d. Using bitwise operators
e. Write a C program to do the following using implicit and explicit type conversion
f. Convert Celsius temperature to Fahrenheit
g. Convert Fahrenheit temperature to Celsius
h. Find area of a triangle given sides a,b,c

**TASK 3**

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

**TASK 4**

a. Write a C program to find the roots of a quadratic equation using if-else.
b. Write a C program to input electricity unit charges and calculate total electricity bill according to the given condition:

For first 50 units Rs. 0.50/unit For next 100 units Rs. 0.75/unit For next 100 units Rs. 1.20/unit For unit above 250 Rs. 1.50/unit An additional surcharge of 20% is added to the bill

c. Write a menu driven C program to implement a simple arithmetic calculator.
d. Write a C program to display number of days in month using switch case (The input is month number 1 -12).

**TASK 5**

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

.

**TASK 6**

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

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

b. Write a C program to generate the prime numbers between x and y where x and y arestarting and ending values to be supplied by the user.

c. Write a C program to calculate the sum of following series:(i) $S1=1+x/1!-x^2/2!+x^3/3!-x^4/4!+\ldots..xn/n!$

(ii) $S2= x^1/1+x^3/3+x^5/5+\ldots.+x^n/n$

**TASK 7**

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

**TASK 8**

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

**TASK 9**

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

**TASK 10**

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

**TASK 11**

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

**TASK 12**

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

**TASK 13**

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

**TASK 14**

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

**TASK 15**

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

**TEXT BOOKS**

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

**REFERENCE BOOKS**

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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**ENGINEERING WORKSHOP**

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

**I B.Tech 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**

**Text Books**

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

**Reference Books**

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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**ELEMENTS OF COMPUTER SCIENCE AND ENGINEERING**

**Course Code: GR24A1009** **L/T/P/C:1/0/0/1**

**I Year I Semester**

**Course Outcomes**

1. Interpret the working principles of functional units of a basic Computer.
2. Analyze steps in program development and types of operating systems.
3. Identify the significance of database systems and computer networks.
4. Develop applications using MS-Word and MS-Excel .
5. Design presentations using MS-PowerPoint and develop web pages using web designing tools.

## UNIT – I

**Basics of a Computer** – Characteristics of computer, Generations, classification, Hardware - Components of CPU, Memory – hierarchy, types of memory, Input and output devices. Software – systems software, application software, packages, frameworks, IDEs.

## UNIT – II

**Software development** – Waterfall model, Agile, Types of computer languages – Programming, markup, scripting, Program Development – steps in program development, flowcharts, algorithms.

**Operating systems:** Functions of operating systems, types of operating systems, Examples of OS- MS-DOS, Windows, Linux, Installation and formatting of Windows OS.

## UNIT – III

**Database Management Systems**: Database Vs File System, Database applications, types of DBMS, Database users, SQL – Types of SQL commands.

**Computer Networks:** Advantages of computer networks, LAN, WAN, MAN, internet, WiFi, 5G communications – evolution, key technologies.

## UNIT – IV

**MS-Word:** Introduction, MS-Word screen and its components- Office button—New, open, save, save as, print, close, Ribbon—Home, Insert, Page layout, References, Review, View. Example Applications - Resume preparation, Magazine Cover, Mail merge.

**MS-Excel:** Basics of Spreadsheet, MS-Excel screen and its components, Office button, Ribbon- Home, Insert, Page Layout, Formulas, Data, Review, View. Example Application- Employee Salary calculation.

## UNIT – V

**MS-PowerPoint:** MS-PowerPoint screen and its components, Office button, Ribbon- Home, Insert, Design, Animations, Slideshow, Review, View. Example - Design a “Happy Birthday” card.

**World Wide Web**: Basics, role of HTML, CSS, XML, Tools for web designing, Social media.

**Teaching methodologies:**

- Power Point Presentations
- Tutorial Sheets
- Assignments

## TEXT BOOKS


1. Computer Fundamentals, Anita Goel, Pearson Education India, 2010.
2. Invitation to Computer Science, G. Michael Schneider, Macalester College, Judith L. Gersting University of Hawaii, Hilo, Contributing author: Keith Miller University of Illinois, Springfield.


## REFERENCE BOOKS


1. Introduction to computers, Peter Norton, 8th Edition, Tata McGraw Hill.
2. Elements of computer science, Cengage.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DESIGN THINKING**

**Course Code: GR241028** **L/T/P/C: 2/0/0/0**
**I Year I Semester**

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

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


**REFERENCE BOOKS**


1. Emotionally Durable Design: Objects, Experiences and Empathy, Jonathan Chapman, 2nd Edition, Routledge, ISBN: 978-0415732161, 2015
2. Innovation Design: How Any Organization Can Leverage Design Thinking to Produce Change, Drive New Ideas, and Deliver Meaningful Solutions, Thomas Lockwood, Edgar Papke, New Page Books, ISBN: 978-1632651167, 2017
3. Design Thinking Business Analysis: Business Concept Mapping Applied, Thomas Frisendal, Springer, ISBN: 978-3642434822, 2012
4. Chapter 1: A Simple Framework for Leading Innovation, The Three Box Solution, HBR Press, 2016
5. Design a Better Business: New Tools, Skills and Mindset for Strategy and Innovation, Patrick Van Der Pijl, Justin Lokitz, Lisa Kay Solomon, Erik van der Pluijm, Maarten van Lieshout, Wiley, ISBN: 978-8126565085, 2016

# I Year
# II Semester

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

# DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

(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:** After learning the contents of this paper, the student must be able to

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

## UNIT-I ORDINARY DIFFERENTIAL EQUATIONS OF THE FIRST ORDER

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

## UNIT-II ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

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

## UNIT-III MULTIPLE INTEGRALS

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

## UNIT-IV VECTOR DIFFERENTIATION AND LINE INTEGRATION

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

## UNIT-V SURFACE INTEGRATION AND VECTOR INTEGRAL THEOREMS

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

**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**
**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.

**Text books:**


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


**References:**


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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**ENGLISH**
**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:**
Students will be able to

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

**UNIT – I**
Chapter entitled 'Toasted English' by R.K.Narayan from "English: Language, Context and Culture" published by Orient BlackSwan, Hyderabad.

**Vocabulary**: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance withPrefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms
**Grammar**: Identifying Common Errors in Writing with Reference to Articles and Prepositions.
**Reading**: Reading and Its Importance- Techniques for Effective Reading.
**Writing**: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structuresand Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

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

**Vocabulary**: Words Often Misspelt - Homophones, Homonyms and Homographs
**Grammar**: Identifying Common Errors in Writing with Reference to Noun- pronoun Agreement and Subject-verb Agreement.
**Reading**: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice **Writing**: Nature and Style of Writing- Defining /Describing People, Objects, Places and **Events**– Classifying- Providing Examples or Evidence.

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

**Vocabulary:** Words Often Confused - Words from Foreign Languages and their Use in English.
**Grammar:** Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
**Reading:** Sub-Skills of Reading – Intensive Reading and Extensive Reading Exercises for Practice.
**Writing:** Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter ofRequisition, Email Etiquette, Job Application with CV/Resume.

**UNIT – IV**
Chapter entitled 'Art and Literature' by Abdul Kalam from "English: Language, Context and Culture" published by Orient Black Swan, 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 not covered in the previous units)
**Reading:** Reading Comprehension-Exercises for Practice
**Writing:** Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

**Note**: Listening and Speaking Skills which are given under Unit-6 in AICTE Model Curriculum are 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.

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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DATA STRUCTURES**

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

**I Year II Semester**

**Course Outcomes:**

1. Implement various sorting techniques and analyze the computational complexity ofalgorithms.
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 of a linked list in memory, operations-insertion, deletion, display, search.

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

**UNIT IV**

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

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

**UNIT V**

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

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

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

**Teaching methodologies:**

- Power Point Presentations
- Tutorial Sheets
- Assignments

**TEXT BOOKS**

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

**REFERENCE BOOKS**

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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**GRAPHICS FOR ENGINEERS**

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

**I Year II Semester**

**Course Outcomes**

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

**UNIT I**

**Introduction to AutoCAD software:** user interface, tool bar -draw, modify, dimension, layers, setting drawing area, status bar, print setup, generation of two-dimensional drawings.

**Construction of Engineering Curves**- Ellipse, Parabola and Hyperbola -general method only.

**UNIT II**

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

**UNIT III**

**Projections of planes -** definition and types of regular plane figures like triangle, square, pentagon, hexagon, and circle; projections of planes -inclined to one reference plane only.

**Projections of solids -** definition and types of right regular solids objects like prism, cylinder, pyramid, and cone; projections of solids -axis inclined to one reference plane only.

**UNIT IV**

**Sections of solids**- Section and sectional views of right regular solids like Prism, Cylinder, Pyramid and Cone – Auxiliary Views.

**Development of surfaces**- Development of surfaces of Right Regular Solids like Prism, Pyramid, Cylinder and Cone.

**UNIT V**

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

**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.

**Reference Books:**


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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**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**
**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.
(1) create, (2) insert, (3) delete, (4) search and (5) display

**TASK 7**

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

**TASK 8**

a. Write a C program to implement Double Linked List operations – create, insert, 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 (1) create (2) insert, (3) search (4) delete

**TASK 11**

a. Implement the following operations on Binary Search Tree (1) count-nodes, (2) height (3) minimum node and (4) 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: (1) insert, (2) delete (3) search, (4) display

**TEXT BOOKS**

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

**REFERENCE BOOKS**

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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

## ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

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

**Subject Code: GR24A1020** **L/T/P/C: 0/0/2/1**
**I year II Semester**

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

**English Language and Communication Skills Lab (ELCS) shall have two parts:**
a. Computer Assisted Language Learning (CALL) Lab
b. Interactive Communication Skills (ICS) Lab

**Exercise I CALL Lab:**
**Understand:** Introduction to Phonetics – Speech Sounds – Consonant and Vowel Sounds.
**Practice:** Introduction to Phonetics – Speech Sounds – Vowels and Consonants.

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

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

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

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

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

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

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

# GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
# PYTHON PROGRAMMING

**Course Code: GR24A1027** **L/T/P/C: 1/0/0/1**

**I Year II Semester**

**Course Outcomes:**

1. Demonstrate the fundamental concepts and flow control in Python
2. Implement different sequence types and file handling operations.
3. Design python programs using functions and exception handling mechanisms.
4. Develop programs with object oriented programming features and modules.
5. Design GUI based applications using Tkinter.

## UNIT I

**Introduction:** features of Python-Interactive execution, comments, types, variables, operators, expressions, Statements-assignment, input, print.

**Control flow**: if, if-else, if-elif-else Statements, Nested Decision Structures, Loops- while loop, for loop, Nested Loops, break, continue, pass statement.

## UNIT II

**Sequences**: Strings, Lists and Tuples-basic operations and functions, iterating over sequences, Sets and Dictionaries- operations and functions, Python program examples. **Files**-operations-opening, reading, writing, closing, file positions.

## UNIT III

**Exceptions**: raising and handling exceptions, try/except statements, finally clause, standard exceptions, custom exceptions.

**Functions**: definition, call, scope and lifetime of variables, keyword arguments, default parameter values, variable length arguments, recursive functions, Lambda function.

## UNIT IV

**Modules:** Modules, Standard Modules, Importing Modules, Namespaces and Packages. **Object Oriented Programming**: Classes, constructors, objects, class variables, class methods, static methods, operator overloading. Inheritance-is-a relationship, composition, polymorphism, overriding, multiple inheritance, abstract classes, multithreaded programming, Python program examples.

## UNIT V

**GUI Programming: Introduction,** Tkinter, Widgets (Buttons, Canvas, Frame, Label, Menu, Entry, Text, Scrollbar, Combobox, Listbox), event driven programming-events, callbacks, binding, layout management- geometry managers: pack and grid, creating GUI based applications in Python.

**Teaching methodologies:**

- Power Point Presentations
- Tutorial Sheets
- Assignments

## Textbooks:

1. Exploring Python, Timothy A. Budd, McGraw Hill Publications.
2. Introduction to Programming using Python, Y.Daniel Liang, Pearson.
3. Python Programming, Sheetal Taneja and Naveen Kumar, Pearson.

## Reference Books:


1. Introduction to Computer Science using Python, Charles Dierbach, Wiley India Edition.
2. Internet of Things - A hands on approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
3. Fundamentals of Python, K. A. Lambert, B.L. Juneja, Cengage Learning.
4. Think Python, how to think like a computer scientist, Allen B. Downey,SPD, O'Reilly.
5. Core Python Programming, Wesley J.Chun, second edition, pearson.

# II Year
# I Semester

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DATA SCIENCE**

**Course Code: GR24A2084** **L/T/P/C: 3/0/0/3**
**II Year II Semester**

**Course Outcomes:**
1. Use R environment, data structures, functions, to solve statistical problems
2. Analyse basic and descriptive statistical analysis methods using R
3. Apply data collection , preparation, visualization and feature engineering with R
4. Summarize data analysis and machine learning techniques with R
5. Implement R advanced features for real time business case studies

**UNIT I**

I**ntroduction to R -** R Windows Environment, R-Data types,R-Data Structures,R Functions and loops, Reading Datasets, Working with different file types, R packages. Introduction to statistical learning and R-Programming,Overview of CRAN.

**UNIT II**

**Descriptive Statistics**- Measures of central tendency, Measures of location of dispersions, Practice and analysis with R.

**Basic Statistical Analysis** - Statistical hypothesis generation and testing, Chi-Square test, t- Test, Analysis of variance, Correlation analysis, Maximum likelihood test, Practice and analysis with R.

**UNIT III**

**Introduction to Data Science**:Data Science Terminology, Data Science Process, Data Science Project Roles.

**Data Collection and Management**: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.

Data Preparation, Feature Engineering, Data Visualization in R.

**UNIT IV**

**Data Analysis techniques** - Exploratory data analysis, Association rules analysis, Regression analysis, Classification techniques, Clustering, Practice and analysis with R **Model Evaluation** - Machine Learning concepts, types of machine learning, Machine learning with R.

**UNIT V**

**Advanced R Programming –** Data Models, PCA, LDA, Exploratory fact Analysis, NN Modeling with R.

**Business Case studies and projects -**Understanding business scenarios, scalable and parallel computing with Hadoop and Map-Reduce, Sensitivity Analysis.

**Text Books:**


1. Probability & Statistics for Engineers & Scientists (9th Edn.), Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Prentice Hall Inc.
2. The Elements of Statistical Learning, Data Mining, Inference, and Prediction(2nd Edn.), Trevor Hastie Robert Tibshirani Jerome Friedman, Springer, 2014
3. An Introduction to Statistical Learning: with Applications in R, G James, D. Witten,T Hastie, and R. Tibshirani, Springer, 2013
4. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer
5. Beginning R: The Statistical Programming Language, Mark Gardener, Wiley, 2013


**Reference Books:**


1. Advances in Complex Data Modeling and Computational Methods in Statistics,Anna Maria Paganoni and Piercesare Secchi, Springer, 2013
2. Data Mining and Analysis, Mohammed J. Zaki, Wagner Meira, Cambridge, 2012
3. Hadoop: The Definitive Guide (2nd Edn.) by Tom White, O'Reilly, 2014
4. MapReduce Design Patterns: Building Effective Algorithms and Analytics forHadoop and Other Systems, Donald Miner, Adam Shook, O'Reilly, 2014

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**JAVA PROGRAMMING**

**Course Code: GR24A2071** **L/T/P/C : 3/0/0/3**

**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. Correlate 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 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 linearguments, 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, userdefined Exception.

## UNIT IV MULTITHREADING, COLLECTIONS

java.lang.Thread, the main Thread, creation of new Threads, Thread priority, multithreading-usingisalive() and join(), Synchronization, suspending and resuming Threads, Communication between Threads. Exploring java.io, Exploring java.util **Collections:** Overview of Collection Framework: ArrayList, Vector, TreeSet, Hash Map, Hash Table,Iterator, Comparator.

## UNIT V APPLETS, AWT AND SWINGS

Applet class, Applet structure, an example Applet program, Applet life cycle.

**Event Handling-** Introduction, Event Delegation Model, Java.awt.event Description, Adapter classes,Innerclasses.

**Abstract Window Toolkit:** Introduction to AWT, components and containers, Button, Label, Checkbox,Radio buttons, List boxes, choice boxes, Text field and Text area, container classes, Layout Managers. **Swing:** Introduction, JFrame, JApplet, JPanel, Components in swings, JList and JScroll Pane, Split Pane, JTabbed Pane, Dialog Box, Pluggable Look and feel.

**Teaching methodologies:**

- Power Point Presentations
- Tutorial Sheets
- Assignments

**TEXT BOOKS**

1. Java: The Complete Reference, 10th edition, Herbert Schildt, Mcgraw Hill.
2. Java Fundamentals: A Comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.

**REFERENCE BOOKS**

1. Java for Programming, P.J. Dietel Pearson Education.
2. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
3. Thinking in Java, Bruce Eckel, Pearson Education.
4. Programming in Java, S.Malhotra and S.Choudhary, Oxford University Press.

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

**Code: GR24A2004** **L/T/P/C: 3/0/0/3**
**II Year I Semester**

**Course Outcomes:**

After studying this course, students will be in a position to:

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-1: 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-2: 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-3: 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-4: 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-5: 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
7. J. Weygandt, Paul D. Kimmel, Donald E. Kieso, Wiley, 2021
8. Managerial Economics Aryasri: Managerial Economics and Financial Analysis, TMH, 2009.


**Reference Books:**


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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**DISCRETE MATHEMATICS**

**Course Code: GR24A2077** **L/T/P/C: 2/1/0/3**

**II Year I Semester**

**Course Outcomes:**

1. Use propositional and predicate logic in knowledge representation and truth verification.
2. Demonstrate the application of discrete structures in different fields of computer science.
3. Apply basic and advanced principles of counting to the real-world problems.
4. Formulate the problem and solve using recurrence relations and generating functions.
5. Devise the given problem as a graph network and solve with techniques of graph theory.

**UNIT I**

**Mathematical Logic:** Statements and notations, Connectives, Well-formed formulas, Truth tables, Tautology, Equivalence implication, Normal forms.

**Predicates:** Predicative logic, Free & Bound variables, Rules of inference, Consistency, proof ofcontradiction.

**UNIT II**

**Set Theory**: Properties of binaryrelations, Compatibility, Equivalence and Partial ordering relations, Hassediagram, Lattice and its properties.

**Functions:** Inverse function, Composite of functions, Recursive functions, Pigeon hole principle and itsapplication.

**Algebraic Structures:** Algebraic systems examples and general properties, Semi groups and monads,groups and sub groups' Homomorphism, Isomorphism.

**UNIT III**

**Elementary Combinatorics:** Basics of counting, Combinations & Permutations, with repetitions, Constrained repetitions, Binomial coefficients, Binomial and Multinomial theorems, the principle of Inclusion – Exclusion.

**UNIT IV**

**Recurrence Relation:** Generating functions, Function of sequences calculating coefficient of generating function, Recurrence relations, solving recurrence relation by substitution, Generating functions and Characteristics roots, solution of Inhomogeneous recurrence relation.

**UNIT V**

**Graph Theory:** Representation of graph, Graph theory and applications, Planar graphs, basic concepts ofIsomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic numbers, Depth First Search, Breadth First Search, Spanning trees.

**Teaching Methodologies:**

- Power Point Presentations
- Tutorial Sheets
- Assignments

**TEXT BOOKS**


1. Discrete and Combinational Mathematics- An Applied Introduction-5th Edition– Ralph.P.Grimadi Pearson Education
2. Discrete Mathematical Structures with applications to computer science Trembly J.P. & Manohar. P, TMH
3. Discrete Mathematics for Computer Scientists and Mathematicians 2nd Edition by Joe L. Mott, Abhraham Kandel and Theodore P. Baker

**REFERENCE BOOKS**


1. Discrete Mathematics and its Applications, Kenneth H. Rosen, Fifth Edition.TMH.
2. Discrete Mathematics with Applications, Thomas Koshy, Elsevier
3. Discrete Mathematical Structures, Bernand Kolman, Roberty C. Busby, Sharn Cutter Ross,Pearson
4. Discrete mathematical structures, Dr. D S Chandrashekar, PRISM Publishers.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DATABASE MANAGEMENT SYSTEMS**

**Course Code: GR24A2072** **L/T/P/C: 3/0/0/3**
**II Year I Semester**

**Course Outcomes:**

1. Interpret the concepts of Database systems and design issues in modeling applications.
2. Develop the database using constraints and queries in SQL and PL/SQL.
3. Outline the concepts of relational model and indexing techniques.
4. Apply the Schema Refinement techniques for database design.
5. Summarize the components of transaction management in database systems.

**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 Administrator, Database System Structure.

**Introduction to Database Design:** ER Diagrams, Attributes, Entities and Entity sets, Relationships and Relationship sets, Extended ER Features, Conceptual Design with the ER Model, Logical database Design.

**UNIT II**

**SQL Queries and Constraints:** Types of SQL Commands, Form of Basic SQL Query, SQL Operators, Set Operators, Nested Queries, Aggregate Operators, NULL values, Keys, Integrity Constraints Over Relations, Joins, Introduction to Views, DCL Commands, Introduction to PL/SQL, Cursors, Triggers and Active Databases.

**UNIT III**

**Relational Model:**

Introduction to Relational Model, Basic Structure, Database Schema, Relational Algebra, Relational Calculus.

**File Organization and Indexing**:

Introduction, Types of File Organizations, Overview of Indexes, Types of Indexes, Index DataStructures, Tree structured Indexing, Hash based Indexing.

**UNIT IV**

**Schema Refinement And Normal Forms:**

Introduction to Schema Refinement, Properties of Decomposition, Functional Dependencies, Reasoning about FD, Normal Forms – 1NF, 2NF, 3NF, BCNF, Multivalued Dependencies and 4NF.

**UNIT V**

**Transaction Management:**

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability.

**Concurrency Control:** Lock based Protocols, Time stamp based protocols.

**Recovery System**: Recoveryand Atomicity, Log based recovery, Shadow Paging, Recoverywith concurrent Transactions, Buffer Management.

**Teaching methodologies:**

- Power Point Presentations
- Tutorial Sheets
- Assignments

**TEXT BOOKS**


1. "Database Management Systems",Raghurama Krishnan, Johannes Gehrke, TATA Mc GrawHill 3rd Edition.
2. "Database System Concepts", Silberschatz, Korth, Mc Grawhill, V edition.
3. "Introduction to Database Systems", C.J. Date Pearson Education.


**REFERENCE BOOKS**


1. "Database Systems design, Implementation and Management", Rob &Coronel 5th Edition.
2. "Database Management Systems", P.RadhaKrishna HI-TECH Publications 2005.
3. "Database Management System", Elmasri Navate, Pearson Education.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**DATA SCIENCE LAB**

**Course Code: GR24A2085** **L/T/P/C: 0/0/4/2**

**II Year II Semester**

**Course Outcomes:**

1. Demonstrate to use R in any OS (Windows / Mac / Linux). Able to work with R packages and their installation.
2. Demonstrate exploratory data analysis (EDA) for a given data set.
3. Understand to produce effective visualization for the given data set.
4. Implement and assess relevance and effectiveness of machine learning algorithms for a given dataset.
5. To be able to use and program in the programming language R be able to use R to solve
6. statistical problems, able to implement and describe Monte Carlo the technology, able to minimize and maximize functions using R.

**TASK 1**

**a)** Write R script for Vector creation and Data Frames

**b)** Implement data analysis and data visualization in R

**TASK 2**

a) Implement linear and multiple regression model using one variable and multiplevariables

b) Calculate the Error measures SSE, SST, RMSE, and R2

c) Implement Lasso and ridge regression Correlation using R

**TASK 3**

a) Perform logistic regression using R script

b) Evaluating model accuracy using confusion matrix using R

c) Implement ROC curve with threshold selection and Area under the ROC curve.

**TASK 4**

a) Create the decision tree model using ctree and plot the model

b) Implement single data imputation and multiple imputation

**TASK 5**

a) Create Classification and Regression Tress with cross validation

b) Implement ROC curve for CART

**TASK6**

a) Implement Random Forest using R

b) Implement K-fold Cross Validation using R

**TASK 7**

a) Write R Script for Text Analytics

**TASK 8**

a) Implement Time Series Analysis in R

**TASK 9**

a) Implement clustering and Random forest with clustering using R

b) Implement Heatmaps Using R

**TASK 10**

a) Implement Support Vector Machines using R
b) Implement Naive Bayes - Bayesian GLM using R

**Note: min 3 data sets for practice.**

## Text/Reference Books


1. William N. Venables and David M. Smith, An Introduction to R. 2nd Edition. Network Theory Limited, 2009.
2. Norman Matloff, The Art of R Programming - A Tour of Statistical Software Design,No Starch Press, 2011.
3. Hands-on programming with R, Garrett Grolemund, O'Reilley, 1st Edition, 2014.
4. Statistics: An Introduction Using R, Michael J. Crawley, WILEY, Second Edition, 2015.
5. R for everyone, Jared Lander, Pearson, 1st Edition, 2014.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**JAVA PROGRAMMING LAB**

**Course Code: GR24A2073** **L/T/P/C : 0/0/4/2**
**II Year I Semester**

**Course Outcomes:**
1. Analyze a problem, identify and define the computing requirements appropriate to its solution
2. using object-oriented programming concepts.
3. Design the applications using Inheritance, Polymorphism and Synchronization concepts.
4. Illustrate exception handling at Compile time and Run time.
5. Solve the real-world problems using Java Collection framework.
6. Develop GUI applications using Applets, AWT and Swings.

**TASK 1**
Write java programs that implement the following
a. Class and object
b. Constructor
c. Parameterized constructor
d. Method overloading
e. Constructor overloading.

**TASK 2**
a. Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is apalindrome.
b. Write a Java program for sorting a given list of names in ascending order.
c. Write a Java Program that reads a line of integers, and then displays each integer and the sum of allthe integers (Use StringTokenizer class of java.util)

**TASK 3**
Write java programs that uses the following keywords (a) this b)super c)static d)final

**TASK 4**
a. Write a java program to implement method overriding
b. Write a java program to implement dynamic method dispatch.
c. Write a Java program to implement multiple inheritance.
d. Write a java program that uses access specifiers.

**TASK 5**
a. Write a Java program that reads a file name from the user, then displays information about whether thefile exists, whether the file is readable, whether the file is writable, the type of file and the length of thefile in bytes.
b. Write a Java program that reads a file and displays the file on the screen, with a line number before eachline.
c. Write a Java program that displays the number of characters, lines and words in a text file

**TASK 6**

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

**TASK 7**

a. Write a Java program that creates three threads. First thread displays "Good Morning" every one second,the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds.
b. Write a Java program that correctly implements producer consumer problem using the concept of interthread communication.

**TASK 8**

Write a program illustrating following collections framework

a) ArrayList b) Vector c) HashTable d) Stack

**TASK 9**

a. Develop an applet that displays a simple message.
b. Develop an applet that receives an integer in one text field and compute its factorial value and return itin another text field, when the button named "Compute" is clicked.
c. Write a Java programthat works as a simple calculator. Use a grid layout to arrange button for the digitsand for the +, -,*, % operations. Add a text field to display the result.

**TASK 10**

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

**TASK 11**

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

**TASK 12**

a. Write a java program that simulates traffic light. The program lets the user select one of three lights: red, yellow or green. When a radio button is selected, the light is turned on, and only one light can be on at a time. No light is on when the program starts.
b. Write a Java program that allows the user to draw lines, rectangles and ovals.
c. Create a table in Table.txt file such that the first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to displaythe table using JTable component.

**TEXT BOOKS**

1. Java: The Complete Reference, 10th edition, Herbert Schildt, Mcgraw Hill.
2. Java Fundamentals - A Comprehensive introduction, Herbert schildt and Dale skrien, TMH.

**REFERENCE BOOKS**


1. Java for programming, P.J.Dietel Pearson education (OR) Java: How to Program P.J.Dietel andH.M.Dietel,PHI
2. Object Oriented Programming through java, P.Radha Krishna, Universities Press.
3. Thinking in Java, Bruce Eckel, Pearson Education
4. Programming in Java, S.Malhotra and S.Choudhary, Oxford University Press.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DATABASE MANAGEMENT SYSTEMS LAB**

**Course Code: GR24A2074** **L/T/P/C: 0/0/3/1.5**
**II Year I Semester**

**Course Outcomes:**

1. Demonstrate the use of DDL and DML commands in SQL.
2. Apply the basic SELECT operations for data retrieval.
3. Illustrate the SQL concepts to retrieve data from multiple tables.
4. Construct PL/SQL code to work with database objects.
5. Experiment with procedural constructs and exception handling to develop applications in the database systems.

**TASK 1 : DDL commands (Create, Alter, Drop, Truncate)**

1. Create a table EMP with the following structure:

| Name | Data Type |
|---|---|
| EMPNO | NUMBER (6) |
| ENAME | VARCHAR2(20) |
| JOB | VARCHAR2(10) |
| MGRID | NUMBER(6) |
| DEPTNO | NUMBER(3) |
| SAL | NUMBER(7,2) |

2. Add a column **commission** to the emp table. Commission should be numeric with null valuesallowed.
3. Alter the **job** field of EMP table by modifying its size.
4. Create a table DEPT with the following structure:

| Name | DataType |
|---|---|
| DEPTNO | NUMBER(3) |
| DNAME | VARCHAR2(10) |
| LOC | VARCHAR2(10) |

**DEPTNO** as the primary key

5. Add constraints to the EMP table with **empno** as the primary key and **deptno** as the foreign key referencing the DEPT table.
6. Add check constraint to the EMP table to check the **empno** value with **empno** >100.
7. Add NOT NULL constraint on **sal** field with default value 5000, otherwise it should accept the values from the user.
8. Add columns **dob, doj** with date data type to the EMP table. Drop the column **doj** from the EMP table.
9. Create EMP1, EMP2 tables as copy of EMP table. Drop EMP1 table and truncate EMP2 table.

**TASK 2: DML COMMANDS (Insert, Update, Delete)**

1. Insert 5 records into DEPT table.
2. Insert 11 records into EMP table.
3. Update the EMP table to set the value of **commission** of all employees to Rs1000/- who are working as "clerk".
4. Delete the records from EMP table whose **job** is "Admin".
5. Delete the rows from DEPT table whose **deptno** is 10.

**TASK 3: DQL COMMAND (SELECT) - SQL Operators and Order by Clause**

**Note: Use EMPLOYEES and DEPARTMENTS tables of HR Schema**

1. List the records in the EMPLOYEES table by sorting the salary in descending order.
2. Display only those employees whose department number is 30.
3. Display the unique department numbers from EMPLOYEES table.
4. List the employee name, salary and 15% rise in salary. Label the column as "pay_hike".
5. Display the rows whose salary ranges from 5000 to 7500.
6. Display all the employees in department 10 or 20 in alphabetical order of employee names.
7. List the employee names who do not earn commission.
8. Display all the details of the employees with 5-character names with 'S' as starting character.
9. Display joining date of all employees in the year of 1998.
10. List out the employee names whose salary is greater than 5000 and less than 6000.

**TASK 4: SQL Aggregate Functions, Group By clause, Having clause**

1. Count the total records in the EMPLOYEES table.
2. Calculate the total and average salary of the employees.
3. Determine the max and min salary and rename the column as "max_salary" and "min_salary".
4. Find number of unique departments from the EMPLOYEES table.
5. Display job wise sum, average, maximum, and minimum salary from EMPLOYEES table.
6. Display maximum salaries of all the departments having maximum salary >2000.
7. Display job wise sum, average, maximum, minimum salaries in department 10 having average salary greater than1000. Sort the result with the sum of salary in descending order.

**TASK 5: SQL Functions**

1. Display the employee name concatenated with employee number.
2. Display the employee name with half of employee name in upper case and half in lowercase.
3. Display the month name of "14-OCT-09" in full.
4. Display the date of joining of all employees in the format "dd-mm-yy".
5. Display the date after two months of hire date of employees.
6. Display the last date of the month in "05-OCT-09".
7. Display the hire date by rounding the date with respect to month and year.
8. Display the commission earned by employees. If they do not earn commission, display it as "NoCommission".

**TASK 6: Nested Queries**

1. Display the salary of the third highest paid employee in EMPLOYEES table.
2. Display the employee name and salary of employees whose salary is greater than the minimum salary of the company and job title starts with 'I'.
3. Write a queryto display information about employees who earn more than any employee in department number 30.
4. Display the employees who have the same job as "Jones" and whose salary is greater than or equal to the salary of "Ford".
5. List out the employee names who get the salarygreater than the maximum salary of departments with department number 20, 30.
6. Display the maximum salary of the departments where maximum salary is greater than 9000.
7. Create a table employee with the same structure as EMPLOYEES table and insert rows into the table using select clause.
8. Create MANAGER table from the EMPLOYEES table which should hold details only about the managers.

**TASK 7: Joins, Set Operators.**

1. Display all the EMPLOYEES and the DEPARTMENTS information implementing a left outer join.
2. Display the employee name and department name in which they are working implementing a fullouter join.
3. Write a queryto display the employee name, salary and their manager's name for everyemployee.
4. Write a queryto display the employee name, job, employee number, department name and location for each department, even if there are no employees.
5. Display the details of employees those who draw the same salary.
6. Display the names of employees who did not change their job at least once. (Use Set Operators)
7. Display the names of employees whose current job_id is same as their previous one. (Use Set Operators)
8. Display the names of employees with their current and previous job details. (Use Set Operators)

**TASK 8: Views**

1. Create a view that displays the employee id, name and salary of employees who belong to $10^{th}$ department using with check option.
2. Create a view with read only option that displays the employee name and their department name.
3. Display all the views generated.
4. Execute the DML commands on the views created.

**TASK 9: Sequence and Index**

1. Write a PL/SQL code to retrieve the employee name, hire date and designation of an employee whosenumber is given as input by the user.
2. Write a PL/SQL code to calculate tax of employee.
3. Write a PL/SQL program to display top ten employee details based on salary using cursors.
4. Write a PL/SQL program to update the commission values for all the employees with salary lessthan 2000, by adding 1000 to the existing values.

**TASK 10: TCL COMMANDS (Save Point, Rollback, Commit)**

**TASK 11: Triggers, Procedures, and Functions**

1. Write a trigger on employee table that shows the old and new values of employee name after updatingon employee name.
2. Write a PL/SQL procedure to insert, delete, and update the records in the EMPLOYEES table.
3. Write a PL/SQL function that accepts the department number and returns the total salary of thatdepartment.

**TASK 12: Exceptions and Packages**

1. Write PL/SQL program to handle predefined exceptions.
2. Write PL/SQL program to handle user defined exception.
3. Write a PL/SQL code to create
   a) Package specification
   b) Package bodyto insert, update, delete and retrieve data on EMPLOYEES table.

**TEXT BOOKS**


1. The Complete Reference, 3rd edition by James R.Groff, Paul N.Weinberg, Andrew
2. J. Oppel
3. SQL & PL/SQL for Oracle10g, Black Book, Dr. P.S.Deshpande.


**REFERENCE BOOKS**


1. Database Systems design, Implementation and Management", Rob &Coronel 5th Edition.
2. "Database Management Systems", P.RadhaKrishna HI-TECH Publications 2005.
3. "Database Management System", Elmasri Navate, Pearson Education.

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

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

**II year II 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.


**Reference Books**


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

# II Year
# II Semester

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**COMPUTER ORGANIZATION**

**Course Code: GR24A2075** **L/T/P/C: 3/0/0/3**
**II Year II Semester**

## Course Outcomes:

1. Demonstrate knowledge of register organization of a basic computer system
2. Incorporate In-depth understanding of control unit organization and micro programmed control.
3. Analyze the performance of central processing unit of a basic computer system.
4. Apply various algorithms to perform arithmetic operations and propose suitable hardware and appraisevarious methods of communications with I/O devices.
5. Analyze and emphasize various communication media in the basic computer system using design ofvarious memory structures and Multiprocessor systems.

### UNIT I

**Basic Structure of Computers:** Computer Types, Functional unit, Data Representation, Fixed Point Representation, Floating – Point Representation, Error Detection codes.

**Register Transfer Language and Micro operations:** Register Transfer language. Register
Transfer, Bus and memory transfers, Arithmetic Micro operations, Logic micro operations, Shift microoperations, Arithmetic logic shift unit.

### UNIT II

**Basic Computer Organization and Design:** Instruction codes, Computer Registers, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt, Complete Computer Description.

**Micro Programmed Control:** Control memory, Address sequencing, micro program example, design of control unit, Micro program Sequencer, Hard wired control Vs Micro programmed control

### UNIT III

**Central Processing Unit Organization:** General Register Organization, STACK organization. Instruction formats, Addressing modes. DATA Transfer and manipulation, Program control. Reduced Instruction set computer.

**Computer Arithmetic**: Addition and subtraction, multiplication Algorithms, Floating – point Arithmeticoperations, BCD Adder.

### UNIT IV

**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous data transfer Modes of Transfer, Priority Interrupt, Direct memory Access, Input –Output Processor (IOP).

**Pipeline and Vector Processing:** Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Dependencies, Vector Processing.

### UNIT V

**Memory Organization:** Memory Hierarchy, Main memory- RAM and ROM chips, Memory Address map, Auxiliary memory – Magnetic Disks, Magnetic Tapes,

Associative Memory – Hardware Organization, Match Logic, Cache Memory – Associative mapping, Direct mapping, Set associativemapping, writing into cache and cache initialization, Cache Coherence, Virtual memory – Address Spaceand Memory Space, Address mapping using pages, Associative Memory page table, Page Replacement.**Multi Processors**: Characteristics or Multiprocessors, Interconnection Structures, Cache Coherence,Shared Memory Multiprocessors.

**Teaching methodologies:**

- Power Point Presentations
- Tutorial Sheets
- Assignments

TEXT BOOKS


1. Computer Systems Architecture – M.Moris Mano, 3rd Edition, Pearson/PHI
2. Computer Organization – Carl Hamacher, ZvonksVranesic, SafeaZaky, 5th Edition, McGraw Hill.


REFERENCE BOOKS


1. Computer Organization and Architecture–William Stallings 7th Edition, Pearson/PHI
2. Structured Computer Organization – Andrew S. Tanenbaum, 6th Edition PHI/Pearson
3. Fundamentals or Computer Organization and Design, - Sivaraama Dandamudi Springer Int. Edition.
4. Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, 5th Edition Elsevier
5. Computer Architecture: Fundamentals and principles of Computer Design, Joseph D. Dumas II, B S Publication.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**OPERATING SYSTEMS**

**Course Code: GR24A2076** **L/T/P/C: 2/1/0/3**
**II 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. Analyse 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.

**Teaching methodologies:**
- Power Point Presentations
- Tutorial Sheets
- Assignments

**TEXT BOOKS**


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


**REFERENCE BOOKS**


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 DESIGN AND ANALYSIS OF ALGORITHMS

**Course Code: GR24A2079** **L/T/P/C: 3/0/0/3**

**II Year II Semester**

**Course Outcomes:**

1. Distinguish various performances of algorithms.
2. Illustrate Divide and Conquer Design Paradigm algorithms.
3. Examine various algorithms based on Dynamic programming paradigm.
4. Demonstrate greedy approach and back tracking algorithms.
5. Demonstrate branch and bound problems and Distinguish problems related to variouscomplexity classes.

**UNIT I Introduction to algorithms:**

Definition of an algorithm, properties of an Algorithm, performance analysis--space complexity, time complexity, amortized analysis

**UNIT II**

**Disjoint sets:** disjoint set Representation, Operations, union and find algorithms.

**Divide and Conquer:** General method, applications, binary search, Quick sort, merge sort,s trassen's matrix multiplication.

**UNIT III**

**Dynamic Programming:**

General method, applications, optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, travelling salesperson problem, optimal rod-cutting-Top down approach and bottom up approach.

**UNIT IV**

**Greedy method:** General method, applications-- job sequencing with deadlines, knapsack problem,minimum cost spanning trees, single source shortest path problem, activity selection problem.

**Backtracking:** General method, applications, n-queen problem, sum of subsetsproblem, Hamiltoniancycles.

**UNIT V**

**Branch and Bound:**

General method, applications, travelling sales person problem, 0/1 knapsack problem: LC branch and boundsolution, FIFO branch and bound solution

**Complexity Classes:** non deterministic algorithms, deterministicalgorithms, relationship between P, NP, NP-completeness, circuit-satisfiability problem, 3-CNF satisfiability.

**Teaching methodologies:**

- Power Point Presentations
- Tutorial Sheets
- Assignments

**TEXT BOOKS**

1. Ellis Horowitz, Satraj Sahni and S Rajasekharam, Fundamentals of Computer Algorithms, Galgotia publishers.
2. Design and Analysis of Computer Algorithms by Aho, Hopcroft and Ullman, Pearson

**REFERENCE BOOKS**

1. T H Cormen, C E Leiserson, and R L Rivest, Introduction to Algorithms, 3rd Edition,Pearson Education.
2. Michael T. Goodrich & Roberto Tamassia, Algorithm Design, Wiley Singapore Edition,2002.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**FULL STACK WEB DEVELOPMENT**

**Course code: GR24A2078** **L/T/P/C: 3/0/0/3**
**II Year II Semester**

**Course Outcomes:**
1. Build the knowledge of web development basics, HTML, CSS and building interactive web pages
2. using JavaScript.
3. Develop a complete web application from the scratch that includes Front-end, Back-end and Data-exchange technologies.
4. Design server side applications using servlets and JSP for interactive web applications.
5. Demonstrate simple NodeJs Applications and connectivity to MongoDB.
6. Apply concepts of Express over full stack application development using MERN Stack.

**UNIT I**
**HTML Common tags**- List, Tables, images, forms, Frames; Introduction to JavaScript- Objects and Functions in javascript, Manipulating HTML DOM; Cascading Style sheets; XML: Introduction to XML, Document Type Definition, XML Schemas, XHTML Parsing XML Data – DOM and SAX Parsers.

**UNIT II**
**Bootstrap Programming** - Setup, Templates & Navbar, Typography, Forms & Tables, CSS Components, Grid System, Modal, Dropdown, Tabs & Tooltip, Collapse, Accordion and Carousel.
jQuery Programming: Selectors & Events, Effects & Animation, DOM Traversing & Filtering Angular JS: Introduction, Expressions, Modules, directives, AngularJS HTML DOM, Events, Forms.

**Unit-III**
**Introduction to Servlets:** Life cycle of a Servlet, deploying a servlet, The Servlet API, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.
Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, implicit objects, Using Beans in JSP Pages.

**Unit-IV**
**Introduction to Node.js**- NPM - Events, Timers, and Callbacks in Node.js – file upload – email – Express framework – request –response –routing - templates- view engines.
Introduction to MongoDB- creating DB, collection – CRUD operations - Accessing MongoDB from Node.js. – Accessing online MongoDB from Node JS.

**Unit-V**
**Express:** Getting Started with Express, Configuring Routes, Using Requests Objects, Using Response Objects.
**React:** Need of React, Simple React Structure, The Virtual DOM, React Components, Introducing React Components, Creating Components in React, Data and Data Flow in React, Rendering and Life Cycle Methods in React, Working with forms in React, integrating third party libraries, Routing in React.

### Teaching Methodologies:

- Power Point Presentations
- Tutorial Sheets
- Assignments

**TEXT BOOKS**


1. Beginning JavaScript with DOM scripting and AJAX: From Novice to Professional by Christian Heilmann
2. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech
3. Jakarta Struts Cookbook, Bill Siggelkow, SPDO'Reilly.


**REFERENCE BOOKS**


1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018.
2. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo,Express, React, and Node', Second Edition, Apress, 2019.
3. Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018.
4. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications
5. Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**APPLIED STATISTICS FOR ENGINEERS**
**(Common to CSE(DS) & CSE(AIML))**

**Course Code: GR24A2006** **L/T/P/C: 3/0/0/3**
**II year II Semester**

**Pre-requisites: E**lementary statistics, Calculus and Linear algebra

**Course Outcomes**

After completion of the course, the student will be able to
1. Compute and interpret descriptive statistics
2. Make use of the properties of Binomial, Poisson, Normal and Exponential distributions to estimate the variability of occurrence
3. Analyze univariate and bivariate data using statistical modelling
4. Apply inferential statistics to suggest explanations for a situation or phenomenon arising in the case of large samples
5. Apply parametric and non parametric tests of inferential statistics to suggest explanations for a situation or phenomenon arising in the case of small samples

**Unit-1 Basic Statistics and Random Variables**
Measures of central tendency, moments, Skewness and Kurtosis.
Random variables- Discrete&Continuous, Probability mass function and density functions,constants of random variables(Mean,Variance and Moments about mean), Concepts of Bivariate distributions and Covariance.

**Unit-II Discrete and Continuous Probability Distributions**
Binomial, Poisson,Normal and Exponential (Statements of Properties and applications), evaluation of statistical parameters for Binomial, Poisson and Normal distributions through numerical examples.

**Unit-III Correlation, Regression and Time Series analysis**
Correlation(Karl-Pearson's correlation coefficient and Spearman's Rank correlation (Statements of their properties and problems)), Simple and Multiple Linear Regression of three variables (Statements of properties of Regression coefficients and problems).

Components of Time series, Additive and Multiplicative models of Decomposition of Time series, Estimation of trend by method of Moving averages, fitting of various mathematical curves (Straight line and Second degree parabola).

**Unit-IV Testing of Hypothesis-1**
Concept of Sampling distribution and Standard error; tests for single proportion, difference of proportions in large sampling, single mean and difference of means in large and small sampling.

**Unit-V Testing of Hypothesis-2**
Tests for ratio of variances, ANOVA 1-way and 2-way.
Non-parametric Inference: Wilcoxon signed rank test and Run test for randomness Chi-square test for independence of attributes.

**Texts and References:**


1. S. C.Gupta &V.K.Kapoor, "Fundamentals of Mathematical Statistics", S.Chand.
2. Richard A.Johnson," Probability and Statistics for Engineers", Pearson Education.
3. Jay Devore, "Probability and Statistics for Engineering and the Sciences",Cengage learning.
4. Murat Kulahci,"Time series analysis and forecasting by example",John Wiley & Sons.
5. S. C.Gupta &V.K.Kapoor, "Fundamentals of Applied Statistics", S.Chand.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY FULL STACK WEB DEVELOPMENT LAB**

**Course code: GR24A2080** **L/T/P/C: 0/0/3/1.5**

**II Year II Semester**

**Course Outcomes:**

1. Design a website using the basic core concepts of Front-End technologies.
2. Develop robust and scalable websites using client and server-side validations.
3. Apply the concepts of Servlets and JSP to develop the web applications.
4. Demonstrate the creation of full stack applications using Angular JS, React JS and Mongo DB.
5. Implement simple full stack application development using Express and optimize server side rendering.

**Task - 1:** Design an HTML webpage to design Curriculum Vitae.

**Task - 2:** Write a JavaScript program to design a shopping list, where user can add or remove items as shown below.

My Shopping List

- Milk X
- Bread X
- Cheese X

Add

**Task - 3:** Develop a web page using jQuery to display five star rating application.

**Task - 4:** Write a Program on Bootstrap templates and Navbar.

**Task - 5:** Develop AngularJS application that displays details of students and their CGPA. Allow users to input the student details.

**Task - 6:** Write a Servlet Program that accepts the Mobile phone details from user and displays the details on the next page. Create a table and perform insert operation as shown in the Figure 1 below. Connect using JDBC to display each record at a time on the webpage using servlet request and response.

**Mobile Details**

| Model Id | Price(Rs.) | Company | Color |
|---|---|---|---|
| J2 | 12000 | Samsung | Silver |
| 6600 | 20000 | Nokia | Black |
| Note 3 | 12000 | Red Mi | Grey |
| Zenfone 2 | 20000 | Asus | Grey |

Figure 1: Table Details

**Task - 7:** Create a JSP application for performing basic arithmetic operations using Java Beans.

Ex: Use jsp:use Bean action tag

**Task - 8:** Create a food delivery website where users can order food from a particular restaurant listed in the website for handling http re quests and responses using NodeJS. **Task - 9:** Implement CRUD operations on the given dataset using MongoDB.

**Task - 10:** Develop a web application to manage student information using Express and Angular JS.

**Task - 11:** Write a program to create a voting application using React JS.

**Task - 12:** Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days using react application.

**TEXT BOOKS**


1. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech
2. Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018.


**REFERENCE BOOKS**


1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018.
2. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo,Express, React, and Node', Second Edition, Apress, 2019.
3. Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**OPERATING SYSTEMS LAB**

**Course Code: GR24A2081** **L/T/P/C: 0/0/3/1.5**
**II Year II Semester**

**Course Outcomes:**
1. Evaluate the performance of different types of CPU scheduling algorithms
2. Implement producer-consumer problem, reader-writers problem, and Dining philosophers' problem using semaphores.
3. Simulate Banker's algorithm for deadlock avoidance
4. Implement paging techniques and page replacement policies, memory allocation techniques in memory management.
5. Implement disk scheduling techniques and file allocation strategies.

**TASK 1** Practice the following commands in UNIX environment
a) cp b) rm c) mv d) chmod e) ps f) kill

**TASK 2** Write a program that makes a copy of a file using standard I/O and system calls.

**TASK 3** Simulate the following Scheduling algorithms. a) FCFS b)SJF c)Priority d)Round Robin

**TASK 4** Simulate the Producer Consumer problem using semaphores.

**TASK 5** Simulate the Readers – Writers problem using semaphores.

**TASK 6** Simulate the Dining Philosophers problem using semaphores

**TASK 7** Simulate Bankers Algorithm for Deadlock Avoidance.

**TASK 8** Simulate First Fit and Best Fit algorithms for Memory Management.

**TASK 9** Simulate paging technique of memory management.

**TASK 10** Simulate page replacement Algorithms. a) FIFO b) LRU

**TASK 11** Simulate following Disk Scheduling algorithms.
a) FCFS b)SSTF c)SCAN d)C-SCAN e)LOOK f)C-LOOK

**TASK 12** Simulate file allocation strategies. a) Sequential b)Indexed c)Linked

**Text Books**

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

**Reference Books**


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. Operating Systems, R. Elmasri, A. G. Carrick and D. Levine, Mc Graw Hi

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

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

**II Year II Semester**

**Course Outcome:**

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

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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**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**
**CLEANLINE**
**SS DRIVE**

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

**UNIT V**
**CASE STUDIES**

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

**TEXT BOOKS:**

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

**Course Code: GR24A3087** **L/T/P/C: 3/0/0/3**

**III Year I Semester**

**Pre-requisites:**
Students are expected to have knowledge in

- Basic computer hardware
- Multiuser Operating systems
- Types of Ports and their purpose

**Course Outcomes:**

1. Articulate basic terminologies of Computer Networks and transmission media in building a network for an organization.
2. Interpret the error correction and detection techniques and MAC Protocols for specific networks.
3. Illustrate the purpose of routing algorithms in real time applications.
4. Mind map the protocols and mechanism used in transport layer.
5. Integrate the application layer protocols in Internet based Applications.

**UNIT I**

**Computer Networks:** Uses of Computer Networks, Network Hardware, Network Software, Types of networks, Network topologies, Layered architecture. Reference Models: OSI, TCP/IP, ARPANET, Internet, and ATM header, Reference model, QoS.

**Physical Layer:** Guided Transmission Media, Wireless Transmission Media, Communication Satellites. Switching and Multiplexing, Mobile Telephone Network, GSM.

**UNIT II**

**Data link layer:** Design Issues, Framing, Error Detection, Elementary Data Link Protocol, and Sliding Window Protocols.

**Medium Access sub layer:** Static vs. Dynamic, Multiple Access Protocols: ALOHA, CSMA and Collision Free Protocols. Ethernet (IEEE 802.3), wireless LANS (IEEE 802.11), Bluetooth (IEEE 802.15), The Network and internetwork devices.

**UNIT III**

**Network Layer:** Routing Algorithms, Flooding, Broadcasting and Multicasting. Congestion Control Algorithms: General Principles of Congestion Control, Prevention Policies, Congestion Control in Virtual and Datagram Subnets, QoS in the Internet.

**The Network Layer in the Internet:** IPv4 Addressing Scheme, Subnetting and Masking, CIDR, NAT, Intra and Inter domain routing protocols, Mobile IP, IPv6 Header Format and Transmission Methods.

**UNIT IV**

**Transport Layer:** Transport Services, Elements of Transport Protocols.

**Transport Layer Protocols:** TCP & UDP protocols, TCP Connection Establishment and Release, TCP Congestion Control, TCP Fast Retransmit and Recovery, Slow start Mechanism in TCP, Transaction Oriented TCP.

**UNIT V**

**Application Layer:** DNS, Electronic Mail, the World Wide Web, FTP, HTTP, TELNET.

**Multimedia:** Audio and video compression techniques, streaming audio and video, VOIP.

**Textbooks:**

1. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education/PHI
2. Data Communications and Networking-Behrouz A. Forouzan, Third Edition TMH.

**Reference Books**:

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks- 3rd Edition, W.A. Shay, Thomson.
3. Computer Networking: A Top-down Approach, Jim Kurose and Keith W. Ross, Pearson Education.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DATA WAREHOUSING AND DATA MINING**

**Course Code: GR24A3129** **L/T/P/C: 3/0/0/3**

**III Year I Semester**

**Prerequisites**:
Students are expected to have knowledge of transactional and relational databases, probability and statistics.

**Course Outcomes:**
1. Demonstrate the concepts of datamining, its applications, and various pre-processing methods.
2. Develop a prototype for dataware house and data mart for any organization.
3. Apply different types of association rule mining techniques for solving practical problems.
4. Implement classification models and algorithms in dataware houses and datamining.
5. Analyze clustering techniques and recent trends in advanced datamining techniques.

**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 Data warehouse System, Major issues in Data Mining.
**Data Preprocessing:** Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction.

**UNIT II**
**Datawarehouse-Online-Analytical Processing:** Data Warehouse - Basic concepts, Data Warehouse Modeling–Multidimensional Data Model, Star, Snowflake, Fact Constellation Schemas, Concept Hierarchies, Measures, Typical OLAP Operations, From Data Warehousing to Data Mining.
**Data Warehouse Implementation**-Efficient Data Cube Computation: Overview, Indexing OLAP Data – Bitmap Index, Join Index.

**UNIT III**
**Data Characterization and Discrimination:** Data Generalization by Attribute-Oriented Induction.
**Mining Frequent Patterns, Associations and Correlations:** Basic Concepts, Market Basket Analysis, Efficient and Scalable Frequent Itemset Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.

**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.

**Prediction:** Introduction to Regression techniques, Linear Regression.

**Accuracy and Error measures:** Classifier Error measures, Predictor Error Measures, evaluating the accuracy of Classifier and Predictor.

**UNIT V**

**Cluster Analysis:** What is Cluster Analysis, Types of Data in Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Methods-k-Means, k- Medoids, Hierarchical Methods-AGNES and DIANA, Density-Based Methods-DBSCAN.

**Introduction to Mining Complex Data Types:** Mining Data Streams, Mining Time- Series Data, Mining Sequence Patterns in Transactional Databases, Mining Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

**Textbooks:**


1. Data Mining Concepts and Techniques- JiaweiHan &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**

# DATA VISUALIZATION

**Course Code: GR24A3138** **L/T/P/C: 3/0/0/3**

**III Year I Semester**

**Prerequisite:**

Students should have prior knowledge of

1. Basic programming skills.
2. Fundamentals of Probability and Statistics.

**Course Outcomes:**

On successful completion of this course, students will be able to

1. Apply data visualization principles and Gestalt design concepts to evaluate and optimize visualization workflows, ensuring clarity and perceptual effectiveness for diverse data types.
2. Design and develop interactive dashboards and effective data visualizations in Tableau by leveraging measures, dimensions, and VizQL**,** critically analysing their impact on user understanding and decision-making.
3. Implement data preparation pipelines using Tableau Prep**,** including data cleaning, transformation, joining, and aggregation**,** demonstrating their role in enhancing analysis quality and efficiency.
4. Analyze and design visualization systems for multidimensional, hierarchical, and network data**,** applying advanced methods (e.g., manifold and graph-based visualization) to interpret complex relationships**.**
5. Create and evaluate advanced visualization techniques, including GIS-based maps, 2D/3D plots, and perceptual annotation methods**,** integrating analytical insights to solve real-world business intelligence and geospatial problems.

**UNIT I**

**Introduction to Visualization**: Visualization process, visual representation of data, Gestalt principles, information overloads. Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

**UNIT II**

**Introduction to Tableau:** Tableau Architecture, Tableau Server Architecture VizQL, Foundations for building visualizations Measures and dimensions, Visualizing data: Bar charts, Iterations of bar charts for deeper analysis, Line charts, Geographic visualization, Using Show Me, Putting everything together in a dashboard, The dashboard interface, Building your dashboard.

**Connecting to Data in Tableau:** Managing data source metadata, Working with extracts instead of live connections, Filtering data, Understanding the Tableau Data Model, Joins, and Blends, Structuring Messy Data to Work Well in Tableau. Telling a Data Story with Dashboards.

**UNIT III**

**Tableau Prep Builder:** Introduction to Tableau Prep, Tableau Prep Builder User Interface, Data Preparation techniques using Tableau Prep Builder tool, Flowing with the fundamental paradigm: Connecting to data, Cleaning the data, Unioning, merging mismatched fields, and removing unnecessary fields, Grouping and cleaning.

**Calculations and aggregations in Tableau Prep:** Row-level calculations, Level of detail calculations, Aggregation, Filtering, Transforming the data for analysis, Options for automating flows.

**UNIT IV**

**Designing of visualization system:** Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents. Visualization of groups, trees, graphs, clusters, networks, Metaphorical visualization.

**UNIT V**

**Geospatial and Volumetric Data Visualization**: Visualization of volumetric data, Vector fields, Visualization of maps, Choropleth maps, symbol maps, density maps, geographic information, GIS systems.

**Perception:** Pre-attentive Properties, Color, Form, Spatial Position.

**Advanced Visualization:** Slope charts and bump charts, Waterfall charts, Step lines and jump lines, Sparklines, Dumbbell charts, Unit/symbol charts, Marimekko-chart.

**Textbooks:**


1. Matthew O. Ward, Georges Grinstein, Daniel Keim, Interactive Data Visualization: Foundations, Techniques, and Applications, 2nd Edition (2015).
2. Joshua N. Milligan, Learning Tableau 2022: Create effective data visualizations, build interactive visual analytics, and transform your organization, 5th Edition (2022).
3. Jack Dougherty & Ilya Ilyankou, Hands-On Data Visualization: Interactive Storytelling from Spreadsheets to Code, 1st Edition (2021).


**Reference Books:**


1. J. Hilden & J. Koponen, The Data Visualization Handbook, 1st English Edition (2019).
2. Chun-houh Chen, Wolfgang Härdle, Antony Unwin, Handbook of Data Visualization, 1st Edition (2008; softcover reprint 2016).

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**ARTIFICIAL INTELLIGENCE**
**(PROFESSIONAL ELECTIVE – I)**

**Course Code: GR24A3130** **L/T/P/C: 3/0/0/3**

**III Year I Semester**

**Prerequisites:**

A Course in Artificial intelligence would require knowledge of following concepts

- Logic Theory
- Probability Theory
- Numerical Analysis
- Operations on Matrices

**Course Outcomes:**

1. Select an appropriate searching strategy for developing intelligent agents to find solution in optimized way using building blocks of AI.
2. Apply Prepositional and First Order Logic methods to resolve decisions for Knowledge-based agents.
3. Implement uncertain knowledge rules and Probabilistic reasoning.
4. Analyze the working of temporal model, Hidden Markov Model, and Decision trees.
5. Develop a small robot capable of performing perception and movement based on techniques learnt in the course.

**UNIT I**

**Introduction to AI:** Introduction, Foundation of AI, History of Intelligent Agents, Agents and environments, Concept of Rationality, Nature of environments & Structure of Agents, Problem solving agents and formulation, Searching For Solutions and Strategies, Uninformed search strategies BFS, DFS, Heuristic approach, Greedy best search, A* Search, Game Playing: adversal search, Games, Min-Max algorithm, Optimal decisions in multiplayer games, Alpha Beta pruning.

**UNIT II**

**Knowledge Representation & Reasons**: Logical agents, Knowledge based agents, The Wumpus world, Logic: Proportional logic, Resolution patterns in proportional logics, Resolution: Forwardand Backward chaining, First order logic: Inference in First order logic, Proportional vs first order inference, Unification & Lifting, forward chaining, Resolution, Practice problems.

**UNIT III**

**Uncertain Knowledge and Reasoning**: Uncertainty-Acting under uncertainty, Basic probability notion, the axioms of probability, inference using full joint distribution, Independence, Bayes' rule.

**Probabilistic Reasoning**: Representing Knowledge in uncertain domain, the semantics of Bayesian networks, efficient representations of conditional distributions, exact inference in Bayesian networks, approximate inference in Bayesian networks.

**UNIT IV**

**Probabilistic reasoning over time**: Time and uncertainty, inference in temporal model, Hidden Markov models.

**Planning:** Overview, Components of Planning, Conditional Planning, Goal Stack Planning.

**Learning**: Learning from observations: Forms of learning, inductive learning, learning decision trees, ensemble learning, why learning works.

**UNIT V**

**Perception**: Image formation, Early Image Processing operations- Edge detection, image segmentation. Object recognition, using vision for manipulation and navigation.

**Robotics**: Introduction, Robot hardware, robotic perception, planning to move, robotic software architectures, application domains.

Introduction to Expert Systems, Conversational AI, Generative AI.

**Textbooks:**

1. Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig, 4th Edition, Pearson

**Reference Books:**

1. Artificial Intelligence, Elaine Riche & Kevin Night, 2nd Edition, Tata McGraw Hill Education Pvt Ltd.
2. Artificial Intelligence, Kevin Knight, Elaine Rich, Shivashankar B. Nair, 3rd Edition, McGraw Hill Education Pvt Ltd.
3. Paradigms of Artificial Intelligence Programming, Case Studies in Common Lisp, Peter Norvig, Morgan Kaufmann Publisher.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**CLOUD COMPUTING**
**(PROFESSIONAL ELECTIVE – I)**

**Course Code: GR24A3099** **L/T/P/C: 3/0/0/3**

**III Year I Semester**

**Prerequisites:**
Students are expected to have knowledge on Operating systems, Virtualization and Networking

**Course Outcomes:**
1. Identify various features, advantages and challenges of cloud computing, compare their operation, implementation and performance
2. Applying knowledge of Virtualization, Analyze and compare different types of clouds and cloud services.
3. Validating the financial and technological implications in selecting cloud computing paradigm for an organization.
4. Compare operation and economic models of varies trending cloud platforms in IT Industry.
5. To know how to overcome the security challenges and risks involved in the cloud.

**UNIT I**
**Understanding Cloud Computing:** Cloud Computing, Introduction to Cloud Computing, Cloud Architecture and Cloud Services (IaaS, PaaS, SaaS), Cloud models– Public vs Private, Cloud Technologies for Network-Based System, System Models for Distributed and Cloud Computing, NIST Cloud Computing Reference Architecture.

**UNIT II**
**Virtualization:** Basics of Virtualization, Types of Virtualizations, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data-centre Automation.

**UNIT III**
**Cloud Infrastructure:** Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources.

**UNIT IV**
**Programming Model:** Parallel and Distributed Programming Paradigms, Map Reduce, Twister and Iterative Map Reduce, Hadoop Library from Apache, Mapping Applications, Programming Support, Google App Engine, Amazon AWS, Cloud Software Environments, Eucalyptus, Working with EC2 API, Open Nebula, Open Stack, Aneka, CloudSim.

**UNIT V**

**Security in the Cloud:** Security Overview, Cloud Security Challenges and Risks, Software-as-a Service Security, Security Governance, Risk Management, Security Monitoring, Security Architecture Design, Data Security, Application Security, Virtual Machine Security, Identity Management and Access Control, Autonomic Security.

**Textbooks:**


1. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O' Reilly.
2. Kumar Saurabh, "Cloud Computing, insights into New-Era Infrastructure", Wiley India.
3. Rajkumar Buyya, Christian Vecchiola, S. Tamarai Selvi, 'Mastering Cloud Computing", TMGH.


**Reference Books:**


1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers.
2. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH.
4. Ronald L. Krutz, Russell Dean Vines, "Cloud Security, A comprehensive Guide to Secure Cloud Computing", Wiley, India.
5. Nick Antonopoulos, Cloud computing, Springer Publications.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**MOBILE APPLICATION DEVELOPMENT**

**(PROFESSIONAL ELECTIVE – I)**

**Course Code: GR24A3100** **L/T/P/C: 3/0/0/3**

**III Year I Semester**

**Course Outcomes:**

1. Analyze Android OS features and Android Application life cycle.
2. Design Android user interfaces using various layouts, UI components, and fragments.
3. Develop Android applications using Intents, Broadcast Receivers, and Notifications
4. Implement persistent storage mechanisms in Android applications using files and shared preferences.
5. Develop Android applications that perform structured data storage and retrieval using SQLite databases and Content Providers.

**UNIT I**

**Introduction to Android Operating System:** Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming.

**Android tools Android application components:** Android Manifest file, Externalizing resources like values, themes, layouts, Menus, Resources for different devices and languages, Runtime Configuration Changes.

**Android Application Lifecycle:** Activities, Activity lifecycle, activity states, monitoring state changes.

**UNIT II**

**Android User Interface:** Measurements – Device and pixel density independent measuring units **Layouts**: Linear, Relative, Grid and Table Layouts

**User Interface (UI) Components**: Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers.

**Event Handling**: Handling clicks or changes of various UI components.

**Fragments:** Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.

**UNIT III**

**Intents and Broadcasts:** Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS.

**Broadcast Receivers**: Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity.

**Notifications:** Creating and Displaying notifications, Displaying Toasts.

**UNIT IV**

**Persistent Storage:** Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference.

**UNIT V**

**Database:** Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

**Textbooks:**


1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.
2. Android Application Development (with Kitkat Support), Black Book, Pradeep Kothari, 2014, Dreamtech Press publisher, Kogent Learning Inc.,2014.


**Reference Books:**


1. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.
2. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.
3. Android Programming: Pushing the Limits, Erik Hellman, 1st Edition,Wiley Publications, 2014.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

# GRAPH THEORY
## (PROFESSIONAL ELECTIVE – I)

**Course Code: GR24A3089** **L/T/P/C: 3/0/0/3**

**III Year I Semester**

**Prerequisites:**
Students are expected to have knowledge in Discrete Mathematics, Design and Analysis of Algorithms

**Course Outcomes:**
1. Summarize the concepts of Paths, Circuits and Graphs.
2. Illustrate the idea of using trees, cut-sets and cut-vertices.
3. Implement planar and Dual graphs with matrix representation.
4. Develop solutions using coloring, covering and partitioning of graphs.
5. Construct algorithms for graph related problems.

**UNIT I**

**Introduction:** Graph, Applications, Finite and Infinite graphs, Incidence and Degree, Isolated Vertex, Pendant Vertex, Null Graph.

**Paths and Circuits:** Isomorphism, Sub-graphs, Walks, Paths and Circuits, Connected Graphs, Disconnected Graphs, Components, Euler Graphs, Hamiltonian Paths and Circuits, Travelling Salesman Problem.

**Directed Graphs:** Directed Graph, Types of Digraphs, Digraphs and Binary Relations, Directed Paths and Connectedness, Euler Digraphs, Trees with Directed Edges, Fundamental Circuits in Digraphs, Matrices Digraphs, Adjacency Matrix of a Digraph.

**UNIT II**

**Trees:** Properties, Pendant Vertex, Distance and Centers, Rooted and Binary Tree, Counting Trees, Spanning Trees, Finding all Spanning Tress of a Graph, Spanning Trees in a Weighted Graph.

**Cut-Sets and Cut-Vertices:** Properties, All Cut-sets in a Graph, Fundamental Circuits and Cut- Sets, Connectivity and Separability, Network Flows, 1-Isomorphisn,2-Isomorphism.

**UNIT III**

**Planar and Dual Graphs:** Planar graphs, Different representations of planar graphs, Detection of Planarity, Geometric dual, Combinatorial dual.

**Matrix Representation of Graphs:** Incidence Matrix, Circuit Matrix, Fundamental Circuit Matrix and Rank, Cut-Set Matrix, Path Matrix, Adjacency Matrix

**UNIT IV**

**Coloring, Covering and Partitioning:** Chromatic Number, Chromatic Partitioning, Chromatic Polynomial, Matching, Coverings, The Four Color Problem.

**UNIT V**

**Graphs Theoretic Algorithms:** Computer Representation of a Graph, Algorithm for- Connectedness and Components, Spanning tree, Cut-Vertices and Separability, Planarity Testing, Isomorphism, Shortest Path.

**Textbooks:**

1. Narasingh Deo, Graph Theory with Applications to Engineering and Computer Science, PHI.
2. J. A. Bondy and U. S. R. Murty. Graph Theory with Applications.

**Reference Books:**

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall India Ltd.
2. Robin J. Wilson, Introduction to Graph Theory, Longman Group Ltd.
3. J. A. Bondy and U. S. R. Murty. Graph Theory, volume 244 of Graduate Texts in Mathematics, Springer, 1st edition, 2008.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DATA WAREHOUSING AND DATA MINING LAB**

**Course Code: GR24A3134** **L/T/P/C: 0/0/2/1**

**III Year I Semester**

**Course Outcomes:**

1. Extract knowledge and implementation of various data mining techniques.
2. Learn the concept of creating database tables in attribute relation file format (.arff).
3. Design database tables in .arff format and insert, modify the data.
4. Apply pre-processing statistical methods for any given raw data.
5. Implement data mining algorithms in real time problem solving using Weka tool.

**Implement the following Tasks using Weka Tool:**

(Solve the tasks 1 to 6 by taking given German credit data as case study)

**The German Credit Data:**

Actual historical credit data is not always easy to come by because of confidentiality rules. Here is one such dataset, consisting of 1000 actual cases collected in Germany. Credit dataset (original) Excel Spreadsheet version of the German credit data (Download from web). In spite of the fact that the data is German, you should probably make use of it for this assignment. (Unless you really can consult a real loan officer).A few notes on the German dataset:

- DM stands for Deutsche Mark, the UNIT of currency, worth about 90 cents Canadian (but looks and acts like a quarter).
- Own_telephone: German phone rates are much higher than in Canada, so fewer people own telephones.
- Foreign_worker: There are millions of these in Germany (many from Turkey). It is very hard to get German citizenship if you were not born of German parents.
- There are 20 attributes in judging a loan applicant. The goal is to classify the applicant into two categories: good or bad.

**TASK 1**

List all the categorical (or nominal) attributes and the real-valued attributes separately. What attributes do you think might be crucial in making the credit assessment? Come up with some simple rules in plain English using your selected attributes. One type of model that you can create is a Decision Tree - train a Decision Tree using the complete dataset as the training data. Report the model obtained after training.

**TASK 2**

Suppose you use your above model (task1) trained on the complete dataset and classify credit good/bad for each of the examples in the dataset. What % of examples can you classify correctly? (This is also called testing on the training set) Why do you think you cannot get 100 % training accuracy? Why or why not? Check to see if the data shows a bias against "foreign workers" (attribute 20),or "personal status" (attribute 9). Did removing these attributes have any significant effect? Discuss.

**TASK 3**

Describe what cross-validation is briefly. Train a Decision Tree again using cross-validation and report your results. Does your accuracy increase/decrease? Why?

**TASK 4**

Another question might be, do you really need to input so many attributes to get good results? Maybe only a few would do. For example, you could try just having attributes 2, 3, 5, 7, 10, 17 (and 21, the class attribute (naturally)). Try out some combinations. Train your Decision Tree again and report the Decision Tree and cross-validation results.

**TASK 5**

Do you think it is a good idea to prefer simple decision trees instead of having long complex decision trees? How does the complexity of a Decision Tree relate to the bias of the model? You can make your Decision Trees simpler by pruning the nodes. One approach is to use Reduced Error Pruning - Explain this idea briefly. Try reduced error pruning for training your Decision Trees using cross- validation (you can do this in Weka) and report the Decision Tree you obtain? Also, report your accuracy using the pruned model. Does your accuracy increase?

**TASK 6**

How can you convert a Decision Trees into "if-then-else rules". Make up your own small Decision Tree consisting of 2-3 levels and convert it into a set of rules. There also exist different classifiers that output the model in the form of rules - one such classifier in Weka is rules. PART, train this model and report the set of rules obtained. Sometimes just one attribute can be good enough in making the decision, yes, just one! Can you predict what attribute that might be in this dataset? Report the rule obtained by training a one R classifier. Rank the performance of j48, PART and one R.

**TASK 7**

(a) Create a data set Student.arff with required data.
(b) Demonstrate preprocessing techniques on dataset Student.arff.

**TASK 8**

(a) Create a data set Employee.arff by adding required data fields.
(b) Apply Association rule mining on dataset Employee.arff (Use Apriori Algorithm).

**TASK 9**

(a) Create a data set Weather.arff with required fields.
(b) Apply preprocessing techniques on dataset Weather.arff and normalize Weather Table data using Knowledge Flow.

**TASK 10**

(a) Demonstrate classification algorithm on dataset student.arff using j48algorithm.
(b) Demonstration of classification rule process on dataset employee.arff using naïve bayes algorithm.

**TASK 11**

(a) Create a data set customer.arff with required fields.

(b) Write a procedure for Clustering Customer data using Simple K-Means Algorithm.

**TASK 12**

Demonstration of clustering rule process on dataset student.arff using simple k-means

**Textbooks:**


1. Data Mining– Concepts and Techniques-Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, Second Edition,2006.
2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.


**Reference Books:**


1. Data Mining Techniques – Arun K. Pujari, Second Edition, Universities Press.
2. Data Warehousing in the Real World, Sam Aanhory and Dennis Murray, Pearson EdnAsia.
3. www.data.gov.in repository

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**COMPUTER NETWORKS LAB**

**Course Code: GR24A3094** **L/T/P/C: 0/0/3/1.5**

**III Year I Semester**

**Prerequisites:**
Basics in Network Models, connectors, Network cables, crimping tool, etc.

**Course Outcomes:**
1. Implement the Data link layer framing methods and protocols.
2. Illustrate routing, security and congestion control algorithms
3. Analyze how network and Internetwork devices are configured using Packet Tracer.
4. Demonstrate Virtual LANs, Network Address Translation, Port Address Translation and routing protocols.
5. Demonstrate how to connect and monitor IOT devices.

**Task-1**
Implement the following Data Link Layer framing methods
a) Bit stuffing b) Character-stuffing c) Character count.

**Task-2**
Implement the following Data Link layer protocols
a) Simplex protocol b) Stop and Wait protocol c) Sliding Window protocol

**Task-3**
Design a program to implement the following:
a) Shortest Path routing protocol b) Distance Vector routing protocol c) Token Bucket algorithm

**Task-4**
Develop a program to implement the following:
a) DES algorithm b) RSA algorithm

**Task-5**
a) Configure network devices, such as hubs and switches within a network topology using Packet Tracer software.
b) Construct a single LAN and understand the concepts and operation of ARP.

**Task-6**
a) Configure and implementation of a Switch within a Network using Packet Tracer.
b) Configure and deploy a router to enable inter-network communication using Packet Tracer.

**Task-7**

a) Configure network topology and implement static routing using Packet Tracer Software.

b) Configure network topology and implement dynamic routing protocol such as RIP, OSPF using Packet Tracer.

**Task-8**

a) Configure network topology to implement VLANs with using Packet Tracer software.

b) Learn and implement basic commands of Computer network like PING, traceroute, nslookup etc.

**Task-9**

a) Configure and examine Network Address Translation (NAT).

b) Configure PAT and interpret NAT table entries for multiple internal hosts.

**Task-10**

a) Configure DHCP Server in the Network using packet tracer software.

b) Configure a remote login using SSH and Telnet.

**Task-11**

a) Establishing a Web Server Connection Using the PC's Web Browser

b) Install Wireshark and view

i) Network Traffic ii)Wired and wireless NIC information iii) Examine Ethernet Frames

**Task-12**

a) Adding IoT devices to Smart Homes using Packet Tracer.

b) Connect and Monitor IoT Devices using Packet Tracer.

**Textbooks:**


1. Packet Tracer Network Simulator, Jesin A, O'REILLY, Packt Publishing.
2. Introduction to Networks Companion Guide (CCNAv7), Cisco Press, Cisco Networking Academy**.**


**Reference Books:**


1. Routing and switching Essentials Companion guide, Cisco Press, Cisco Networking Academy.
2. CISCO PACKET TRACER LABS: Best practice of configuring or troubleshooting Network Kindle Edition, **MULAYAM SINGH**.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DATA VISUALIZATION LAB**

**Course Code: GR24A3144** **L/T/P/C: 0/0/3/1.5**

**III Year I Semester**

**Prerequisites:**

Students should have prior knowledge of

1. Basic programming skills.
2. Fundamentals of Probability and Statistics.

**Course Outcomes:**

On successful completion of this course, students will be able to

1. Understand and apply fundamental data visualization workflows and design principles, including perceptual rules, storytelling techniques, and chart selection heuristics, to effectively represent structured, semi-structured, and unstructured data for diverse business and real-world applications.
2. Create and analyze effective visualizations and dashboards in Tableau, leveraging features like calculated fields, filters, parameters, and interactive controls, to extract actionable insights from business datasets.
3. Perform and automate data cleaning, joining, aggregation, and transformation tasks using Tableau Prep Builder and other ETL workflows, ensuring high-quality, integrated data pipelines for accurate analysis and visualization.
4. Apply advanced visualization techniques such as 2D and 3D plots, manifold learning-based visualization, network/graph-based analytics, and geospatial mapping to explore high-dimensional data, uncover hidden patterns, and support decision-making.
5. Interpret and communicate insights related to product, customer, and order-level performance through interactive dashboards and business intelligence reports, enabling organizations to make data-driven strategic and operational decisions.

**Reference Datasets for implementation:**

a) Global Superstore dataset (in-build)
b) Students Performance in Exams (from Kaggle)
c) Tourism in India Dataset (from Kaggle)

**TASK 1: Data Visualization Workflow**

a) Demonstrate the data visualization workflow by defining visualization concepts, describing processes (data acquisition → cleaning → exploration → visualization → interpretation).
b) Develop a Bar Chart to visualize and analyze sales performance across product categories using a given sales dataset.

**Case study:** Sales Dashboard Preparation

- Understand data (e.g., Global Superstore dataset).
- Identify KPIs (Sales, Profit, Quantity).
- Choose proper chart types.

**Use case:** For decision-making, and to identify top-performing product categories.

**TASK 2: Data Representation Experiments**
**Query:** Which Category contributes the most to Sales?
**Experiments:**

a) Categorical Chart: Bar/Pie Chart: Show sales by category.
b) Hierarchical Chart: TreeMap/Stacked Bar: Sales by Category → Sub-Category.
c) Relational Chart: Scatter/Bubble: Sales vs Profit highlighting category.
d) Temporal Chart: Line/Bump Chart: Sales trend over time by category.
e) Spatial Chart: Filled/Symbol Map: Sales by category across regions.

**Case study:** Market analysis for sales contribution.
**Use case:** Helps stakeholders understand contributions across dimensions.

**TASK 3: 2-D Data Representation**
**Experiments:**

a) Bar chart: Total sales by category, identify highest contributor.
b) Clustered bar: Compare sales by category segmented by region.
c) Dot plot: Find category with lowest sales.
d) Connected dot plot: Analyze profit differences across regions.
e) Pictogram: Represent sales volume per category; highlight top seller.
f) Proportional shape: Visualize sales contribution per category.
g) Bubble chart: Explore revenue, profit, and sales relationships.
h) Radar chart: Evaluate balance among revenue, profit, and sales.
i) Polar chart: Visualize revenue distribution across categories.

**Case study:** E-commerce site analyzing product performance.
**Use case:** Helps visualize relationships and patterns for strategy.

**TASK 4: Advanced 2-D Data Visualization**
**Experiments:**

a) Range chart: Variation in prices; find widest range.
b) Box & whisker: Compare distribution; detect outliers.
c) Univariate scatter: Relationship between satisfaction & sales.
d) Histogram: Order quantity distribution; find most common.
e) Word cloud: Analyze customer feedback themes.
f) Pie chart: Sales distribution by region; find top region.
g) Waffle chart: Sales proportion by category.
h) Stacked bar: Contribution of each region to total sales.
i) Back-to-back bar: Compare sales of two products.
j) Treemap: Hierarchical structure of sales; top sub-category.
k) Scatter: Product price vs ratings; identify patterns.
l) Line chart: Monthly sales trend; highest/lowest months.
m) Dashboard: Combine multiple visualizations for overall performance.

**Case study:** Retail chain analyzing sales & customer feedback.
**Use case:** Provides deep analysis and actionable insights.

**TASK 5: Data Cleaning and Transformation (Tableau Prep)**
Remove nulls & duplicates, standardize dates, rename columns, fix data types.
**Case study:** Cleaning messy sales data for reporting.
**Use case:** Ensures accurate, consistent analytics.

**TASK 6: Joining, Aggregation and Output**
**Experiment:**

a) Join Orders with Returns table.
b) Aggregate by Category & Region → Total Sales & Profit.
c) Create calculated fields (e.g., Profit Ratio = Profit/Sales).
d) Output cleaned dataset.

**Case study:** E-commerce return impact analysis.
**Use case:** Data preparation for business reports.

**TASK 7: TASK 11: 3D and Advanced Data Visualization (Python)**

**TASK 7:** Implement Surface Plots, Contour Plots, Hidden Surface Removal, PM3D Coloring
**Experiment:**

a) Load a 3D dataset (e.g., elevation data or sales data across multiple regions and time).
b) Generate surface and contour plots using tools like Matplotlib (Python) or Gnuplot.
c) Implement hidden surface removal (so only visible surfaces are shown).
d) Apply PM3D coloring to indicate intensity (e.g., heat levels or sales density).

**Case study:** Elevation maps for different terrains using geospatial datasets (like USGS or DEM data).
**Use case:** 3D mapping in geospatial analytics: visualizing terrain elevation, rainfall distribution, or population density.

**TASK 8**: Multi-Dimensional Data Visualization for Relationships Across Variables
**Experiment:**

a) Use a dataset with multiple numerical features (e.g., marketing dataset: ad spend, sales, ROI, customer reach).
b) Create multi-variable visualizations such as bubble charts, parallel coordinates plots, or pair plots (Seaborn).
c) Analyze how one variable affects another (e.g., does higher ad spend increase ROI?).

**Case study:** Visualizing sales performance vs marketing spend across different channels (TV, social media, email campaigns).
**Use case:** Marketing analysis: identifying which channels give the best ROI and optimize ad spend.

**TASK 9:** Manifold Visualization (e.g., t-SNE) to Explore High-Dimensional Datasets
**Experiment:**

a) Take a high-dimensional dataset (e.g., customer purchase data with 50+ features).
b) Apply dimensionality reduction using t-SNE or PCA to project it into 2D/3D space.
c) Plot the clusters and interpret customer segments.

**Case study:** Retail customer segmentation based on buying patterns (e.g., RFM analysis: Recency, Frequency, Monetary value).
**Use case:** Customer segmentation: grouping customers with similar purchasing behavior for targeted marketing.

**TASK 10:** Graph Data Visualization: Analyze & Display Network Structures

**Experiment:**

a) Use a graph/network dataset (e.g., social network followers, website hyperlink structure).
b) Create visualizations using NetworkX (Python) or Gephi to display nodes and edges.
c) Analyze metrics like centrality, shortest paths, and communities.

**Case study:** Visualizing a Facebook/Twitter network showing relationships between users and influencers.

**Use case:** Social network analysis: detect influencers, communities, and information flow.

**TASK 11:** Annotation Techniques: Enhance Clarity and Interpretation

**Experiment:**

a) Take any visualization (bar, line, scatter).
b) Add annotations, labels, reference lines, tooltips to highlight key metrics (e.g., highest sales point, anomaly in data).
c) Compare the chart before and after annotation to see clarity improvements.

**Case study:** Annotating quarterly revenue growth and highlighting dips/spikes in a sales report dashboard.

**Use case:** Presenting KPIs effectively to stakeholders: making dashboards understandable for decision-makers.

**TASK 12: Global Superstore Advanced Analysis**

**Query:** Identify Sub-Categories where top 20 customers have higher sales than others in the same region.

**Further Analysis:**

1. Product level analysis.
2. Customer level analysis.
3. Order level analysis.

**Case study:** Top customer segmentation and targeted marketing.

**Use case:** Identifies loyal customers & informs business strategies.

**Textbooks:**


1. Andy Kirk, Data Visualization: A Handbook for Data Driven Design, 3rd Edition Paperback, 2025.
2. Cole Nussbaumer Knaflic, Storytelling with Data: A Data Visualization Guide for Business Professionals, Wiley, 2015.
3. Philipp K. Janert, Gnuplot in Action, 2nd Edition, 2016.


**Reference Books:**


1. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 3rd Edition, 2022.
2. Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, 2nd Edition, 2022.
3. Kyran Dale, Data Visualization with Python and JavaScript, 2nd Edition, 2017.

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

**Course Code: GR24A3013** **L/T/P/C: 0/0/2/1**

**III Year I Semester**

**Course Outcomes:**

On successful completion of this course, 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.

**Syllabus**:

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

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

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

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

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

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

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

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

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

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

**Textbooks:**


1. Rizvi, M. Ashraf (2018). Effective Technical Communication. (2nd ed.). McGraw Hill Education (India) Pvt. Ltd.
2. Suresh Kumar, E. (2015). Engineering English. Orient BlackSwan Pvt. Ltd.
3. Bailey, Stephen. (2018). Academic Writing: A Handbook for International Students. (5th Edition). Routledge.
4. Koneru, Aruna. (2016). Professional Communication. McGraw Hill Education (India) Pvt. Ltd.
5. Raman, Meenakshi & Sharma, Sangeeta. (2022). Technical Communication, Principles and Practice. (4th Edition) Oxford University Press.
6. Anderson, Paul V. (2007). Technical Communication**.** Cengage Learning Pvt. Ltd. New Delhi.
7. McCarthy, Michael; O'Dell, Felicity & Redman, Stuart. (2017). English Vocabulary in Use Series. Cambridge University Press

8. Sen, Leela. (2009). Communication Skills. PHI Learning Pvt Ltd., New Delhi.
9. Elbow, Peter. (1998). Writing with Power. Oxford University Press.
10. Goleman, Daniel. (2013). Emotional Intelligence: Why it can matter more than IQ. Bloomsbury Publishing.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**CONSTITUTION OF INDIA**

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

**III Year I Semester**

**Course Outcomes:**

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**

**MACHINE LEARNING**

**Course Code: GR24A3082** **L/T/P/C: 3/0/0/3**

**III Year II Semester**

**Prerequisites:**

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

**Course Outcomes:**

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

**UNIT-I**

**Introduction:** Introduction to machine learning, Supervised learning, Unsupervised learning, Semi-supervised learning, Reinforcement learning, Deep learning.

**Concept learning and General to Specific Ordering:** A Concept Learning Task, Concept Learning as Search, Find-S Finding a Maximally Specific Hypothesis.

**Feature Engineering:** Feature Selection using Filter, Wrapper, Embedded methods, and Feature normalization using min-max normalization, z-score normalization, and constant factor normalization,

**Introduction to Dimensionality Reduction:** Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) techniques.

**UNIT-II**

**Supervised Learning – I (Regression and Classification)**

**Regression models:** Simple linear regression, Multiple linear regression. Cost Function, Gradient Descent, Performance Metrics: Mean Absolute Error (MAE), Mean Squared Error (MSE), R-Squared error, Adjusted R Square.

**Classification models:** Decision Trees-ID3, CART, Naive Bayes, K-Nearest-Neighbours (KNN), Logistic regression, Multinomial logistic regression, Support Vector Machines (SVM).

**UNIT-III**

**Supervised Learning – II (Classification with Neural Networks)**

**Neural Network Representation:** Introduction to Artificial Neural Networks (ANN), Activation Functions, Perceptron and Back Propagation algorithms.

**Convolutional Neural Networks**-Convolution and Pooling layers, Recurrent Neural Networks (RNN).

**Classification Metrics**: Confusion matrix, Precision, Recall, Accuracy, F-Score, ROC curves.

**UNIT-IV**

**Model Validation in Classification:** Cross Validation - Holdout Method, K-Fold, Stratified K-Fold, Leave-One-Out Cross Validation (LOOC-V). Bias-Variance tradeoff, Regularization, Overfitting, Underfitting.

**Ensemble Methods:** Boosting, Bagging, Random Forest classifier.

**UNIT-V**

**Unsupervised Learning:** K-means, K-Modes, K-Prototypes, Gaussian Mixture Model clustering algorithms, Expectation-Maximization, BIRCH clustering algorithms.

**Reinforcement Learning**: Exploration and exploitation trade-offs, non-associative learning, Markov decision processes, Q-learning.

**Textbooks:**


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


**Reference Books:**


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

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**AUTOMATA AND COMPILER DESIGN**

**Course Code: GR24A3096** **L/T/P/C: 2/1/0/3**

**III Year II Semester**

**Course Outcomes:**

1. Articulate the models for regular sets grammar for program constructs.
2. Develop the phases of the compiler for a language definition through regular expressions and grammars.
3. Build the Bottom up parsers and intermediate code generation algorithms.
4. Experiment memory management techniques in the phases of compiler.
5. Interpret the Code optimization and code generation techniques.

**UNIT I**

**Introduction:** Alphabets, Strings and Languages, Automata and Grammars, introduction to CFG, Ambiguous grammar, Regular Expressions, Deterministic Finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic Finite Automata (NFA), Arden's theorem.

**UNIT II**

**Compiler Structure:** Compilers and Translators, Various Phases of Compiler, Pass Structure of Compiler, Bootstrapping of Compiler.

**Lexical Analysis:** The role of Lexical Analyzer, The Lexical- Analyzer Generator Lex.

**Syntax Analysis:** CFG, Lexical Versus Syntactic Analysis, Eliminating Ambiguity, Elimination of Left Recursion, Left Factoring.

**Top-Down parsers:** Recursive-Descent Parsing, FIRST and FOLLOW, LL(1) Grammars, Non recursive Predictive Parsing, Error Recovery in Predictive Parsing.

**UNIT III**

**Bottom–up Parsers:** Reductions, Handle Pruning, Shift-Reduce Parsing, Conflicts During Shift-Reduce Parsing, LR Parsers: SLR, Canonical LR, LALR, Parser Generators: YACC. Syntax Directed translation mechanism and attributed definition.

**Intermediate Code Generation:** Variants of Syntax Trees, Three-Address Code, Quadruples & Triples, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Switch- Statements, Intermediate Code for Procedures.

**UNIT IV**

**Run Time Memory Management:** Static and Dynamic storage allocation, stack-based memory allocation schemes, Symbol Table management, Error Detection and Recovery: Lexical phase errors, Syntactic phase errors, Semantic errors.

**UNIT V**

**Code Optimization and Code Generation:** Local optimization, Loop optimization, Peephole optimization, Basic blocks and flow graphs, DAG, Data flow analyzer, Machine Model, Order of evaluation, Register allocation and code selection.

**Textbooks:**

1. Introduction to Theory of Computation. Sipser, 2nd Edition, Thomson.
2. Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education.
3. Compilers Principles, Techniques and Tools Aho, Ullman, Sethi, Pearson Education.

**Reference Books:**

1. Modern Compiler Construction in C , Andrew W. Appel Cambridge University Press.
2. Compiler Construction, LOUDEN, Thomson.
3. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group.
4. Principles of Compiler Design, V.Raghavan, TMH.
5. Engineering a Compiler, K. D. Cooper, L.Torczon, ELSEVIER.
6. Introduction to Formal Languages and Automata Theory and Computation –Kamala Krithivasan and Rama R, Pearson.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**BIG DATA ANALYTICS**

**Course Code: GR24A3137** **L/T/P/C: 3/0/0/3**

**III Year II Semester**

**Prerequisite:**
Students should have knowledge of any Programming Language, basics of SQL, and exposure to Linux/ UNIX Environment.

**Course Outcomes:**
On successful completion of this course, students will be able to
1. Analyze the role of HDFS in storing and processing large-scale Big Data.
2. Evaluate the significance of data ingestion tools for integrating diverse datasets in Big Data systems.
3. Develop distributed data processing solutions using MapReduce and Pig for large-scale analytics.
4. Construct queries in Hive and HBase to efficiently manage and analyze structured and unstructured data.
5. Examine Apache Spark components to enable scalable in-memory data processing.

**UNIT - I**
**Introduction to Big Data and Hadoop**
Types of Digital Data, Definition of Big Data, V's of Big Data, Advantages of Big Data, Characteristics of Hadoop, RDBMS Vs Hadoop, Ecosystem components of Hadoop, Big Data Analytics Pipeline, Hadoop Distributions, Need for HDFS, Characteristics of HDFS, HDFS Components, HDFS High Availability Architecture, Block Replication Method, Rack Awareness, HDFS Commands.

**UNIT - II**
**Data Ingestion into Big Data Systems and ETL**
Big Data Ingestion Tools, Apache Sqoop, Benefits of Apache Sqoop, Sqoop Connectors, Importing and Exporting to and from Hadoop using Sqoop, Limitations of Sqoop, Apache Flume Model, Data Sources for FLUME, Components of FLUME Architecture.

**UNIT - III**
**Distributed Processing - Map Reduce and PIG**
Need for YARN, Elements of YARN Architecture, Characteristics of Map Reduce, Phases of Map Reduce with an Example, Anatomy of MR Job Run with YARN, Handling Failures, Task Execution, Map Reduce Input and Output Formats, Shuffle and Sort, Joins in Map Reduce, Introduction to PIG, Components of PIG, Data Types in PIG – Simple and Complex, PIG Execution Modes, PIG Interactive Modes, Comparison of PIG with databases, Data Processing Operators.

**UNIT - IV**

**Apache Hive and NOSQL Database - HBase**

Features of HIVE, HIVE Architecture, HIVE Meta store, Datatypes in HIVE, HIVEQL, Tables, File Format Types–Text, Sequence, AVRO, Parquet, Querying Data, Types of NOSQL Database, Characteristics of HBASE, Architecture, HBase Vs RDBMS, HBASE Shell Commands.

**UNIT - V**

**Apache Spark**

Functional Programming, Components of Apache Spark, Applications of in-memory processing, Hadoop Ecosystem Vs. Spark, Spark Architecture, RDDs in Spark, SparkSQL, Architecture of SparkSQL, Data Frames, Data Analytics, Types of Analytics.

**Textbooks:**


1. Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O’Reilly Media, 2015.
2. Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia, “Learning Spark: Lightning-Fast Big Data Analysis”, O’Reilly Media, 2015.


**Reference Books:**


1. Seema Acharya, Subhasini Chellappan, “Big Data Analytics”, Wiley, 2015.
2. Chris Eaton, Dirk Deroos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill, 2012.
3. Lars George, “HBase: The Definitive Guide”, O’Reilly Media, 2011.
4. Edward Capriolo, Dean Wampler, Jason Rutherglen, “Programming Hive”, O’Reilly Media, 2012.
5. Alan Gates, “Programming Pig”, O’Reilly Media, 2011.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**SOFTWARE ENGINEERING**
**(PROFESSIONAL ELECTIVE-II)**

**Course Code: GR24A3098** **L/T/P/C: 3/0/0/3**

**III Year II Semester**

**Course Outcomes**:

1. Understand business requirements and choose a relevant Process model for a given software proposal.
2. Analyze the requirements to prepare SRS.
3. Model various Architectural Designs for a software project.
4. Develop various functional and structural test cases for a software module.
5. Estimate the Cost and Schedules of a Software Project.

**UNIT I**

**Introduction to Software Engineering:** The evolving role of software, Changing Nature of Software, Software myths.

**A Generic view of process:** Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models.

**Process models:** The waterfall model, Incremental process models, Evolutionary process models, The Unified process.

**UNIT II**

**Software Requirements:** Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.

**Requirements engineering process:** Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

**UNIT III**

**Design Engineering:** Design process and Design quality, Design concepts, the Design model.

**Creating an architectural design:** Software architecture, Data design, Architectural Styles and Patterns, Architectural Design.

**Performing User interface design:** Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

**UNIT IV**

**Testing Strategies:** A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging.

**Product metrics:** Software Quality, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance.

**Metrics for Process and Products:** Software Measurement, Metrics for software quality.

**UNIT V**

**Risk management:** Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan.

**Quality Management:** Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards.

**Textbooks:**

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition. McGraw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson education.

**Reference Books:**

1. Software Engineering- K.K. Agarwal & Yogesh Singh, New Age International Publishers.
2. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiely.
3. Systems Analysis and Design- Shely Cashman Rosenblatt, Thomson Publications.
4. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**INFORMATION RETRIEVAL SYSTEMS**
**(PROFESSIONAL ELECTIVE-II)**

**Course Code: GR24A3139** **L/T/P/C: 3/0/0/3**

**III Year II Semester**

**Prerequisite:**
Students should have prior knowledge of Data Structures and Database Management Systems.

**Course Outcomes**:
On successful completion of this course, students will be able to:

1. Apply IR principles to locate relevant information in extensive data collections.
2. Design and differentiate various indexing and document clustering algorithms.
3. Implement retrieval systems for web-based search tasks.
4. Analyze and apply user search techniques with ranking and feedback methods.
5. Design and evaluate an information retrieval system with visualization and multimedia retrieval features.

**UNIT I**
**Introduction to Information Retrieval Systems:** Definition, Objectives, and Functional Overview. Relationship to Database Management Systems, Digital Libraries, and Data Warehouses.
**Information Retrieval System Capabilities:** Capabilities include Search, Browse, and Miscellaneous Functions.

**UNIT II**
**Cataloguing and Indexing:** History and Objectives of Indexing, Indexing Process, Automatic Indexing, **Information Extraction and Data Structures:** Introduction to Data Structures, Stemming Algorithms, Inverted File Structures, N-Gram Data Structures, PAT Data Structures, Signature File Structures, Hypertext and XML Data Structures, Hidden Markov Models.

**UNIT - III**
**Automatic Indexing:** Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages
**Document and Term Clustering:** Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters.

**UNIT - IV**
**User Search Techniques:** Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET, and Hypertext.
**Information Visualization:** Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies.

**UNIT - V**

**Text Search Algorithms:** Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems.

**Multimedia Information Retrieval:** Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval.

**Information System Evaluation:** Introduction, Measures used in system evaluation, Measurement example – TREC results.

**Textbooks:**

1. Gerald J. Kowalski, Mark T. Maybury, Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Springer, 2009.
2. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, *Modern Information Retrieval*, Pearson Education, 1999.

**Reference Books:**

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
2. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons, 1997.

**E-Learning Resources:**

1. Coursera – NLP Course (https://class.coursera.org/nlp/lecture/178).
2. Cosmo Learning – Database Design (http://cosmolearning.org/courses/database-design-417/video-lectures/).
3. NPTEL – Database & IR Lectures (http://nptel.ac.in/video.php?subjectId=106102064).

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DEVOPS**
**(PROFESSIONAL ELECTIVE-II)**

**Course Code: GR24A3097** **L/T/P/C: 3/0/0/3**

**III Year II Semester**

**Pre-requisites:**
Students are expected to have knowledge in
1. Software Engineering
2. Software Project Management

**Course Outcomes:**
1. Summarize the principles of DevOps, Agile and ITIL.
2. Analyze software development models and architectural patterns.
3. Demonstrate the use of source code management tools.
4. Build and manage CI/CD pipelines.
5. Apply automated testing and deployment strategies.

**UNIT-I**
**Introduction to DevOps:**
Introduction, Agile development model, DevOps and ITIL, DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, identifying bottlenecks.

**UNIT-II**
**Software development models and DevOps:**
DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing. DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Micro services and the data tier, DevOps, architecture, and resilience.

**UNIT-III**
**Introduction to Project Management:**
The need for source code control, the history of source code management, Roles and code, source code management system and migrations, shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab**.**

**UNIT-IV**
**Integrating the system:**
Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

**UNIT-V**

**Testing Tools and Deployment:**

Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development. Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker.

**Textbooks:**


1. Joakim Verona., Practical DevOps, Packt Publishing, 2016.
2. The Devops Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations by Gene Kim, Jez Humble, et al.


**Reference Books:**


1. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications.
2. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**BLOCKCHAIN TECHNOLOGY**

**(PROFESSIONAL ELECTIVE-II)**

**Course Code: GR24A3140** **L/T/P/C: 3/0/0/3**

**III Year II Semester**

**Course Outcomes:**

1. Summarize the fundamental concepts of Blockchain, Consensus mechanism and Cryptocurrency.
2. Illustrate the application of public blockchain system and smart contract in industry.
3. Comprehend the characteristics of private blockchain, consortium blockchain.
4. Demonstrate the security, privacy challenges and applications of blockchain.
5. Develop blockchain programs for real time applications.

**UNIT-I**

**Fundamentals of Blockchain:** Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

**Blockchain Types and Consensus Mechanism**: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol.

**Cryptocurrency – Bitcoin, Altcoin and Token:** Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

**UNIT-II**

**Public Blockchain System:** Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain.

**Smart Contracts:** Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

**UNIT-III**

**Private Blockchain System:** Introduction, Key Characteristics of Private Blockchain, Why We Need Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E-commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.

**Consortium Blockchain: I**ntroduction, Key Characteristics of Consortium Blockchain, Why We Need Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda.

**UNIT-IV**

**Security in Blockchain:** Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

**Applications of Blockchain:** Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Healthcare, Blockchain in Real-estate, The Blockchain and IoT. Limitations and Challenges of Blockchain.

**UNIT-V**

**Blockchain Case Studies:** Case Study 1 – Retail, Case Study 2 – Banking and Financial Services, Case Study 3 – Healthcare, Case Study 4 – Energy and Utilities.

**Blockchain Platform using Python**: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.

**Blockchain platform using Hyperledger Fabric:** Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

**Textbooks:**


1. "Blockchain Technology", Chandramouli Subramanian, Asha A. George, Abhilash K A and Meena Karthikeyan, Universities Press.
2. "Blockchain Technology Concepts and Applications" Kumar Saurabh, Ashutosh Saxena, Wiley Publications.


**Reference Books:**


1. Blockchain Blueprint for Economy, Melanie Swan, SPD O'Reilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gaur, Pearson Addition Wesley.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**MACHINE LEARNING LAB**

**Course Code: GR24A3093** **L/T/P/C: 0/0/3/1.5**

**III Year II Semester**

**Prerequisites:**

1. Mastery of introduction-level algebra, statistics, and probability theory.
2. Proficiency in basic programming skills and coding experience in Python or R programming.

**Course Outcomes:**

1. Illustrate the applications of python's machine learning libraries.
2. Apply dimensionality reduction techniques in machine learning applications.
3. Design and analyze various supervised learning mechanisms.
4. Develop back propagation and Random Forest algorithms.
5. Design and analyze various unsupervised learning algorithms.

**Task 1**

Write a python program to import and export data using Panda's library functions.

**Task 2**

Demonstrate various data preprocessing techniques for a given dataset.

**Task 3**

Implement dimensionality reduction using Principal Component Analysis (PCA) method.

**Task 4**

Write a python program to demonstrate various Data Visualization Techniques.

**Task 5**

Implement Simple and Multiple Linear Regression models.

**Task 6**

Develop Logistic Regression model for a given dataset.

**Task 7**

Develop Decision Tree classification model for a given dataset and use it to classify a new sample.

**Task 8**

Implement Naïve Bayes Classification in Python for a given dataset.

**Task 9**
Build KNN Classification model in python for a given dataset.

**Task 10**
Implement Back propagation model in python for a given dataset.

**Task 11**
a) Implement Random Forest classification method in python for a given dataset.
b) Implement Boosting ensemble method on a given dataset.

**Task 12 (with & without Libraries)**
a) Write a python program to implement K-Means clustering algorithm.
b) Write a python program to implement the BIRCH algorithm.

**Reference Books:**

1. Python Machine Learning by Sebastian Raschka, Oreilly Publishers.
2. Machine Learning – Tom M. Mitchell, -MGH.
3. Data Mining–Concepts and Techniques -Jiawei Han and Micheline Kamber, Morgan Kaufmann.
4. Introduction to Data Mining - Michael Steinbach, Pang-Ning Tan, and Vipin Kumar (Second Edition).
5. Christopher Bishop, Pattern Recognition and Machine Learning, Springer.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**BIG DATA ANALYTICS LAB**

**Course Code: GR24A3142** **L/T/P/C: 0/0/3/1.5**

**III Year II Semester**

**Prerequisite:**
Students should have knowledge of any Programming Language, basics of SQL, and exposure to Linux/ UNIX Environment.

**Course Outcomes:**
On successful completion of this course, students will be able to
1. Demonstrate proficiency in the Hadoop ecosystem by understanding its architecture, components, and working environment for big data processing.
2. Design and implement MapReduce programs to address real-world large-scale data processing and analytical problems.
3. Develop Pig scripts to perform data transformation, analysis, and problem-solving in big data applications.
4. Formulate and optimize Hive queries to analyse structured and semi-structured datasets effectively.
5. Apply Spark for large-scale data processing and explore its integration with R for advanced data analytics and machine learning tasks.

**TASK-1: HDFS Basics**
Practice creation of directories, uploading files, listing, reading, downloading, and deleting files in HDFS.
**Case study:** Manage student assignment files by uploading, viewing, and retrieving them from HDFS.
**Use case:** It provides foundational skills for handling distributed storage in Big Data environments.

**TASK-2: Data Ingestion**
**a)** Import structured data into Hadoop HDFS using Apache Sqoop.
**b)** Ingest structured and unstructured data into Hadoop using Flume.
**Case study:** E-commerce Data Pipeline Scenario.
**Use case:** Structured Data: Customer transaction records stored in a MySQL database.
Unstructured Data: Raw web server logs (access/error logs) and user activity streams

**TASK-3: MapReduce Basics**
**a)** Write a Word Count program to simulate the MapReduce paradigm.
**Case study:** Count word frequencies in a large text dataset.
**Use case:** Introduces distributed programming with Map and Reduce phases.
**b)** Implement a MapReduce program for matrix multiplication.
**Case study:** Multiply two large matrices stored in HDFS.
**Use case:** Demonstrates parallel computation for large-scale mathematical operations.

**TASK-4: Weather Data Analysis with MapReduce**
Implement a MapReduce program to mine and analyse weather datasets.
**Case study:** Extract yearly maximum/minimum temperatures from meteorological data.
**Use case:** Useful in climate studies, sensor analysis, and environmental monitoring.

**TASK-5: Pig Latin – Data Operations**
Write Pig Latin scripts to sort, group, join, project, and filter datasets.
**Case study:** Analyse sales data to group by region, filter by product, and project attributes.
**Use case:** Simplifies data analysis tasks without writing complex MapReduce code.

**TASK-6: Pig Latin – Data Analysis**
**a)** Write a Pig Latin script to count the number of words in a text file.
**Case study:** Perform word count on book or article datasets.
**Use case:** Text analytics for natural language processing.
**b)** Develop a Pig Latin script to find maximum temperature across years using weather datasets.
**Case study:** Identify hottest recorded temperatures over decades.
**Use case:** Applied in meteorological research and big data analytics.

**TASK-7: Pig UDFs (User Defined Functions)**
Create User Defined Functions/Eval functions in Pig to handle unwanted data during processing.
**Case study:** Cleanse dataset by removing nulls, duplicates, or noisy values.
**Use case:** Ensures data quality in ETL (Extract, Transform, Load) workflows.

**TASK-8: Hive Basics**
Use Hive to create, alter, and drop databases, tables, and views.
**Case study:** Define a table for employee records and query using HiveQL.
**Use case:** Provides SQL-like interaction with Hadoop for structured data analysis.

**TASK-9: Hive Advanced**
Practice User Defined Functions (UDFs) and indexes in Hive.
**Case study:** Create a Hive UDF to format dates and apply indexing on employee IDs.
**Use case:** Enhances Hive query performance and flexibility for enterprise data.

**TASK-10: HBase Operations**
Write queries in HBase to handle databases (create, insert, update, scan).
**Case study:** Store and retrieve student records in HBase tables.
**Use case:** Supports real-time NoSQL database operations on top of Hadoop.

**TASK-11: Apache Spark Basics**
Develop a Spark program for processing large datasets.
**Case study:** Perform word count or log analysis using Spark RDD transformations.
**Use case:** Provides faster distributed data processing compared to MapReduce.

**TASK-12: Spark SQL**
Practice data analysis using Spark SQL environment.
**Case study:** Load structured sales data into Spark SQL and run aggregation queries.
**Use case:** Combines SQL querying power with Spark's scalability for large datasets.

**Textbooks:**

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media, 2015.
2. Bill Chambers and Matei Zaharia, "Spark: The Definitive Guide", 1st Edition, O'Reilly Media, 2018.


**Reference Books:**

1. Alex Holmes, "Hadoop in Practice", 2nd Edition, Manning Publications, 2015.
2. Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", 1st Edition, O'Reilly Media, 2012.
3. Lars George, "HBase: The Definitive Guide", 1st Edition, O'Reilly Media, 2011.
4. Tanmay Deshpande, "Hadoop Real-World Solutions Cookbook", 2nd Edition, Packt Publishing, 2016.
5. Dirk deRoos, "Hadoop For Dummies", 1st Edition, John Wiley & Sons, 2014.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**MINI PROJECT WITH SEMINAR**

**Course Code: GR24A3027** **L/T/P/C: 0/0/4/2**

**III Year II Semester**

**Prerequisite:**

Students should have prior knowledge of

- Basics of Programming and Data Structures
- Core Computer Science Subjects' Knowledge
- Fundamentals of Project Design and Technical Communication

**Course Outcomes:**

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

1. Apply fundamental and domain-specific knowledge to frame a clear abstract, identify objectives, and justify the significance of the mini project with appropriate literature support.
2. Design and analyse architectural solutions, define suitable methodologies, and evaluate the scalability, feasibility, and data flow for the proposed project.
3. Divide the project into well-structured modules, implement them using suitable computing frameworks, integrate components, and validate outputs through systematic execution cycles.
4. Plan, schedule, and manage project tasks effectively, demonstrate teamwork, adhere to specified timelines, and ensure successful completion within given constraints.
5. Prepare professional documentation, deliver effective oral presentations, and showcase technical content confidently through seminars, road shows, and technical event participation.

# IV Year

# I Semester

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**BUSINESS INTELLIGENCE**

**Course Code: GR24A4104** **L/T/P/C: 3/0/0/3**

**IV Year I Semester**

**Prerequisite:**
Students should have prior knowledge of Database Management Systems, Data Mining and Data Warehousing**.**

**Course Outcomes:**
On successful completion of this course, students will be able to
1. Understand the core concepts and principles of business intelligence fundamentals.
2. Integrate data mining techniques with business intelligence systems for enhanced decision-making.
3. Design suitable modeling approaches for analyzing complex business problems.
4. Analyze business data and present insights using visualization tools and techniques.
5. Review and recommend appropriate techniques for developing effective business intelligence solutions.

**UNIT I**
**Introduction to Business Intelligence**: Effective and Timely Decisions-Data, Information and Knowledge, Role of mathematical models, Fundamentals of BI.
**Business intelligence Architectures:** Cycle of a Business Intelligence Analysis, BI Implementation Challenges and Success Factors, Enabling Factors in Business Intelligence Projects, Development of a Business Intelligence System, Ethics and Business Intelligence.

**UNIT II**
**Knowledge Delivery:** The Business Intelligence User Types, Standard Reports, Interactive Analysis and Ad hoc Querying, Parameterized Reports and Self-Service Reporting, Dimensional Analysis, Alerts/Notifications
**Visualization:** Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations, Optimizing the Presentation for the Right Message.

**UNIT III**
**Efficiency Measures:** CCR Model with Target Objectives, Peer Groups, Identification of Best Operating Practices, Cross-Efficiency Analysis, Virtual Inputs and Outputs and Alternative Models, Pattern Matching-Including Cluster Analysis and Outlier Detection.

**UNIT IV**
**Business intelligence Applications:** Marketing Models, Logistic and Production Models, Supply Chain Analytics and CRM Analytics, Case Studies.

**UNIT V**

**Future Of Business Intelligence:** Future of Business Intelligence, Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics, Advanced Visualization- Rich Report, Future Beyond Technology, Business Analytics Tools- COGNOS.

**Textbooks:**


1. Business Intelligence: Data Mining and Optimization for Decision Making, Carlo Vercellis, Wiley, 1st Edition, 2009.
2. Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications, Larissa T. Moss & Shaku Atre, Addison-Wesley Professional, 1st Edition, 2003.
3. Business Intelligence: A New Paradigm, Claudio Vettor, Lulu.com, 1st Edition, 2016.


**Reference Books:**


1. "Big Data in Practice: How 45 Successful Companies Used Big Data Analytics to Deliver Extraordinary Results", Bernard Marr, 1st Edition, 2016**.**
2. The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Ralph Kimball & Margy Ross, Wiley, 3rd Edition, 2013.
3. Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst, Dean Abbott, Wiley, 1st Edition, 2014.
4. Data Mining Techniques for Marketing, Sales, and CRM, Michael J.A. Berry & Gordon S. Linoff, Wiley, 3rd Edition, 2011.
5. Fundamentals of Business Analytics, Ramesh Sharda, Dursun Delen & Efraim Turban, Pearson, 1st Edition, 2015.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**NEURAL NETWORKS AND DEEP LEARNING**

**Course Code: GR24A3101** **L/T/P/C: 3/0/0/3**

**IV Year I Semester**

**Prerequisites:**

The subject of Neural Networks & Deep Learning requires strong mathematical concepts of probability, statistics, matrices and a course on Artificial Intelligence is expected to be completed by the student.

**Course Outcomes:**

1. Summarize the working of basic ANN models and Supervised Learning Models.
2. Apply different unsupervised learning networks that can be used to solve a problem.
3. Compare the working of ANN models and Deep learning models in selecting a network for solution.
4. Evaluate Parameter Regularization Procedure in Deep Neural network.
5. Design various Deep learning optimization algorithms for real-time applications.

**UNIT I**

**Artificial Neural Networks -** Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks: Perceptron, Single Layer, Multilayer Perceptron Networks, Adaptive Linear Neuron, Back- propagation Network. Associative Memory Networks. BAM and Hopfield Networks.

**UNIT II**

**Unsupervised Learning Network-** Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks- Introduction to various networks.

**UNIT III**

**Introduction to Deep Learning**: Historical Trends in Deep learning, Deep Feed - forward networks, Gradient- Based learning, Hidden Units, Architecture Design, Back- Propagation and Other Differentiation Algorithms, Transfer learning.

**UNIT IV**

**Regularization for Deep Learning:** Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations.

**UNIT V**

**Optimization for Train Deep Models:** Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates.

**Applications:** Large-Scale Deep Learning, Computer Vision, Image classification, Speech, Recognition, Natural Language Processing, GANS.

**Textbooks:**


1. Deep Learning –Ian Good fellow, Yoshua Bengio, Aaron Courville — MIT Pressbook-ISBN-13: 978- 0262035613,
2. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.


**Reference Books:**


1. Artificial Neural Networks – B. Vegnanarayana Prentice Hall of India P Ltd2005
2. Neural Networks in Computer Intelligence, Li Mm Fu TMH2003
3. Deep Learning Fundamentals: An Introduction for Beginners by Chao Pan , AI Sciences Publisher.
4. Pattern Recognition and Machine Learning - Christopher M. Bishop -Information Science and Statistics.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**CRYPTOGRAPHY AND NETWORK SECURITY**
**(PROFESSIONAL ELECTIVE-III)**

**Course Code: GR24A4089** **L/T/P/C: 3/0/0/3**

**IV Year I Semester**

**Prerequisites:**
Students should have good knowledge in Computer Networks

**Course Outcomes:**
1. Summarize the security attacks, services and mechanisms.
2. Apply various public key and private key cryptographic algorithms for encryption and decryption.
3. Articulate the issues and structure of Authentication Service and Electronic Mail Security.
4. Interpret the IP Security Architecture, Web Security and Key Management techniques.
5. Analyze intrusion detection, Web security, firewalls.

**UNIT I**
Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) Security Mechanisms, a model for Internetwork security.

**UNIT II**
Conventional Encryption Principles, substitution ciphers, transposition ciphers. Conventional encryption algorithms (DES, Blowfish, Idea), cipher block modes of operation, location of encryption devices, key distribution.
Public key cryptography principles, public key cryptography algorithms (RSA, Diffie-Hellman, ECC), digital signatures, digital certificates, certificate authority and key management.

**UNIT III**
Approaches of Message Authentication, Secure Hash Functions (MD-5,SHA-1) and HMAC. Kerberos, X.509 Directory Authentication Service.
**Email Security:** Pretty Good Privacy (PGP), MIME,S/MIME.
**Wireless Network Security:** Wireless Security, Mobile Device Security, Wireless LAN Security.

**UNIT IV**
**IP Security:** Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.
**Transport-level Security:** Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

**UNIT V**

Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3, Intruders, Viruses and related threats, firewall Design principles, Trusted System, Intrusion Detection Systems.

**Case Studies on Cryptography and security:** Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.

**Textbooks:**


1. Cryptography and Network Security Principles and Practice, Global Edition, Eighth Edition, William Stallings, Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley Dreamtech.


**Reference Books:**


1. Fundamentals of Network Security by Eric Maiwald (Dreamtech press).
2. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.
3. Principles of Information Security, Whitman, Thomson.
4. Network Security: The complete reference, Robert Bragg, Mark Rhodes,TMH
5. Introduction to Cryptography, Buchmann, Springer.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**COMPUTER VISION AND ROBOTICS**
**(PROFESSIONAL ELECTIVE-III)**

**Course Code: GR24A4131** **L/T/P/C: 3/0/0/3**

**IV Year I Semester**

**Prerequisites:**
Students should have prior knowledge of
- Fundamentals of linear algebra and probability**.**
- Core concepts of machine learning and programming (Python preferred).

**Course Outcomes:**
On successful completion of this course, students will be able to
1. Apply concepts of image acquisition, representation, filtering, and restoration, along with camera models and geometric transformations, to analyze vision-based systems.
2. Utilize imaging devices, lighting methods, and image analysis techniques for robotic vision, and design basic object recognition pipelines by training vision systems.
3. Estimate pose and motion using feature alignment, structure-from-motion principles, optical flow, and visual odometry, to support trajectory tracking in robotics.
4. Implement SLAM methods by integrating feature-based and direct approaches with sensor fusion techniques (IMU, stereo, RGB-D) for effective robot localization and mapping.
5. Apply machine learning and deep learning methods for object recognition and scene understanding, and explore active, incremental, and embodied learning strategies in robotic vision.

**UNIT - I**
**Fundamentals of Computer Vision:** Image acquisition and representation, image transformation, filtering, restoration, morphing, Camera Models, Calibration, Single view geometry, Multiple view geometry.

**UNIT - II**
**Robotic Machine Vision**: Imaging Devices, Lighting Techniques, Image Processing & Analysis, Analog to Digital Signal Conversion, Object recognition, Training the Vision System.

**UNIT - III**
**Position and Orientation:** Feature based alignment, Pose estimation, Time varying pose and trajectories. Basics of Structure from motion, Basic optical flow, Basic Visual Odometry Principles, Bundle Adjustment.

**UNIT - IV**
**Localization and Mapping:** Initialization, Tracking, Mapping, Geometric SLAM formulations (indirect vs. direct error formulation, geometry parameterization, sparse vs. dense model, optimization approach).
**Examples:** Indirect (Feature based) methods (MonoSLAM, PTAM, ORB-SLAM), Direct methods (DTAM, LSD-SLAM), Sensor combinations (IMU, mono vs. Stereo, RGB-Depth).

**UNIT -V**

**Recognition and Interpretations:** Concepts of machine learning and deep learning, sequence modelling.

**Learning for Robotic Vision:** Active learning, Incremental and Class Incremental Learning, identify unknowns.

**Embodiment for Robotic Vision:** Active vision, Spatial and Temporal embodiment, Reasoning for object.

**Textbooks:**


1. H. R. Everett, Sensors for Mobile Robots: Theory and Application, A K Peters/CRC Press, 2019.
2. Dahiya, Ravinder S., Valle, Maurizio, Robotic Tactile Sensing, Springer, 2013.


**Reference Books:**


1. S. R. Deb, Sankha Deb, Robotics Technology and Flexible Automation, 2nd edition, McGraw Hill Education, 2017.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis and Machine Vision, Cengage, Third Edition, 2013.
3. Abdessalan Bouzerdoum, George Mamic and M. Bennamoun, Object Recognition: Fundamentals & Case Studies, First Edition, Universities Press, 2008.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**NATURAL LANGUAGE PROCESSING**
**(PROFESSIONAL ELECTIVE-III)**

**Course Code: GR24A3125** **L/T/P/C: 3/0/0/3**

**IV Year I Semester**

**Prerequisites:**
Students are expected to have knowledge in Formal Languages and Automata Theory, Compiler Design, and basic Python programming skills.

**Course Outcomes**
1. Summarize the role of NLP in various applications and explain both classical and modern language modelling approaches.
2. Analyze information retrieval systems and utilize lexical resources for processing natural language text.
3. Apply word-level analysis, syntactic analysis, and modern embedding techniques in NLP.
4. Demonstrate semantic analysis and discuss discourse processing of text, incorporating context-aware neural models.
5. Illustrate the automation of natural language generation and machine translation, with emphasis on Indian languages, neural approaches, and ethical considerations.

**UNIT I**
**Overview**: Origins and challenges of NLP, Language and Grammar, Processing Indian Languages, **Modern Applications of NLP** (chatbots, sentiment analysis, search engines, virtual assistants).
**Language Modeling**: Grammar-based Models, Statistical Models, and **Neural Language Models** (word embeddings, contextual embeddings).

**UNIT II**
**Information Retrieval:** Introduction, Design features of IR Systems, Classical, Non-classical, Vector Space Model, Evaluation metrics (Precision, Recall, F1).
**Lexical Resources:** WordNet, FrameNet, Stemmers, POS Tagger, Research Corpora.
Introduction to NLTK/spaCy for lexical processing**.**

**UNIT III**
**Word Level Analysis:** Regular Expressions, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part of Speech Tagging, TF, IDF, word embeddings (Word2Vec, GloVe).
**Syntactic Analysis**: Context-Free Grammar, Probabilistic Parsing, dependency parsing and Transition-based Parsing using NLP toolkits.

**UNIT IV**

**Semantic Analysis:** Meaning Representation, Ambiguity, Word Sense Disambiguation. Contextual Embeddings (BERT, mBERT) for semantic tasks.

**Discourse Processing:** Cohesion, Reference Resolution, Discourse Coherence and Structure.

**Ethical NLP:** Bias, fairness, and responsible AI considerations**.**

**UNIT V**

**Natural Language Generation:** Architecture, Generation Tasks and Representations, Applications (summarization, dialogue systems, report generation).

**Machine Translation:** Problems in MT, Characteristics of Indian Languages, Translation involving Indian Languages. Evaluation Metrics: BLEU, ROUGE, METEOR for NLG and MT.

NLP Applications – case study

**Textbooks:**


1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", 3rd Edition (Draft), Prentice Hall, 2023.


**Reference Books:**


1. James Allen, "Natural Language Understanding", 2nd Edition, Benjamin/Cummings, 1995.
2. Steven Bird, Ewan Klein, and Edward Loper, "Natural Language Processing with Python", O'Reilly, 2009.
3. HuggingFace, "Transformers: State-of-the-Art NLP with Python", Online Documentation.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**SEMANTIC WEB**
**(PROFESSIONAL ELECTIVE-III)**

**Course Code: GR24A4132** **L/T/P/C: 3/0/0/3**

**IV Year I Semester**

**Prerequisites:**
Students should have prior knowledge of Programming, Discrete Mathematics, Introduction to Knowledge Representation & Reasoning.

**Course Outcomes:**
On successful completion of this course, students will be able to
1. Understand the concepts, goals, and architecture of the Semantic Web and differentiate it from the traditional web.
2. Design and develop ontologies to represent domain knowledge effectively using OWL and other ontology languages.
3. Explore knowledge of key Semantic Web standards such as RDF, RDFS, OWL, and SPARQL.
4. Use existing Semantic Web tools (Protégé, Apache Jena, etc.) for ontology creation, reasoning, and semantic data processing.
5. Analyze real-world applications of Semantic Web technologies in areas like Linked Data, knowledge management, and intelligent agents.

**UNIT I**
**Introduction:** Introduction to Semantic Web, Current web vs Semantic Web, Types of Semantic Web Technologies, Properties, Semantic Network, Structure of Semantic Web and it's Components, Semantic Web Layered Approach, Business Case for the Semantic Web, XML and Its Impact on the Enterprise.

**UNIT II**
**Web Ontologies:** Introduction to Ontologies, Graphical ontology example: Human resources, Definitions-Syntax, Structure, Ontology Languages for the Semantic Web, Resource Description Framework (RDF), Lightweight ontologies: RDF Schema, Web Ontology Language (OWL) - A query language for RDF: SPARQL, Ontology Engineering Semantic web and Web 2.0 Applications of Semantic Web, Levels of Ontologies.

**UNIT III**
**Semantic Web Services:** Basics of Web Services and its uses, Simple Object Access Protocol (SOAP), Universal Description, Discovery and Integration (UDDI), Orchestrating Web Services, Securing Web Services, Grid Enabled and Semantic Web of Web Services. Intelligent agents, Types, Interactions and Frameworks-Standards.

**UNIT IV**
**Web Resources Framework:** Features, Describing Web Resources in RDF, RDF Schemas. RDF-XML based Technologies: XPath, The Style Sheet Family: XSL, XSLT, and XSL FO, XQuery, XLink, XPointer, XInclude, XMLBase, XHTML, XForms, SVG.

**UNIT - V**

**Semantic Web Application:** Semantic Web Services, e-Learning, Semantic Bioinformatics, Enterprise Application Integration, Knowledge Base. Semantic Search Technology: Search Engines, Semantic Search, Semantic Search Technology, Web Search Agents, Semantic Methods, Latent Semantic Index Search, TAP, Swoogle.

**Case Studies with XML:** The XML Language-Structuring-Namespaces-Addressing and Querying XML Documents-Processing.

**Textbooks:**


1. Thomas. B. Passin: Explorer's guide to the semantic web. Manning Publications Company 2004.
2. Michael C, Daconta, Leo J. Obrst and Kevin T. Smith, "The semantic Web: A guide to the future of XML, web services, and knowledge management", John Wiley & sons, 2003.


**Reference Books:**


1. Grigoris Antoniou, Paul Groth, Frank van Harmelen and Rinke Hoekstra, A Semantic Web Primer, MIT Press; 3rd edition, 2012.
2. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, Publisher: Chapman and Hall, Foundations of Semantic Web Technologies, 1st edition, 2009.
3. Dean Allemang, and James Hendler, Semantic Web for the Working Ontologist, Second Edition, Morgan Kaufmann, 2nd edition, 2011.
4. John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez, and Mike Dean, Semantic Web Programming, Wiley Publications, 1st edition, 2009.
5. David Wood, Marsha Zaidman, Luke Ruth, and Michael Hausenblas, Linked Data: Structured Data on the Web, Manning Publications, 1st edition, 2014.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**INFORMATION STORAGE AND MANAGEMENT**
**(PROFESSIONAL ELECTIVE-IV)**

**Course Code: GR24A4133** **L/T/P/C: 3/0/0/3**

**IV Year I Semester**

**Prerequisites:**
Students should have prior knowledge of Database Management Systems.

**Course Outcomes:**
On successful completion of this course, students will be able to
1. Explore the fundamentals of information storage and data center infrastructure.
2. Analyze and implement storage systems and data protection mechanisms.
3. Design and manage different storage environments.
4. Apply advanced storage solutions and virtualization techniques.
5. Implement backup, replication, and storage security strategies.

**UNIT I**
**Introduction to Information Storage and Management:** Information Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle. Storage System Environment - Data Protection: RAID - Intelligent Storage System.

**UNIT II**
**Direct-Attached Storage and Introduction to SCSI:** Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, SCSI Command Model,
**Storage Area Networks:** Fibre Channel- Overview, The SAN and Its Evolution, Components of SAN, FC Connectivity, Fibre Channel Ports, Fibre Channel Architecture, Zoning, Fibre Channel Login Types, FC Topologies, Concepts in Practice- EMC Connectrix.
**Network-Attached Storage:** General-Purpose Servers vs. NAS Devices, Benefits of NAS, NAS File I/O, Components of NAS, NAS Implementations, NAS File-Sharing Protocols, NAS I/O Operations, Factors Affecting NAS Performance and Availability, Concepts in Practice- EMC Celerra.

**UNIT III**
**Content-Addressed Storage:** Fixed Content and Archives, Types of Archives, Features and Benefits of CAS, CAS Architecture, Object Storage and Retrieval in CAS, CAS Examples, Concepts in Practice- EMC Centera.
**Storage Virtualization:** Forms of Virtualization, SNIA Storage Virtualization Taxonomy, Storage Virtualization Configurations, Storage Virtualization Challenges, Types of Storage Virtualization, Concepts in Practice.

**UNIT IV**
**Backup and Recovery:** Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Process, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Technologies, Concepts in Practice- EMC NetWorker.

**Local Replication:** Local Replication, Source and Target, Uses of Local Replicas, Data Consistency, Local Replication Technologies, Restore and Restart Considerations, Creating Multiple Replicas, Management Interface, Concepts in Practice- EMC TimeFinder and EMC SnapView.
**Remote Replication:** Modes of Remote Replication, Remote Replication Technologies, Network Infrastructure, Concepts in Practice- EMC SRDF, EMC SAN Copy, and EMC MirrorView.

**UNIT V**
**Securing the Storage Infrastructure:** Storage Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking.
**Managing the Storage Infrastructure:** Monitoring the Storage Infrastructure, Storage Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution, Concepts in Practice-EMC ControlCenter.

**Textbooks:**

1. Marc Farley Osborne, "Building Storage Networks, Tata McGraw-Hill, 2001.
2. Robert Spalding and Robert Spalding, "Storage Networks: The Complete Reference", Tata
3. McGraw-Hill, 2003.
4. Meeta Gupta, "Storage Area Network Fundamentals", Pearson Education Ltd., 2002.


**Reference Books:**

1. Gerald J Kowalski and Mark T Maybury," Information Storage Retrieval Systems theory & Implementation," BS Publications, 2000.
2. Thejendra BS, "Disaster Recovery & Business continuity", Shroff Publishers & Distributors, 2006.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**PRINCIPLES OF PROGRAMING LANGUAGES**
**(PROFESSIONAL ELECTIVE-IV)**

**Course Code: GR24A3090** **L/T/P/C: 3/0/0/3**

**IV Year I Semester**

**Course Outcomes:**

1. Evaluate language constructs and programming paradigms.
2. Apply formal methods of syntax, semantics and data types.
3. Illustrate sub programs, blocks and control structures in different programming languages.
4. Construct abstract data types, concurrency and exceptions.
5. Compare functional and imperative languages.

**UNIT I**

**Preliminary Concepts:** Reasons for studying, concepts of programming languages, Programming domains, Language Evaluation Criteria, Influences on Language design, Language categories, Programming Paradigms – Imperative, Object Oriented, Functional Programming, Logic Programming.

**Programming Language Implementation:** Compilation and Virtual Machines, Programming environments.

**UNIT II**

**Syntax and Semantics:** General Problem of describing Syntax and Semantics, formal methods of describing syntax - BNF, EBNF for common programming language features, parse trees, ambiguous grammars, attribute grammars, denotation semantics and axiomatic semantics for common programming language features.

**Data Types:** Introduction, primitive, character, user defined, array, associative, record, union, pointer and reference types, design and implementation uses related to these types, Names, Variable, concept of binding, type checking, strong typing, type compatibility, named constants and variable initialization.

**UNIT III**

**Expressions and Statements:** Arithmetic relational and Boolean expressions, Short circuit evaluation, mixed mode assignment, Assignment Statements, Control Structures– Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, guarded commands.

**Subprograms and Blocks:** Fundamentals of sub-programs, Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are sub- program names, design issues for functions, user defined overloaded operators, co routines.

**UNIT IV**

**Abstract Data types:** Abstractions and encapsulation, Introduction to data abstraction, design issues, language examples, C++ parameterized ADT, object oriented programming in C++, Java, C#, Python.

**Concurrency:** Subprogram level concurrency, semaphores, monitors, message passing, Java threads, Examples: Java RMI, Parallel Java, Parallel C

**Exception handling:** Exceptions, Exception propagation, Exception handler in C++ and Java and PHP. Handling Large Database.

**UNIT V**

**Functional Programming Languages:** Introduction, fundamentals of FPL, LISP, ML, Haskell, application of Functional Programming Languages and comparison of functional and imperative languages.

**Logic Programming Language:** Introduction and overview of logic programming, basic elements of prolog, application of logic programming.

**Textbooks:**

1. Concepts of Programming Languages Robert. W. Sebesta 6/e, Pearson Education.
2. Programming Languages –Louden, Second Edition, Thomson.

**Reference Books:**

1. Programming languages –Ghezzi, 3/e, John Wiley.
2. Programming Languages Design and Implementation – Pratt and Zelkowitz, Fourth Edition PHI/Pearson Education.

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

**Course Code: GR24A4103** **L/T/P/C: 3/0/0/3**

**IV Year I Semester**

**Prerequisites:**
Knowledge on oops and UML concepts.

**Course Outcomes:**
1. Ability to analyze and apply different design patterns for real life scenarios.
2. Ability to solve Object oriented design problems with a case study of designing a Document Editor.
3. Illustrates the skill apply creational design patterns.
4. Demonstrates the ability to apply different structural design patterns.
5. Analyze and apply different behavioral design patterns.

**UNIT I**
**Introduction:** What Is a Design Pattern?, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

**UNIT II**
**A Case Study:** Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation, Summary.

**UNIT III**
**Creational Patterns:** Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.
**Structural Pattern Part-I:** Adapter, Bridge, Composite.

**UNIT IV**
**Structural Pattern Part-II:** Decorator, Façade, Flyweight, Proxy.
**Behavioral Patterns Part-I:** Chain of Responsibility, Command, Interpreter, Iterator.

**UNIT V**
**Behavioral Patterns Part-II:** Mediator, Memento, Observer, State, Strategy, Template Method Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns, A Brief History, The Pattern Community An Invitation, A Parting Thought.

**Textbooks:**
1. Design Patterns by Erich Gamma, Pearson Education.
2. Object-Oriented Design & Patterns, Cay Horstmann, Second edition, Wiley.

**Reference Books:**


1. Pattern's in JAVA Vol-I by Mark Grand, Wiley Dream Tech.
2. Pattern's in JAVA Vol-II by Mark Grand, Wiley Dream Tech.
3. JAVA Enterprise Design Patterns Vol-III by Mark Grand, Wiley Dream Tech.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**SOFTWARE TESTING METHODOLOGIES**
**(PROFESSIONAL ELECTIVE-IV)**

**Course Code: GR24A4095** **L/T/P/C: 3/0/0/3**

**IV Year I Semester**

**Prerequisites:**

1. Students should have finished a course on Software Engineering.
2. Basic Knowledge about Software Testing.

**Course Outcomes:**

1. Analyze the purpose of software testing, testing dichotomies, models, and the taxonomy of bugs to understand the consequences of software defects.
2. Apply path testing techniques using flow graphs and transaction flows to identify achievable paths and design effective test cases.
3. Demonstrate data flow patterns and domain characteristics to design test cases.
4. Develop logic-based testing methods including path expressions, decision tables, and regular expressions.
5. Design state-based and graph-based test cases using state graphs and graph matrices.

**UNIT I**

**Introduction:** Purpose of testing, Dichotomies, Model for testing, Consequences of bugs, Taxonomy of Bugs.

**UNIT II**

**Flow Graphs and Path Testing:** Basics concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.
**Transaction Flow Testing:** Transaction flows, transaction flow testing techniques.

**UNIT III**

**Dataflow testing**: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.
**Domain Testing**: Domains and paths, Nice & ugly domains, Domain Testing, domains and interfaces testing, domain and interface testing, domains and testability.

**UNIT IV**

**Paths, Path products and Regular expressions:** Path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.
**Logic Based Testing:** Overview, decision tables, path expressions, kv charts, specifications.

**UNIT V**

**State, State Graphs and Transition testing:** State graphs, good & bad state graphs, state testing, Testability tips.

**Graph Matrices and Application:** Motivational overview, matrix of graph, relations, power of a matrix, Node Reduction algorithm.

**Textbooks:**

1. Software Testing techniques – Boris Beizer, Dreamtech, 2nd Edition.
2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.
3. Software Testing Techniques –SPD(Oreille).

**Reference Books:**

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing in the Real World – Edward Kit, Pearson.
3. Effective methods of Software Testing, Perry, John Wiley.
4. Art of Software Testing – Meyers, John Wiley.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**BUSINESS INTELLIGENCE LAB**

**Course Code: GR24A4135** **L/T/P/C: 0/0/4/2**

**IV Year I Semester**

**Prerequisites:**

Students should have prior knowledge of Database Management Systems Lab, Data Mining and Data Warehousing.

**Course Outcomes:**

On successful completion of this course, students will be able to

1. Design and Execute frameworks for Decision Support Systems (DSS), analytics, and Business Intelligence (BI).
2. Implement the foundations, architecture, and capabilities of BI systems.
3. Employ and Evaluate business reporting, dashboards, and visual analytics to support decision-making.
4. Apply data mining, text analytics, and social media analytics for business insights.
5. Integrate big data technologies for advanced BI solutions and real-time analytics.

**TASK 1: Import Legacy Data**

Import legacy data from multiple sources such as Excel, SQL Server, Oracle, etc., and load into the target system.

**Case study:** Migrating historical sales data from multiple systems into a unified BI environment.

**Use case:** Used in data warehousing for centralized analytics and historical reporting.

**TASK 2: ETL Process**

Perform Extraction, Transformation, and Loading (ETL) to construct the database in SQL Server.

**Case study:** Cleaning and transforming customer data before loading into the BI warehouse.

**Use case:** Ensures accurate and consistent data for reporting and analytics.

**TASK 3: OLAP Cube Creation**

Create cubes with appropriate dimension and fact tables using ROLAP, MOLAP, and HOLAP models.

**Case study:** Building a cube for sales analysis by region, product, and time.

**Use case:** Enhances multidimensional analysis for faster business insights.

**TASK 4: ETL Scheduling**

Create an ETL map and schedule it for automated execution.

**Case study:** Nightly ETL runs to refresh sales and inventory data.

**Use case:** Enables timely updates for dashboards and decision-making.

**TASK 5: MDX Queries**

Execute MDX queries to extract data from the data warehouse.

**Case study:** Querying total sales by category for the last quarter.

**Use case:** Provides multidimensional analysis and ad-hoc querying in BI systems.

**TASK 6: Excel Integration & Pivot Analysis**

Import data warehouse data into Microsoft Excel and create Pivot Tables and Pivot Charts. Import the OLAP cube into Excel and perform advanced analysis.

**Case study:** Creating a revenue dashboard in Excel using cube data.

**Use case:** Facilitates quick business reporting and decision-making.

**TASK 7: What-if Analysis & Reporting**

Apply What-if Analysis for data visualization. Design and generate reports from warehouse data.

**Case study:** Forecasting sales revenue under different pricing scenarios.

**Use case:** Supports predictive analytics and business planning.

**TASK 8: Classification using Decision Tree**

Perform data classification using a Decision Tree algorithm.

**Case study:** Classifying customers as high-value or low-value based on purchase behavior.

**Use case:** Used in customer segmentation and marketing strategies.

**TASK 9: Data Clustering**

Perform clustering using a suitable clustering algorithm (e.g., K-Means).

**Case study:** Grouping customers based on demographics and buying patterns.

**Use case:** Enables targeted campaigns and personalized recommendations.

**TASK 10: Linear Regression**

Apply linear regression on given warehouse data.

**Case study:** Predicting sales based on advertising spend.

**Use case:** Used in trend analysis and forecasting.

**TASK 11: Logistic Regression**

Perform logistic regression on the given data.

**Case study:** Predicting customer churn probability.

**Use case:** Supports decision-making in retention strategies.

**TASK 12: Sentiment Analysis using Twitter API**

Extract and analyze sentiments from Twitter data via API.

**Case study:** Monitoring public opinion about a new product launch.

**Use case:** Used in social media analytics, brand monitoring, and customer engagement.

**Textbooks:**


1. Business Intelligence and Analytics: Systems for Decision Support, 10th edition, by Ramesh Sharda, Dursun Delen, and Efraim Turban. Upper Saddle River, NJ: Pearson Education,2014.
2. Data Mining for Business Intelligence: Concepts, Techniques, and Applications, Galit Shmueli, N. R. Patel, P. Bruce, Wiley, 2nd Edition, 2017.
3. Business Intelligence Guidebook: From Data Integration to Analytics, Rick Sherman, Morgan Kaufmann, 2014.


**Reference Books:**


1. Business Intelligence Guidebook: From Data Integration to Analytics By Rick Sherman 2014.
2. Data Mining for Business Intelligence: Concepts, Techniques, and Applications By Galit Shmueli, N. R. Patel & P. Bruce, 2008.
3. The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Ralph Kimball, Margy Ross, Wiley, 3rd Edition, 2013.
4. Fundamentals of Business Analytics, R. Sharda, D. Delen, E. Turban, Pearson Education, 2015.
5. Data Mining Techniques: For Marketing, Sales, and Customer Relationship Management, Michael J. A. Berry, Gordon S. Linoff, Wiley, 3rd Edition, 2011.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DEEP LEARNING LAB**

**Course Code: GR24A4126** **L/T/P/C: 0/0/4/2**

**IV Year I Semester**

**Course Outcomes:**

1. Learn and set up deep learning environments using Python, TensorFlow, Keras, and PyTorch for experimental implementation.
2. Learn the Fundamental Principles of Deep Learning.
3. Identify the Deep Learning Algorithms for Various Types of Learning Tasks in various domains.
4. Use Long Shot Term Memory (LSTM) Networks, GRU for time series analysis and Solve Real-world problems.
5. Design Autoencoders to solve Unsupervised Learning problems and Generative Algorithms

**LIST OF EXPERIMENTS:**

**TASK-1**: Setting up the Spyder IDE Environment and Executing a Python Program.
**TASK-2:** Installing Kera's, TensorFlow and Pytorch libraries and making use of them.
**TASK-3:** Implement Activation Functions in Neural Networks and analyze their usage.
**TASK-4:** Implement Perceptron training algorithm to classify flowers in IRIS dataset.
**TASK-5:** Build a Artificial Neural Network by implementing the Back propagation algorithm.
**TASK-6**: Applying the Convolution Neural Network on computer vision problems.
**TASK-7**: Image classification on MNIST dataset (CNN model with Fully connected layer).
**TASK-8**: Applying the Deep Learning Models in the field of Natural Language Processing
**TASK-9**: Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes.
**TASK-10**: Applying the Autoencoder algorithms for encoding the real-world data.
**TASK-11**: Applying Generative Adverbial Networks for image generation and unsupervised tasks.
**TASK-12**: Design a Deep Learning framework for Object Detection. GANS.

**Textbooks:**


1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.


**Reference Books:**


1. Bishop, C.M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.H., and Van Loan, C.F., Matrix Computations, JHU Press, 2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw Hill Education, 2004.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**PROJECT WORK- PHASE I**

**Course Code: GR24A4016** **L/T/P/C: 0/0/12/6**

**IV Year I Semester**

**Prerequisites:**

Students should have prior knowledge of

- Fundamentals of Core Computer Science and Engineering Subjects.
- Basics of Software/Hardware Project Design and Development.
- Knowledge of Technical Documentation and Presentation Skills.

**Course Outcomes:**

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

1. Apply theoretical and practical knowledge within the chosen area of technology to identify and explore project opportunities.
2. Identify, formulate, and justify the problem statement, and analyse technical aspects of the project with a comprehensive and systematic approach.
3. Design and develop engineering solutions by integrating appropriate tools, technologies, and methodologies to implement the proposed project.
4. Demonstrate individual responsibility and effective collaboration in a team, managing tasks, timelines, and resources for successful project execution.
5. Document project activities, prepare structured technical reports, and present findings effectively through oral and written communication.

# IV Year

# II Semester

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

**Course Code: GR24A4069** **L/T/P/C: 3/0/0/3**

**IV Year II Semester**

**Course Outcomes:**

1. Student gain knowledge able 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.


**Reference Books:**


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**
**REAL TIME OPERATING SYSTEMS**
**(PROFESSIONAL ELECTIVE-V)**

**Course Code: GR24A4098** **L/T/P/C: 3/0/0/3**

**IV Year II Semester**

**Course Outcomes:**

1. Summarize the concepts of Operating system Principles, System Calls and Files.
2. Analyze the network topology and network communication process used in distributed operating systems.
3. Implement the Real-time operating system languages and models.
4. Paraphrase the RTOS Kernel Principles and design patterns for inter task synchronization and communication.
5. Articulate the emerging trends and applications in Real-time systems.

**UNIT I**

**Review of Operating Systems:** Basic Principles, system calls, Files-Processes, design and implementation of processes, Communication between processes, operating system structures.

**UNIT II**

**Distributed Operating Systems:** Topology, Network Types, Communication, RPC, Client server model, Distributed file systems and design strategies.

**UNIT III**

**Real Time Models and Languages:** Event based, Process based, Graph models, Petrinet models, Real- time Languages, RTOS tasks, RT scheduling, Interrupt processing, Synchronization, Control blocks, Memory requirements.

**UNIT IV**

Implementation of RTOS in ESP32, Inter-Task Communication in the Spark Fun ESP32 thing with Free RTOS.

**Real-Time System Design Patterns:** Patterns for task synchronization and communication, Patterns for fault tolerance and error handling in real-time systems, Patterns for handling resource conflicts and priority inversion, Patterns for adapting to changing system conditions.

**UNIT V**

**Emerging Trends in Real-Time Systems:** Cyber-Physical Systems (CPS) and IoT integration, Edge and fog computing, Machine learning and AI in real-time applications, Security and safety challenges in real- time systems, Industry trends and future directions in real-time system design, Implementation and analysis of real-time systems using an RTOS, Performance evaluation and optimization of real-time tasks, Design and simulation of real-time communication protocols, Modeling and analysis of a real-time system using formal methods.

**Textbooks:**

1. Charles Crowley “operating systems, A design oriented approach” McGraw Hill.
2. Tenenbum, “Distributed Operating Systems”, PHI, 1999.

**Reference Books:**

1. CM Krishna, Kang G. Shin, “Real time Systems”, McGrawHill,1997.
2. Raymond J.A., Donald L Baily, “An introduction to real time operating systems” PHI, 1999.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**CYBER SECURITY**
**(PROFESSIONAL ELECTIVE-V)**

**Course Code: GR24A4099** **L/T/P/C: 3/0/0/3**

**IV Year II Semester**

**Course Outcomes:**

1. Analyze cyber security fundamentals, layers, threat models, and methods of defense to understand the spectrum of attacks.
2. Demonstrate the legal, regulatory, and forensic frameworks of cyber security.
3. Evaluate the security challenges and organizational implications of mobile and wireless devices, and propose counter measures to mitigate cybercrimes in mobile environments.
4. Assess the impact of cybercrimes, intellectual property issues, and social media risks on organizations.
5. Examine data privacy principles and assess real-world cybercrime incidents to determine associated threats and legal or ethical considerations in diverse domains.

**UNIT - I**

**Introduction to Cyber Security:** Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, Comprehensive Cyber Security Policy.

**UNIT - II**

**Cyberspace and the Law & Cyber Forensics:** Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

**UNIT - III**

**Cybercrime: Mobile and Wireless Devices:** Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones

**Mobile Devices:** Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

**UNIT- IV**

**Cyber Security: Organizational Implications:** Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media

marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

**Cybercrime and Cyber terrorism:** Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

**UNIT - V**

**Privacy Issues:** Basic Data Privacy Concepts, Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial.

**Cybercrime: Examples and Mini-Cases**

**Examples:** Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

**Mini-Cases:** The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

**Textbooks:**


1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.


**Reference Books:**


1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin, CRC Press T&F Group.
3. Cyber Security: Comprehensive Beginners Guide to Learn the Basics and Effective Methods of Cyber Security, Brian Walker, Kindle Edition.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**QUANTUM COMPUTING**

**(PROFESSIONAL ELECTIVE-V)**

**Course Code: GR24A3091** **L/T/P/C: 3/0/0/3**

**IV Year II Semester**

**Prerequisites:**

1. Mastery of Probability and Statistics, Linear Algebra.
2. Data Structures, Design and Analysis of Algorithms, Programming in Python.

**Course Outcomes:**

1. Understand underlying principles of Quantum Computing.
2. Analyze the matrix operators for universal quantum gate.
3. Demonstrate quantum Fourier transformation.
4. Analyze quantum algorithms for searching.
5. Develop a quantum computing application for machine learning/Key distribution.

**UNIT-I**

**Introduction:** Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing, Overview of major concepts in Quantum Computing: Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation.

**Math Foundation for Quantum Computing (Matrix Algebra):** basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors**.**

**UNIT-II**

**QUANTUM CIRCUITS BUILDING BLOCKS FOR QUANTUM**

Quantum Algorithms, Single Qubit operations, Controlled operations, Measurement, Universal quantum gates, Simulation of quantum systems.

**UNIT-III**

**Tensor Products, Teleportation and Super Dense Coding**

Tensor Products, Multi Q-Bit system, Super Position, Entanglement, Decoherence, quantum teleportation, no-cloning theorem super dense coding (10th chapter of Book 2), Quantum Fourier transformations and its applications.

**UNIT-IV**

**Quantum Algorithms:** Hadamard Gates, phase gate, Quantum interference, Quantum parallelism a function evaluation, Deutsch-Jozsa Algorithm, Phase Estimation, Shor's algorithm, Quantum Searching and Grover's Algorithm.

**UNIT-V**

**Quantum Errors & Quantum Computing Applications:** Single -Qubit error, Quantum Operations and Krauss Operations. Quantum Machine Learning (SVM), Quantum Cryptography (QKD, Post-Quantum Cryptography).

**Textbooks:**


1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley References.
3. Eleanor G. Rieffel and Wolfgang H. Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
4. Quantum Computing in Practice with Qiskit(R) and IBM Quantum Experience(R): Practical recipes for quantum computer coding at the gate and algorithm level with Python, Hassi Norlén, Packt Publishing, 2020.


**Reference Books:**


1. Introduction to Quantum Computing: Quantum Algorithms and Qiskit.
2. IBM Experience: https://www.coursera.org/programs/gitam-open-learning 7qv77/learn/introduction-to-quantum-information?authProvider=gitam&sou
3. Microsoft Quantum Development Kit, https://www.microsoft.com/en-us/quantum/ development-kit.
4. Forest SDK PyQuil, https://pyquil.readthedocs.io/en/stable/

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**ROBOTIC PROCESS AUTOMATION**
**(PROFESSIONAL ELECTIVE-V)**

**Course Code: GR24A4100** **L/T/P/C: 3/0/0/3**

**IV Year II Semester**

**Course Outcomes:**

1. Analyze business processes and develop comprehensive RPA implementation strategies with ROI assessment and risk evaluation.
2. Design and develop end-to-end automation workflows using UiPath Studio with proper variable management, control structures, and data manipulation techniques.
3. Implement advanced UI automation including recording, data extraction, selector configuration, and exception handling for robust process automation.
4. Create enterprise-level RPA solutions with Excel/PDF integration, debugging capabilities, and modular project organization following industry best practices.
5. Deploy and manage RPA bots using UiPath Orchestrator with AI/ML integration while developing practical automation projects for real-world business scenarios.

**UNIT – I**

**INTRODUCTION TO ROBOTIC PROCESS AUTOMATION:** Scope and techniques of automation, Robotic process automation - What can RPA do?, Benefits of RPA, Components of RPA, RPA platforms, The future of automation. **RPA BASICS:** History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

**UNIT – II**

**RPA TOOL INTRODUCTION AND BASICS:** Installing **UiPath** Studio Academic Alliance edition - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data.

**UNIT – III**

**Recording and Advanced UI Interaction:** Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors – Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices.

**UNIT – IV**

**Excel Data Tables & PDF and Exception Handling:** Data Tables in RPA - Data Manipulation in excel - Extracting Data from PDF - Anchors - Using anchors in PDF.

**Debugging and Exception handling** - Debugging Tools - Strategies for solving issues - Catching errors. Project Organization - Best practices – Avoiding pitfalls - Invoke Activity.

**UNIT – V**

**Deployment:** UiPath Orchestrator - Tenants - Authentication - Users & Roles - Robots - Environments - Queues & Transactions – Schedules. Artificial Intelligence and Machine learning implementation in RPA - Digital Assistant - Future of RPA - Basic RPA Projects: Sales order entry Robot - Robot for transactions & Email categorization.

**Advanced Projects**: Email Autoresponder Robot - Disk monitoring and clean-up Robot.

**Textbooks:**

1. Alok Mani Tripathi, “Learning Robotic Process Automation”, Packt Publishing, 2018.

**Reference Books:**

1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, “Introduction to Robotic Process Automation: a Primer”, Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant”, Independently Published, 1st Edition 2018.
3. Srikanth Merianda, ” Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation”, Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. Lim Mei Ying, “Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes”, Packt Publishing, 1st Edition 2018.

**Web References:**

1. https://www.uipath.com/landing/academic-studio-download
2. https://www.uipath.com/rpa/robotic-process-automation
3. https://www.uipath.com/rpa/academy

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**DISTRIBUTED SYSTEMS**
**(PROFESSIONAL ELECTIVE-VI)**

**Course Code: GR24A4101** **L/T/P/C: 3/0/0/3**

**IV Year II Semester**

**Course Outcomes:**

1. Illustrate the system models and communication mechanisms in distributed systems
2. Demonstrate the operating system support required for distributed systems
3. Analyze peer-to-peer systems, global time synchronization, and coordination techniques
4. Apply transaction and concurrency control mechanisms in distributed environments
5. Evaluate replication strategies and consistency models in distributed shared memory and fault-tolerant services.

**UNIT-I**

**Characterization of Distributed Systems**: Examples of Distributed systems, Resource sharing and web, challenges.

**System models:** Architectural and Fundamental models, Networking and Internetworking, Interprocess Communication.

**Distributed objects and Remote Invocation:** Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI.

**UNIT-II**

**Operating System Support**- OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture.

**Distributed File Systems**-Introduction, File Service architecture.

**UNIT-III**

**Peer to Peer Systems**– Napster and its legacy, Peer to Peer middleware

**Time and Global States**-Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging.

**Coordination and Agreement**- Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems.

**UNIT-IV**

**Transactions and Concurrency Control**- Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering.

**Distributed Transactions**-Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions

**Distributed deadlocks**: Transaction recovery.

**UNIT-V**

**Replication:** Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data.

**Distributed shared memory:** Design and Implementation issues, Consistency models.

**Textbooks:**


1. Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, Fourth Edition, Pearson Education.
2. Distributed Systems, S. Ghosh, Chapman & Hall/CRC, Taylor & Francis Group, 2010.


**Reference Books:**


1. Distributed Systems – Principles and Paradigms, A.S. Tanenbaum and M.V. Steen, Pearson Education.
2. Distributed Computing, Principles, Algorithms and Systems, Ajay D. Kshemakalyani and Mukesh Singhal, Cambridge, 2010.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**IMAGE AND VIDEO PROCESSING**
**(PROFESSIONAL ELECTIVE-VI)**

**Course Code: GR24A4091** **L/T/P/C: 3/0/0/3**

**IV Year II Semester**

**Prerequisites:**

Students are expected to have knowledge in

1. Analysis of algorithms and linear algebra.
2. Programming experience.

**Course Outcomes:**

1. Summarize the basic principles of image processing and transformations.
2. Organize the image enhancement and segmentation methods.
3. Apply image compression techniques on images.
4. Outline the basic steps of video processing.
5. Implement the 2-D motion Estimation techniques.

**UNIT I**

**Fundamentals of Image Processing and Image Transforms:** Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels.

**UNIT II**

**Image Enhancement:** Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, Image smoothing, Image sharpening, Selective filtering.

**Image Segmentation:** Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

**UNIT III**

**Image Compression:** Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy,

**Compression models:** Lossy& Lossless, Huffman coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, Lossy Predictive coding, JPEG Standards.

**UNIT IV**

**Basic Steps of Video Processing: Analog** Video, Digital Video.

**Time-Varying Image Formation models:** Three Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, filtering operations.

**UNIT V**

**Motion Estimation:** Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Application of motion estimation in Video coding.

Motion Compensation Techniques, Introduction to Video Compression Standards (H.264, HEVC), Multi-Frame Motion Estimation, Evaluation Metrics for Motion Estimation Accuracy.

**Textbooks:**


1. Digital Image Processing – Gonzalez and Woods, 3rd Ed., Pearson.
2. Video Processing and Communication – Yao Wang, Joem Oysterman and Ya–quin Zhang. 1st Ed., PH Int.


**Reference Books:**


1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – Scotte Umbaugh, 2nd Ed, CRC Press, 2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International.
3. Digital Image Processing with MATLAB and Lab view – Vipula Singh, Elsevier.
4. Video Demystified – A Handbook for the Digital Engineer – Keith Jack, 5th Ed., Elsevier.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**INTRODUCTION TO DRONES**

**(PROFESSIONAL ELECTIVE-VI)**

**Course Code: GR24A4130** **L/T/P/C: 3/0/0/3**

**IV Year II Semester**

**Prerequisites:**

Basic knowledge in Linux and Raspberry Pi.

**Course Outcomes:**

1. Summarize the fundamental concepts of Lipo Battries & UAVs.
2. Demonstrate techniques for drone flight operations, shooting methods, camera set-up.
3. Classify various components of drone and build to fly.
4. Compile and combine various components.
5. Build a Linux based drone using RaspberryPi.

**UNIT I**

**Introduction to Drones:** Overview, History of UAVs, Classifications of UAV- scale and lift generation methods, Advantages of Drones, Applications of Drones.

**Hardware:** Motors-overview, Motor Anatomy, LiPo Batteries and their use, Battery Connector Converters, Flight Controllers, Electronic Speed Controllers (ESCs), RC and Telemetry, Propellers, Frames, GPS and Optical Flow.

**UNIT II**

**Designing a Drone Build:** Thrust to Weight Ratios, Estimating Weight of Drones, Drive-train of Drones: Props+Motors+Batteries, Estimating Thrust and Current Draw, Choosing ESCs.

How to build a Drone: Part Placement Planning, Soldering Bullet Connectors to ESCs, Soldering ESCs to PDB, Soldering Battery Connector to PDB, Attaching Legs to Frame, Installing Motors on Frame, Securing Raspberry Pi to Top Plate – Methods, Installing Top Plate to Drone Frame, Fixing ESCs to Drone Arms, Bind Receiver and Transmitter, Calibrate ESCs, Correct Motor Spin Direction, Fix PPM Encoder and RC Receiver to Frame, Wiring the ESC PWM Lines to Flight Controller, Install Telemetry Module to Drone, GPS Mount Assembly, Securing GPS to Frame, Velcro-ing Battery to Drone, Fixing Power Module to Frame, Securing Propellers to Motors.

**UNIT III**

**Initial setup of Drone:** Download and Flash OS Image to SD Card, Configure RPi to Connect to the Internet, SSH Into RPi, Configure ArduPilot on RPi, Install Mission Planner and Connect to Drone, Mission Planner Sensor Calibration and ArduPilot Setup, Setting Up the RC Controller, Charging LiPo Batteries, Leashing the Drone.

**UNIT IV**

**Flying the Drone:** Flashing Light on Drone Flight Controller, Diagnosing Your Drone's Problems, Downloading Flight Logs and Requesting Help on ArduPilotForum, RC Sticks and what they Control, Flight Modes in ArduPilot, Setting Up FlightModes, First Time Flying Drills/Advice, Flying in ALT-HOLD Mode, Flying in LOITER Mode, Using the LANDode, Using the RTL Mode.

**UNIT V**

**Using the Linux Feature of Drone:** Downloading ArduPilot Source Code, Compile ArduPilot Source Code, Changing Firmware in NAVIO Image, Installing Drone Kit, Script for Autonomous **Mission**: Takeoff and Land, Script for Autonomous Mission: Velocity Commands.

**Teaching Methodologies:**

- Power Point Presentations
- Tutorial Sheets
- Assignments

**Textbooks:**


1. A beginners guide, Quadcopters and Drones, Mark D Smith, 2015.
2. Drones (The Ultimate Guide): Ben Rupert.
3. Build a Drone: A Step-by-Step Guide to Designing, Constructing, and Flying Your Very Own Drone, by Barry Davies.


**Reference Books:**


1. Theory, Design, and Applications of Unmanned Aerial Vehicles- by A. R. Jha Ph.D. (Author), 2016.
2. Handbook of Unmanned Aerial Vehicles- Editors: Valavanis, K., Vachtsevanos, George J.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**SOFTWARE PROCESS AND PROJECT MANAGEMENT**
**(PROFESSIONAL ELECTIVE-VI)**

**Course Code: GR24A4105** **L/T/P/C: 3/0/0/3**

**IV Year II Semester**

**Course Outcomes:**

1. Apply software process maturity models to assess and improve organizational processes.
2. Analyze software life-cycle phases and artifacts for effective project management.
3. Prepare project plans using workflows, milestones, and estimation techniques.
4. Use project metrics and organizational structures to monitor and control projects.
5. Evaluate modern software project management practices for future software development.

**UNIT - I**

**Software Process Maturity**

Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process, Process Reference Models Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP).

**UNIT - II**

**Software Project Management Renaissance**

Conventional Software Management, Evolution of Software Economics, Improving Software Economics, Life-Cycle Phases and Process artifacts

Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures.

**UNIT - III**

**Workflows and Checkpoints of process**

Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments, Process Planning Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

**UNIT - IV**

**Project Organizations**

Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation, The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.

**UNIT - V**

CCPDS-R Case Study and Future Software Project Management Practices, Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

**Textbooks:**

1. Managing the Software Process, Watts S. Humphrey, Pearson Education.
2. Software Project Management, Walker Royce, Pearson Education.

**Reference Books:**

1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000.
2. Process Improvement essentials, James R. Persse, O'Reilly, 2006.
3. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006.
4. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O'Reilly, 2006.
5. Software Engineering Project Management, Richard H. Thayer & Edward Yourdon, 2nd edition, Wiley India, 2004.
6. Agile Project Management, Jim Highsmith, Pearson education, 2004.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**PROJECT WORK - PHASE II**

**Course Code: GR24A4026** **L/T/P/C: 0/0/12/6**

**IV Year II Semester**

**Prerequisites:**

Students should have prior knowledge of

- Fundamentals of Core Computer Science and Engineering Subjects.
- Basics of Software/Hardware Project Design and Development.
- Knowledge of Technical Documentation and Presentation Skills.

**Course Outcomes:**

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

1. Apply theoretical and practical knowledge within the chosen area of technology to identify and explore project opportunities.
2. Identify, formulate, and justify the problem statement, and analyse technical aspects of the project with a comprehensive and systematic approach.
3. Design and develop engineering solutions by integrating appropriate tools, technologies, and methodologies to implement the proposed project.
4. Demonstrate individual responsibility and effective collaboration in a team, managing tasks, timelines, and resources for successful project execution.
5. Document project activities, prepare structured technical reports, and present findings effectively through oral and written communication.

# 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, November 2010: First Edition

**REFERENCE BOOKS:**

1. G James, D. Witten, T Hastie, and R. Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer, 2013
2. Chambers, John, Software for Data Analysis Programming with R, Springer, 2008
3. Trevor Hastie Robert Tibshirani Jerome Friedman, The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Springer, 2014
4. Mark Gardener, Beginning R: The Statistical Programming Language, Wiley, 2013
5. Upadhyaya and A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**AUGMENTED REALITY AND VIRTUAL REALITY**
**(OPEN ELECTIVE)**

**Course Code: GR24A4096** **L/T/P/C: 3/0/0/3**

**Course Outcomes:** On completion of the course, the student will be able to
1. Analyze about augmented reality.
2. Identify AR devices for various applications.
3. Analyze about virtual reality.
4. Interpret about usage of VR devices and human factors involved.
5. Apply AR & VR technology in various domains.

**UNIT-I:**
Introduction to Augmented Reality, The Relationship Between Augmented Reality and Other Technologies, Augmented Reality Concepts, How Does Augmented Reality Work?, Ingredients of an Augmented Reality Experience.

**UNIT-II:**
Augmented Reality Hardware, Major Hardware Components for Augmented Reality Systems, Augmented Reality Software, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

**UNIT-III:**
Virtual Reality: The Three I's of Virtual Reality, A Short History of Early Virtual Reality, Early Commercial VR Technology , VR Becomes an Industry, The Five Classic Components of a VR System.
Input Devices: Trackers, Navigation, and Gesture Interfaces: Three-Dimensional Position Trackers, Navigation and Manipulation Interfaces

**UNIT-IV:**
Output Devices: Graphics, Three-Dimensional Sound, and Haptic Displays : Graphics Displays, Sound Displays, Haptic Feedback.
Human Factors in VR: Methodology and Terminology, User Performance Studies, VR Health and Safety Issues, VR and Society

**UNIT-V:**
Augmented Reality Applications, What Makes a Good Augmented Reality Application? Application Areas: Education, Gaming, Robotics, Health care, Manufacturing, Evaluating Augmented Reality Applications.

**TEXT BOOKS:**
1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
2. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley IEEE Press, 2003/2006.

**REFERENCE BOOKS:**
1. LaValle, "Virtual Reality", Cambridge University Press, 2016.

2. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
3. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.
4. Anand R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT**
**(OPEN ELECTIVE)**

**Course Code: GR24A4115** **L/T/P/C: 3/0/0/3**

**Course Pre-Requisite(s):** Fundamentals of Management, Operations Research
**Course Outcomes:** After completing this course, students will be able to:
1. Understand concepts of services and its significance in the economy and society and distinguish it from goods.
2. Understand the service strategy, design, and development.
3. Comprehend ways to design services and able to understand service guarantee, recovery, and failures.
4. Forecast the service demand, supply and facilitate various methods to operate and manage services.
5. Understand the service productivity and how innovation can be approached from services point of view.

**UNIT-I:**
Introduction: Service operations, Role of service in economy and society, Indian service sector.
Nature of Services and Service Encounters: Differences between services and operations, Service package, characteristics, various frameworks to design service operation system, Kind of service encounter, importance of encounters
Service-Dominant Logic: From Goods-Dominant logic to Service-Dominant logic, Value Co-creation.

**UNIT-II:**
Service Strategy and Competitiveness: Development of Strategic Service Vision (SSV), Data Envelopment Analysis.
New Service Development: NSD cycle, Service Blueprinting, Elements of service delivery system Service Design: Customer Journey and Service Design, Design Thinking methods to aid Service Design.
Locating facilities and designing their layout: models of facility locations (Huff's retail model), Role of service-scape in layout design.
Service Quality: SERVQUAL, Walk through Audit, Dimensions of Service quality & other quality tools.

**UNIT-III:**
Service Guarantee & Service Recovery: Service guarantee and its types; Service failure – reasons for failure and service recovery strategies.

**UNIT-IV:**
Simple Forecasting Demand for Services: A review of different types of forecasting methods for demand forecasting.
Managing Capacity and Demand: Strategies for matching capacity and demand, Psychology of waiting, Application of various tools used in managing waiting line in services.
Managing Facilitating Goods: Review of inventory models, Role of inventory in services
Managing service supply relationship: Understanding the supply chain/hub of service, Strategies for managing suppliers of service
Vehicle Routing Problem: Managing after sales service, understanding services that involve

transportation of people and vehicle, Techniques for optimizing vehicle routes.

**UNIT-V:**

**Service Innovation:** Services Productivity, Need for Services Innovation

**Student Project:**

Option 1: Choose any service organization around and present it from the perspective of: nature of service, classification of service, blueprint or service design analysis, service quality, and any additional perspective you would like to add.

Option 2: Choose any latest research paper in services and explain your understanding and feedback on the same.

**TEXT BOOKS:**

1. Fitzsimmons & Fitzsimmons, Service Management: Operations, Strategy, Information Technology, McGraw Hill publications (7th edition)

**REFERENCE BOOKS:**

1. Wilson, A., Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2012). Services marketing: Integrating customer focus across the firm. McGraw Hill.
2. Lovelock, C. (2011). Services Marketing, 7/e. Pearson Education India
3. Reason, Ben, and Lovlie, Lavrans, (2016) Service Design for Business: A Practical Guide to Optimizing the Customer Experience, Pan Macmillan India,
4. Chesbrough, H. (2010). Open services innovation: Rethinking your business to grow and compete in a new era. John Wiley & Sons.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

# IT PROJECT MANAGEMENT
## (OPEN ELECTIVE)

**Course Code: GR24A4116** **L/T/P/C: 3/0/0/3**

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

1. Learn the techniques to effectively plan manage, execute the projects.
2. Learn the techniques to control projects within time and cost targets with a focus on Information Technology and Service Sector.
3. Learn various agile methodologies.
4. Apply agile project management techniques such as Scrum on real time applications.
5. Develop real time applications using agile project management techniques such as DevOps.

**UNIT-I:**

**Project Overview and Feasibility Studies-** Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal

**Project Scheduling**: Project Scheduling, Introduction to PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculation and its importance, Cost reduction by Crashing of activity.

**UNIT-II:**

**Cost Control and Scheduling**: Project Cost Control (PERT/Cost), Resource Scheduling & Resource Leveling **Project Management Features:** Risk Analysis, Project Control, Project Audit and Project Termination.

**UNIT-III:**

**Agile Project Management:** Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum, Lean, DevOps and IT Service Management (ITIL).

**Other Agile Methodologies**: Introduction to XP, FDD, DSDM, Crystal

**UNIT-IV:**

Reporting **Scrum:** Various terminologies used in Scrum (Sprint, product backlog, sprint backlog, sprint review, retro perspective), various roles (Roles in Scrum), Best practices of Scrum.

**UNIT-V:**

**DevOps:** Overview and its Components, Containerization Using Docker, Managing Source Code and Automating Builds, Automated Testing and Test-Driven Development, Continuous Integration, Configuration Management, Continuous Deployment, Automated Monitoring.

**TEXT BOOKS:**

1. Mike Cohn, Succeeding with Agile: Software Development Using Scrum
2. Notes to be distributed by the course instructor on various topics

**REFERENCE BOOKS:**

1. Pichler, Agile Product Management with Scrum
2. Roman Ken Schwaber, Agile Project Management with Scrum (Microsoft Professional

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**MARKETING RESEARCH AND MARKETING MANAGEMENT**
**(OPEN ELECTIVE)**

**Course Code: GR24A4117** **L/T/P/C: 3/0/0/3**

**Course Outcomes:** On completion of the course, the student will be able to
1. Understand the significance of marketing management concepts, marketing environment, consumer behaviour elements and strategies related to STP.
2. Understand various product management strategies and importance of branding, packing.
3. Comprehend the dynamics of marketing mix elements such as pricing, distribution, and promotion mix elements to leverage marketing concepts for effective decision making.
4. Demonstrate analytical skills in identification and resolution of problems pertaining to marketing management and marketing research and uses of various statistical tools in marketing research.
5. Understanding about the concepts of internet marketing and the fundamentals of business-to-business marketing strategy, CRM strategies.

**UNIT-I:**
**Marketing Concepts and Applications:** Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector.
**Marketing Planning & Environment:** Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social
**Understanding the consumer:** Determinants of consumer behavior, Factors influencing consumer behavior
**Market Segmentation:** Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning

**UNIT-II:**
**Product Management:** Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging.

**UNIT-III:**
**Pricing, Promotion and Distribution Strategy:** Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising

**UNIT-IV:**
**Marketing Research**: Introduction, Type of Market Research, Scope, Objectives & Limitations Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research
**Data Analysis**: Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis

**UNIT-V:**
**Internet Marketing: Introduction to Internet Marketing**. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing
**Business to Business Marketing:** Fundamental of business markets. Organizational buying

process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy

Home Assignments:

Written Analyses of Cases – Students are expected to report on their analysis and recommendations of what to do in specific business situations by applying concepts and principles learned in class (Case Studies to be shared by Faculty) e.g. "Marketing Myopia"

1. Field visit & live project covering steps involved in formulating Market Research Project.
2. Measuring Internet Marketing Effectiveness: Metrics and Website Analytics.

**TEXT BOOKS:**

1. Marketing Management (Analysis, Planning, Implementation & Control) – Philip Kotler.
2. Fundamentals of Marketing – William J. Stanton & Others.
3. Marketing Management – V.S. Ramaswamy and S. Namakumari.
4. Marketing Research – Rajendra Nargundkar.
5. Market Research – G.C. Beri.
6. Market Research, Concepts, & Cases – Cooper Schindler.

**REFERENCE BOOKS:**

1. Marketing Management – Rajan Saxena.
2. Marketing Management – S.A. Sherlekar.
3. Service Marketing – S.M. Zha.
4. Journals – The IUP Journal of Marketing Management, Harvard Business Review.
5. Research for Marketing Decisions by Paul Green, Donald, Tull.
6. Business Statistics, A First Course, David M Levine at al, Pearson Publication.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**BASICS OF JAVA PROGRAMMING**

**(OPEN ELECTIVE)**

**Course Code: GR24A3133** **L/T/P/C: 3/0/0/3**

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

1. Apply OOP principles by writing Java programs using data types, operators, and control structures.
2. Analyze Java programs by implementing classes, constructors, arrays, and inheritance, and differentiate overloading and overriding.
3. Demonstrate modular design with packages, interfaces, and abstract classes, and evaluate exception handling.
4. Implement multithreading and synchronization and utilize collections for efficient data management.
5. Design modern Java applications using JavaFX, Spring Boot, and Hibernate/JPA

**UNIT-I:**

Object Oriented Thinking: Introduction, Need of object-oriented programming, principles of object-oriented languages, Applications of OOP, history of JAVA, Java Virtual Machine, Java features, Program structures, Installation of JDK.

Variables, Primitive data types, Identifiers- Naming Conventions, Keywords, Literals, Operators- Binary, Unary and Ternary, Expressions, Primitive Type conversion and casting, flow of control- branching, conditional, loops.

**UNIT-II:**

CLASSES, INHERITANCE, POLYMORPHISM:

Classes and Objects: Classes, Objects, creating objects, methods, constructors- constructor overloading, cleaning up unused objects- Garbage collector, class variable and methods- static keyword, this keyword, arrays, Command line arguments, Nested Classes

Strings: String, String Buffer, String Tokenizer

Inheritance and Polymorphism: Types of Inheritance, deriving classes using extends keyword, super keyword, Polymorphism – Method Overloading, Method Overriding, final keyword, abstract classes.

**UNIT-III:**

INTERFACES, PACKAGES, EXCEPTIONS

Interfaces: Interface, Extending interface, interface Vs Abstract classes.

Packages: Creating Packages, using Packages, Access protection, java I/O package. Exceptions Introduction, Exception handling Techniques: try…catch, throw, throws, finally block, user defined Exception.

**UNIT-IV:**

MULTI-THREADING, COLLECTIONS

java.lang.Thread, the main Thread, creation of new Threads, Thread priority, multithreading-using isalive() and join(), Synchronization, suspending and resuming Threads, Communication between Threads. Exploring java.io, Exploring java.util

Collections: Overview of Collection Framework : Array List, LinkedList, Vector, HastSet, Tree Set, HashMap, Hash Table, Tree Map, Iterator, Comparator

**UNIT-V:**

Introduction to Spring Framework Overview of the Spring ecosystem, concepts of Inversion of Control (IoC) and Dependency Injection (DI), Spring Boot basics for rapid application development, and building a simple REST API with Spring Boot.

Data Access with Java Introduction to JDBC, an overview of JPA (Java Persistence API), using Hibernate with Spring Data JPA, and creating a simple CRUD application as an example.

**Teaching Methodologies:**

Power Point Presentations
Tutorial Sheets
Assignments

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

1. Object Oriented Programming through Java, P.Radha Krishna, Universities Press.
2. Thinking in Java, Bruce Eckel, Pearson Education
3. Programming in Java, S.Malhotra and S.Choudhary, Oxford University Press

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

# INTRODUCTION TO DBMS
# (OPEN ELECTIVE)

**Course Code: GR24A3141** **L/T/P/C: 3/0/0/3**

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

1. Demonstrate the concepts of data mining, its applications
2. Apply data preprocessing techniques such as cleaning, integration, transformation, and reduction.
3. Implement clustering algorithms and evaluate their performance using similarity measures
4. Analyze association rules using Apriori and other frequent pattern mining techniques.
5. Examine outlier detection methods and justify their applications in real-world scenarios.

**UNIT-I:**

Introduction to Database And System Architecture: Database Systems and their Applications, Database Vs File System, View of Data, Data Models, Database Languages- DDL and DML, Transaction Management, Database users and Administrators, Database System Structure.

**UNIT-II:**

Introduction to Database Design: ER Diagrams, Entities, Attributes and Entity sets, Relationships and Relationship set, Extended ER Features, Conceptual Design with the ER Model, Logical database Design.

Relational Model: Introduction to Relational Model, Basic Structure, Database Schema, Keys, Relational Algebra

**UNIT-III:**

SQL Queries and Constraints: SQL Data Definition, Types of SQL Commands, Form of Basic SQL Query, SQL Operators, Set Operators, Nested Queries, Aggregate Operators, NULL values, Integrity Constraints Over Relations, Joins, Introduction to Views, Destroying Altering Tables and Views, Cursors, Triggers.

**UNIT-IV:**

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Properties of Decomposition, Reasoning about FD, Normal Forms,

**UNIT-V:**

Transaction Management: Transaction Concept, Transaction State, Concurrent Executions, Serializability, Testing for Serializability.

Concurrency Control: Lock based Protocols, Timestamp based protocols,

Recovery System: Recovery and Atomicity, Log based recovery, Shadow Paging, Recovery with concurrent Transactions.

**Teaching Methodologies:**

Power Point Presentations
Tutorial Sheets
Assignments

**TEXT BOOKS:**

1. "Data base Management Systems", Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rdEdition

2. “Data base System Concepts”, Silberschatz, Korth, McGraw hill, V Edition.
3. “Introduction to Database Systems”, C.J.Date Pearson Education.

**REFERENCE BOOKS:**

1. “Database Management Systems”, P. Radha Krishna HI-TECH Publications 2005.
2. “Database Management System”, Elmasri Navate, Pearson Education.
3. “Database Management System”, Mathew Leon, Leo

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**INTRODUCTION TO DATA MINING**
**(OPEN ELECTIVE)**

**Course Code: GR24A4124** **L/T/P/C: 3/0/0/3**

**Prerequisites:** Students are expected to have knowledge of transactional and relational databases, probability, and statistics.

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

1. Demonstrate the concepts of data mining, its applications
2. Apply data preprocessing techniques such as cleaning, integration, transformation, and reduction.
3. Implement clustering algorithms and evaluate their performance using similarity measures
4. Analyze association rules using Apriori and other frequent pattern mining techniques.
5. Examine outlier detection methods and justify their applications in real-world scenarios.

**UNIT-I:**

Introduction: Why Data mining, What is Data Mining, What Kinds of Data Can Be Mined, What Kinds of Patterns Can Be Mined, Which Technologies are used, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining.

**UNIT-II:**

Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction.

**UNIT-III:**

Association Rule Mining: Introduction to association rule mining. Apriori algorithm and other frequent pattern mining techniques. Measuring the strength of association rules.

**UNIT-IV:**

Classification: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, k-Nearest-Neighbor Classifiers.

**UNIT-V:**

Clustering: Introduction to clustering and similarity measures.
Clustering algorithms: k-means, hierarchical clustering, density-based clustering.
Evaluating clustering results: silhouette score, Davies-Bouldin index.

**Teaching Methodologies:**

Power Point Presentations
Tutorial Sheets
Assignments

**TEXT BOOKS:**

1. Data Mining Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, Third Edition, 2012.
2. Introduction to Data Mining Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education.

**REFERENCE BOOKS:**

1. Data Mining Techniques – Arun K. Pujari, Second Edition, Universities Press.
2. Data Warehousing in the Real World, Sam Aanhory and Dennis Murray, Pearson Edn Asian

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**
**INTRODUCTION TO OPERATING SYSTEMS**
**(OPEN ELECTIVE)**

**Course Code: GR24A3143** **L/T/P/C: 3/0/0/3**

**Prerequisite:** Students should have prior knowledge of:
- Basics of Programming, and
- Fundamentals of Data Structures and Algorithms, such as stacks, queues, and linked lists.

**Course Outcomes:** After completing this course, students will be able to:
1. Explain the objectives, structure, and functions of an operating system, including process, memory, storage, and security management, and demonstrate how OS services interact with users and hardware.
2. Apply process management concepts such as process states, scheduling algorithms, and interprocess communication; design and solve synchronization problems using semaphores, monitors, and classical solutions.
3. Analyze memory management strategies such as paging, segmentation, and swapping, and evaluate virtual memory techniques including demand paging, page replacement, and thrashing control.
4. Implement basic file operations and explain file system structure, directory management, allocation methods, and disk scheduling techniques for efficient storage management.
5. Identify, prevent, and recover from deadlocks; apply system protection principles and access control mechanisms to safeguard resources and files in different operating system environments.

**UNIT-I: Introduction:**
Overview, Objectives, User view, System view, Operating system definition, Computer System Organization, Computer System Architecture, OS Structure, OS Operations, Process Management, Memory Management, Storage Management, Protection and Security.
Operating System services, User and OS Interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, OS Structure.

**UNIT-II: Process and CPU Scheduling:**
Process concepts: The Process, Process State, Process Control Block, Threads, Process Scheduling-Scheduling Queues, Schedulers, Context Switch, Operations on Processes, System calls-fork(), exec(), wait(), exit(), Interprocess communication.
Process Scheduling: Basic concepts, Scheduling Criteria, Scheduling algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Thread scheduling. Process Synchronization, Critical Section Problem, Peterson's solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.

**UNIT-III: Memory Management and Virtual Memory:**
Memory Management Strategies - Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table.
Virtual Memory Management - Background, Demand Paging, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing.

**UNIT-IV: Storage Management and File System:**
Storage Management - File System, Concept of a File, System calls for File Operations – open

(), read (), write (), close (), seek (), unlink (), Access methods - Directory and Disk Structure, File System Mounting, File Sharing, Protection.
File System Structure, File System Implementation, Directory Implementation, Allocation methods, Free-space Management, Efficiency, and Performance. Mass Storage Structure – Overview, Disk Structure, Disk Attachment, Disk Scheduling.

**UNIT-V: Deadlocks and Protection:**
Deadlocks - System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.
Protection – System Protection, Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Access Control, Revocation of Access Rights, Capability-based Systems, Language-based Protection.

**TEXT BOOKS:**
1. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, PHI, 2019.
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, 7th Edition, Wiley, 2006.

**REFERENCE BOOKS:**
1. Andrew S. Tanenbaum, Modern Operating Systems, 5th Edition, PHI, 2022.
2. Gary J. Nutt, Operating Systems: A Modern Perspective, 3rd Edition, Addison-Wesley, 2004.
3. R. Elmasri, A.G. Carrick, D. Levine, Operating Systems, First Edition, McGraw Hill, 2009.
4. Charles Crowley, Operating System: A Design-oriented Approach, Irwin Publishing, First Edition, 1996.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

# INTERNET OF THINGS
## (OPEN ELECTIVE)

**Course Code: GR24A3145** **L/T/P/C: 3/0/0/3**

**Prerequisite:**
The fundamental knowledge in C programming, Data Structures and Operating Systems

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

1. Understand IoT architecture and fundamental networking protocols and models.
2. Develop Arduino-based IoT applications integrating sensors and actuators.
3. Program Raspberry Pi using Python for cloud-connected IoT solutions.
4. Analyse various IoT applications including smart home and industrial systems.
5. Apply cloud and edge computing for IoT data analytics.

**UNIT-I:**

**Introduction to IoT and Sensor Networks**: Introduction to Internet of Things (IoT), Characteristics and Applications of IoT, IoT Architecture and Reference Models(IETF, ITU-T), Physical Design of IoT- Devices, Gateways, and Data Centers, Functional Blocks of IoT- Sensing, Actuation, Communication, Enabling Technologies: RFID, Wireless Sensor Networks.

**Networking and Communication Protocols**: MQTT, CoAP, ZigBee, HTTP Sensor Networks- Types, Topologies, and Protocols, Introduction to IoT Security and Privacy Fundamentals.

**UNIT-II:**

**Machine to Machine (M2M) and Embedded Programming for IoT**: Machine-to-Machine Communications Overview, Difference between IoT and M2M, Interoperability in IoT, Standards and Protocols.

**Arduino**: Introduction to Arduino Programming for IoT, Integration of Sensors and Actuators with Arduino, Hands-on Exercises- Sensor Data Acquisition and Actuator Control, Basic Communication Protocols, Implementation on Arduino-IoT Device Interoperability, Challenges and Solutions.

**UNIT-III:**

**Raspberry Pi with Python Programming for IoT**: Introduction to Python Programming , Basics, Overview of Raspberry Pi and its Role in IoT, Interfacing Raspberry Pi with Sensors and Actuators (UART, SPI, I2C).

**Data Acquisition and Processing:** Data Acquisition and Local Processing, Sending Data to Cloud Platforms, Implementation of IoT Projects Using Raspberry Pi.

**Case Studies:** Smart Home Automation, Healthcare Monitoring, Environmental Sensing.

**UNIT-IV:**

**IoT Applications**: Smart Homes-Smart Home Origin, Technologies, Implementation,
Smart Grids- Characteristics, Benefits, Architecture, Components, Smart Cities- Characteristics, Frameworks, Challenges, Industrial IoT-Requirements, Design Considerations, Applications.

**UNIT-V:**

**Cloud and Edge Computing Models with IoT Use Cases:** Introduction to Cloud Computing

and Cloud Storage Models, Edge and Fog Computing Concepts for IoT, Web Servers and Cloud Platforms for IoT (AWS IoT, Azure IoT, etc.).
**IoT Use Cases**: Smart Cities, Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT

**TEXT BOOKS:**

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”, 2015.
3. IOT Fundamentals: Networking Technologies, Protocols and Use Cases for IOT, Rowan. Trollope, David Hanes, Patrick Gassetete, Jerome Henry, Pearson Education Limted, 2017.

**REFERENCE BOOKS:**

1. Terokarvinen, kemo, karvinen and villeyvaltokari, “Make sensors”: 1st edition, Maker Media, 2014.
2. Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice, 2010.
3. Charles Bell, Beginning Sensor networks with Arduino and Raspberry Pi, Apress, 2013.
4. Fei Hu, Security and Privacy in Internet of Things (IoTs), CRC Press, Taylor & Francis Group, 2020.
5. S. Sahoo, S. Sahoo, S. Mishra, Software-Defined Networking for Future Internet Technology: Concepts and Applications, Routledge, 2022.

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**SCRIPTING LANGUAGES**

**(OPEN ELECTIVE)**

**Course Code: GR24A4134** **L/T/P/C: 3/0/0/3**

**Prerequisites:** Basic knowledge of programming concepts (loops, functions, arrays) and fundamentals of databases.

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

1. Understand PHP basics including variables, constants, control structures, arrays, and functions for web application development.
2. Apply MySQL database concepts with PHP to design, query, and manage relational databases securely.
3. Implement advanced PHP features such as authentication, file upload, email handling, and encryption in dynamic websites.
4. Design and develop Perl programs using arrays, hashes, subroutines, and advanced features like file system interaction, modules, and object-oriented constructs.
5. Apply Python programming concepts including functions, built-in modules, exception handling, and OOP paradigms for web and general-purpose scripting.

**UNIT-I: PHP Basics:**

Basics - Features, Data types, Variables, Constants, Expressions, String interpolation, Control structures, Embedding PHP Code in Web pages.

Functions: Creating a Function, Function Libraries, Arrays, Strings and Regular Expressions.

**UNIT-II: MySQL Basics:**

**Introduction**: Database Concepts, Overview of MySQL database, Installation. Connection establishment and Accessing MySQL Server, Querying the database. Data Definition Language. Functions and Logical operators, Access Privilege System.

**UNIT-III: Advanced PHP Programming:**

PHP and Web Forms, Files, PHP Authentication and Methodologies - File-based, Database-based, IP-based. Uploading Files with PHP, Sending Email, PHP Encryption Functions, Mcrypt package.

**UNIT-IV: PERL:**

Names and Values, Variables, Scalar Expressions, Control Structures, Arrays, List, Hashes, Strings, Pattern and Regular Expressions, Subroutines.

**Advanced PERL:** Finer points of Looping, Pack and unpack, File system, Data structures, Packages, Modules, Objects, Interfacing to the Operating System.

**UNIT-V: Python:**

Introduction, Syntax and Indentation, Statements, Functions, Built-in-Functions, Basics of Object-Oriented Paradigm, Modules and Packages, Exception Handling.

**TEXT BOOKS:**

1. David Barron, The World of Scripting Languages, Wiley India Pvt. Ltd., 1st Edition, 2003.
2. Jason Gilmore, Beginning PHP and MySQL, From Novice to Professional, Apress (Dreamtech India), 3rd Edition, 2008.

3. Steve Holden and David Beazley, Python Web Programming, New Riders Publications, 1st Edition, 2001.

**REFERENCE BOOKS:**

1. James Lee and Brent Ware, Open Source Web Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP, Addison-Wesley (Pearson Education), 1st Edition, 2003.
2. Julie Meloni and Matt Telles, PHP 6 Fast & Easy Web Development, Cengage Learning, 1st Edition, 2008.
3. Ivan Bayross and Sharanam Shah, PHP 5.1, The X Team, SPD Publications, 1st Edition, 2006.