KLE Technological University | Creating Value, Leveraging Knowledge

| Curriculum Structure and Curriculum Content for the Batch: **2023-27** |
| --- |
| Department: **Computer Science and Engineering** |
| Program: **BE- Computer Science and Engineering** |

## Table of Contents

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# Vision and Mission of KLE Technological University

## Vision

KLE Technological University will be a national leader in Higher Education–recognised globally for innovative culture, outstanding student experience, research excellence and social impact.

## Mission

KLE Technological University is dedicated to teaching that meets highest standards of excellence, generation and application of new knowledge through research and creative endeavors.

The three-fold mission of the University is:

- To offer undergraduate and post-graduate programs with engaged and experiential learning environment enriched by high quality instruction that prepares students to succeed in their lives and professional careers.

- To enable and grow disciplinary and inter-disciplinary areas of research that build on present strengths and future opportunities aligning with areas of national strategic importance and priority.

- To actively engage in the Socio-economic development of the region by contributing our expertise, experience and leadership, to enhance competitiveness and quality of life.

As a unified community of faculty, staff and students, we work together with the spirit of collaboration and partnership to accomplish our mission.

## Vision and Mission Statements of the Department

### Department Vision

The KLE Tech- School of Computer Science will excel and lead in education, research and innovation in computing and information technology, contributing to the evolving needs of the world we live in.

### Department Mission

- To foster a dynamic academic environment with cutting edge curriculum and innovative educational experience to prepare graduates to succeed and lead in a wide range of computing and information technology businesses and occupations.
- To be at the forefront of research through new and exciting innovations leading to the future of computing technologies.
- To collaborate within and beyond discipline to create solutions that benefit humanity and society.

## Program Educational Objectives/Program Outcomes and Program-Specific Objectives

| **Program Educational Objectives -PEO's** |
|---|
| PEO: 1. Graduates will demonstrate peer recognized technical competency to solve analyze, design, develop, deploy and maintain computing solutions for contemporary problems. |
| PEO: 2. Graduates will demonstrate leadership and initiative to advance professional and organizational goals with commitment to ethical standards of profession, teamwork and respect for diverse cultural background. |
| PEO: 3. Graduates will be engaged in ongoing learning and professional development through pursuing higher education and self-study. |
| PEO: 4. Graduates will be committed to creative practice of engineering and other professions in a responsible manner contributing to the socio-economic development of the society. |
| **Program Outcomes-PO's** |
| PO 1: **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems. |
| PO 2: **Problem Analysis:** Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4). |
| PO 3: **Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems, components, or processes to meet identified needs with consideration for public health and safety, whole-life cost, net-zero carbon, culture, society, and environment as required (WK5). |
| PO 4: **Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8). |
| PO 5: **Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6). |
| PO 6: **The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.(WK1, WK5, and WK7). |
| PO 7: **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9). |
| PO 8: **Individual and Collaborative Team Work**: Function effectively as an individual, and as a member or leader in diverse/ multidisciplinary teams. |
| PO 9: **Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences. |
| PO 10: **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to |

| |
|---|
| one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments. |
| PO 11: **Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8). |
| **Program Specific Objectives -PSO's** |
| PSO 1: **Software System Construction:** Apply design and development principles in the construction of software systems of varying complexity. |
| PSO 2: **Domain-specific knowledge:** An ability to develop AI based solutions in the domain of data, system and network engineering. |

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## Curriculum Structure-Overall

| CSE | | | | | Total Program Credit: 176(44+132) | | | Year: 2023 - 27 | |
|---|---|---|---|---|---|---|---|---|---|
| Course with course code | I | II | III | IV | V | VI | VII | VIII | |
| | Single Variable Calculus 18EMAB101 (4-1-0) | Multivariable Calculus 18EMAB102 (4-1-0) | Linear Algebra 24EMAB208 (3-0-1) | Probability and Statistics 24EMAB209 (3-1-0) | Machine Learning and Deep Learning 24ECSC306 (2-0-2) | Generative AI 25ECSC314 (3-0-1) | Big Data Analytics 24ECSC401(2-0-1) | PE-6 XXECSE4XX (3-0-0) | Internship Training 25ECSI495 (0-0-6) |
| | Engineering Physics 22EPHB101 (3-0-0) | Engineering Chemistry 22ECHB102 (3-0-0) | Discrete Mathematical Structures 24ECSC202 (3-1-0) | Computer Networks-1 24ECSC207(3-1-0) | Computer Networks-2 24ECSC303 (3-0-0) | Wireless and Mobile Networks 25ECSC311(3-0-1) | Cryptography & Network Security (24ECSC403)(2-0-1) | OE XXECSO4XX (3-0-0) | |
| | Engineering Mechanics 15ECVF101 (4-0-0) | Problem Solving with Data Structures 18ECSP102 (0-0-3) | Computer Organization and Architecture 24ECSC201 (3-0-1) | Object Oriented Programming 24ECSC204 (3-0-0) | Web Technologies Lab 24ECSP304 (0-0-2) | Embedded Systems and IoT 24ECSC308 (2-0-1) | PE – 4 XXECSE4XX (3-0-0) | Capstone Project 20ECSW402 / Internship Project 25ECSW496 (0-0-11) | |
| | C Programming for Problem Solving 18ECSP101 (0-0-3) | Engineering Exploration 22ECRP101 (0-0-3) | Design and Analysis of Algorithms 24ECSC205 (4-0-0) | Principles of Compiler Design 19ECSC203(3-1-0) | Cloud Computing 25ECSC305 (2-0-1) | PE-2 XXECSE3XX (3-0-0) | PE-5 XXECSE4XX (3-0-0) | | |
| | Basic Electrical Engineering 18EEEF101 (3-0-0) | Basic Electronics 18EECF101 (4-0-0) | Database Management System 15ECSC208 (4-0-0) | Operating System Principles and Programming 24ECSC209 (4-0-1) | Software Engineering 25ECSC301 (3-0-0) | PE-3 XXECSE3XX (3-0-0) | Senior Design Project 20ECSW401 (0-0-6) | | |
| | Design Thinking for Social Innovation 20EHSP101 (0-1-1) | Basic Mechanical Engineering 22EMEF101 (2-1-0) | Database Applications Lab 15ECSP204 (0-0-1.5) | Exploratory Data Analysis 24ECSC210 (2-0-2) | Computer Networks Lab 25ECSP305 (0-0-1) | Minor Project 24ECSW302 (0-0-6) | CIPE & EVS 15EHSA401 (Audit) | | |
| | Applied Physics Lab (0-0-1) 21EPHP101 | Professional Communication (1-1-0) 15EHSH101 | Algorithms Lab 24ECSP205 (0-0-2) | Object Oriented Programming Lab 24ECSP203 (0-0-1.5) | Mini Project 15ECSW301 (0-0-3) | | | | |
| | | | | | PE-1 XXECSE3XX (3-0-0) | Professional Aptitude & Logical Reasoning 16EHSC301 (3-0-0) | | | |
| | | | Corporate Communication 24EHSA201 (Audit) | Problem Solving & Analysis 24EHSA202 (Audit) | Arithmetical Thinking & Analytical Reasoning 23EHSA303 (Audit) | Industry Readiness & Leadership Skills (23EHSA304)( Audit) | | | |
| Credits | **21** | **23** | **23.5** | **25.5** | **22** | **26** | **18** | **17** | |

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## Curriculum Structure-Semester wise

### Semester - I

| No | Code | Course | Category | L-T-P | Credits | Contact Hours | ISA | ESA | Total | Exam Duration |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18EMAB101 | Single Variable Calculus | BS | 4-1-0 | 5 | 6 | 50 | 50 | 100 | 3 hours |
| 2 | 22EPHB101 | Engineering Physics | BS | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 3 | 15ECVF101 | Engineering Mechanics | ES | 4-0-0 | 4 | 4 | 50 | 50 | 100 | 3 hours |
| 4 | 18ECSP101 | C Programming for Problem solving | ES | 0-0-3 | 3 | 6 | 80 | 20 | 100 | 3 hours |
| 5 | 18EEEF101 | Basic Electrical Engineering | ES | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 6 | 20EHSP101 | Design Thinking for Social Innovation | HSS | 0-1-1 | 2 | 3 | 80 | 20 | 100 | 3 hours |
| 7 | 21EPHP101 | Applied Physics Lab | BS | 0-0-1 | 1 | 2 | 80 | 20 | 100 | 3 hours |
| **Total** | | | | **14-2-5** | **21** | **27** | **440** | **260** | **700** | |

**ISA**: In Semester Assessment **ESA**: End Semester Assessment **L**: Lecture **T**: Tutorials **P**: Practical

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## Semester - II

| No | Code | Course | Category | L-T-P | Credits | Contact Hours | ISA | ESA | Total | Exam Duration |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18EMAB102 | Multivariable Calculus | BS | 4-1-0 | 5 | 6 | 50 | 50 | 100 | 3 hours |
| 2 | 22ECHB102 | Engineering Chemistry | BS | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 3 | 18ECSP102 | Problem Solving with Data Structures | ES | 0-0-3 | 3 | 6 | 80 | 20 | 100 | 3 hours |
| 4 | 22ECRP101 | Engineering Exploration | ES | 0-0-3 | 3 | 6 | 80 | 20 | 100 | 3 hours |
| 5 | 18EECF101 | Basic Electronics | ES | 4-0-0 | 4 | 4 | 50 | 50 | 100 | 3 hours |
| 6 | 22EMEF101 | Basic Mechanical Engineering | ES | 2-1-0 | 3 | 4 | 50 | 50 | 100 | 2 hours |
| 7 | 15EHSH101 | Professional Communication | HSS | 1-1-0 | 2 | 3 | 50 | 50 | 100 | 3 hours |
| **Total** | | | | **14-3-6** | **23** | **32** | **410** | **290** | **700** | |

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## Semester- III

| No | Code | Course | Category | L-T-P | Credits | Contact Hours | ISA | ESA | Total | Exam Duration |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 24EMAB208 | Linear Algebra | BS | 3-0-1 | 4 | 4 | 50 | 50 | 100 | 3 hours |
| 2 | 24ECSC202 | Discrete Mathematical Structures | PC | 3-1-0 | 4 | 5 | 50 | 50 | 100 | 3 hours |
| 3 | 24ECSC201 | Computer Organization and Architecture | PC | 3-0-1 | 4 | 5 | 50 | 50 | 100 | 3 hours |
| 4 | 24ECSC205 | Design and Analysis of Algorithms | PC | 4-0-0 | 4 | 4 | 50 | 50 | 100 | 3 hours |
| 5 | 15ECSC208 | Database Management System | PC | 4-0-0 | 4 | 4 | 50 | 50 | 100 | 3 hours |
| 6 | 15ECSP204 | Database Applications Lab | PC | 0-0-1.5 | 1.5 | 3 | 80 | 20 | 100 | 3 hours |
| 7 | 24ECSP205 | Algorithms Lab | PC | 0-0-2 | 2 | 4 | 80 | 20 | 100 | 3 hours |
| 8 | 24EHSA201 | Corporate Communication | HSS | 0-0-0 | 0 | 1 | 100 | 0 | 100 | 3 hours |
| **TOTAL** | | | | **17-1-5.5** | **23.5** | **30** | **510** | **290** | **800** | |

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## Semester- IV

| No | Code | Course | Category | L-T-P | Credits | Contact Hours | ISA | ESA | Total | Exam Duration |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 24EMAB209 | Probability and Statistics | BS | 3-1-0 | 4 | 5 | 50 | 50 | 100 | 3 hours |
| 2 | 24ECSC207 | Computer Networks-1 | PC | 3-1-0 | 4 | 5 | 50 | 50 | 100 | 3 hours |
| 3 | 24ECSC204 | Object Oriented Programming | PC | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 4 | 19ECSC203 | Principles of Compiler Design | PC | 3-1-0 | 4 | 5 | 50 | 50 | 100 | 3 hours |
| 5 | 24ECSC209 | Operating System Principles and Programming | PC | 4-0-1 | 5 | 6 | 50 | 50 | 100 | 3 hours |
| 6 | 24ECSC210 | Exploratory Data Analysis | PC | 2-0-2 | 4 | 6 | 50 | 50 | 100 | 2 hours |
| 7 | 24ECSP203 | Object Oriented Programming Lab | PC | 0-0-1.5 | 1.5 | 3 | 80 | 20 | 100 | 3 hours |
| 8 | 24EHSA202 | Problem Solving & Analysis | HSS | 0-0-0 | 0 | 1 | 100 | 0 | 100 | 3 hours |
| | | **TOTAL** | | **18-3-4.5** | **25.5** | **34/33** | **480** | **320** | **800** | |

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## Semester- V

| No | Code | Course | Category | L-T-P | Credits | Contact Hours | ISA | ESA | Total | Exam Duration |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 24ECSC306 | Machine Learning and Deep Learning | PC | 2-0-2 | 4 | 6 | 50 | 50 | 100 | 2 hours |
| 2 | 24ECSC303 | Computer Networks - 2 | PC | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 3 | 24ECSP304 | Web Technologies Lab | PC | 0-0-2 | 2 | 4 | 80 | 20 | 100 | 3 hours |
| 4 | 25ECSC305 | Cloud Computing | PC | 2-0-1 | 3 | 4 | 67 | 33 | 100 | 2 hours |
| 5 | 25ECSC301 | Software Engineering | PC | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 6 | 25ECSP305 | Computer Networks Lab | PC | 0-0-1 | 1 | 2 | 80 | 20 | 100 | 2 hours |
| 7 | 15ECSW301 | Mini Project | PW | 0-0-3 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 8 | XXECSE3XX | Professional Elective-1 | PE | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 9 | 23EHSA303 | Arithmetical Thinking & Analytical Reasoning | HSS | 0-0-0 | 0 | 1 | 100 | 0 | 100 | 3 hours |
| **TOTAL** | | | | **13-0-9** | **22** | **29** | **577** | **323** | **900** | |

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## Semester- VI

| No | Code | Course | Category | L-T-P | Credits | Contact Hours | ISA | ESA | Total | Exam Duration |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 25ECSC314 | Generative AI | PC | 3-0-1 | 4 | 5 | 63 | 37 | 100 | 3 hours |
| 2 | 25ECSC311 | Wireless and Mobile Networks | PC | 3-0-1 | 4 | 5 | 63 | 37 | 100 | 3 hours |
| 3 | 24ECSC308 | Embedded Systems and IoT | PC | 2-0-1 | 3 | 4 | 67 | 33 | 100 | 2 hours |
| 4 | XXECSE3XX | Professional Elective-2 | PE | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 5 | XXECSE3XX | Professional Elective-3 | PE | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 6 | 24ECSW302 | Minor Project | PW | 0-0-6 | 6 | 3 | 50 | 50 | 100 | 3 hours |
| 7 | 16EHSC301 | Professional Aptitude & Logical Reasoning | HSS | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 8 | 23EHSA304 | Industry Readiness & Leadership Skills | HSS | 0-0-0 | 0 | 1 | 100 | 0 | 100 | 3 hours |
| | | | | **17-0-9** | **26** | **27** | **493** | **307** | **800** | |

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## Semester- VII

| No | Code | Course | Category | L-T-P | Credits | Contact Hours | ISA | ESA | Total | Exam Duration |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 24ECSC404 | Big Data Analytics | PC | 2-0-1 | 3 | 4 | 67 | 33 | 100 | 2 hours |
| 2 | 24ECSC403 | Cryptography & Network Security | PC | 2-0-1 | 3 | 4 | 67 | 33 | 100 | 2 hours |
| 3 | XXECSE4XX | Professional Elective-4 | PE | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 4 | XXECSE4XX | Professional Elective-5 | PE | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 5 | 20ECSW401 | Senior Design Project | PW | 0-0-6 | 6 | 3 | 50 | 50 | 100 | 3 hours |
| 6 | 15EHSA401 | CIPE & EVS (Audit) | HSS | 0-0-0 | 0 | 2 | 50 | 50 | 100 | 3 hours |
| **TOTAL** | | | | **10-0-8** | **18** | **19** | **300** | **300** | **600** | |

**ISA**: In Semester Assessment **ESA**: End Semester Assessment **L**: Lecture **T**: Tutorials **P**: Practical

Date: Program Head

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## Semester- VIII

| No | Code | Course | Category | L-T-P | Credits | Contact Hours | ISA | ESA | Total | Exam Duration |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | XXECSE4XX | Professional Elective-6 | PE | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 2 | XXECSO4XX | Open Elective | OE | 3-0-0 | 3 | 3 | 50 | 50 | 100 | 3 hours |
| 3* | 25ECSI495 | Internship Training | PW | 0-0-6 | 6 | 12 | 50 | 50 | 100 | 3hours |
| 4 | 25ECSW496 | Internship Project | PW | 0-0-11 | 11 | 22 | 50 | 50 | 100 | 3 hours |
| | 20ECSW402 | Capstone Project | | | | | | | | |
| **TOTAL** | | | | **6-0-17** | **17** | **34** | **100** | **100** | **200** | |

**ISA**: In Semester Assessment **ESA**: End Semester Assessment **L**: Lecture **T**: Tutorial **P**: Practical

*Note students can either choose (1, 2 & 4(Capstone Project) or (3 & 4(Internship Project).)

Date: Program Head

| Semester | I | II | III | IV | V | VI | VII | VIII | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Credits** | **21** | **23** | **23.5** | **25.5** | **22** | **26** | **18** | **17** | **176** |

## List of Program Electives

| Sr. No | Name of the Course | Course Code |
|---|---|---|
| **3rd Year (Professional Electives- 1, 2 & 3)** | | |
| **Data Engineering** | | |
| 1. | Signals & Systems (3-0-0) | 21ECSE313 |
| 2. | Fundamentals of Image & Video Processing (2-0-1) | 24ECSE312 |
| 3. | Computer Vision (3-0-0) | 24ECSE339 |
| 4. | Responsible AI (2-0-1) | 25ECSE326 |
| 5. | Multimodal AI (2-0-1) | 25ECSE327 |
| 6. | AI in Healthcare (2-0-1) | 25ECSE328 |
| 7. | Informatica - Intelligent Data Management Cloud (1-0-2) | 24ECSE322 |
| 8. | Augmented and virtual reality (2-0-1) | 25ECSE329 |
| 9. | Information Retrieval (2-0-1) | 25ECSE330 |
| 10. | Agentic AI (2-0-1) | 25ECSE331 |
| 11. | Reinforcement Learning (2-0-1) | 25ECSE332 |
| 12. | Human Computer Interaction (2-0-1) | 25ECSE333 |
| **Networking** | | |
| 1. | Multimedia Networks (3-0-0) | 21ECSE311 |
| 2. | Cyber security (3-0-0) | 25ECSE325 |
| 3. | Software Defined Networks (2-0-1) | 25ECSE334 |
| 4. | Block chain and Distributed Ledgers (2-0-1) | 24ECSE324 |
| 5. | Security Operations (2-0-1) | 24ECSE321 |
| 6. | Edge Computing (2-0-1) | 24ECSE323 |
| 7. | Web Security (2-0-1) | 25ECSE335 |
| **Systems Engineering** | | |
| 1. | Computational Medicine (3-0-0) | 24ECSE340 |
| 2. | The ARM Architecture (2-1-0) | 19ECSE308 |
| 3. | Embedded Intelligent Systems (1-0-2) | 24ECSE302 |
| 4. | Robotic Process Automation Design & Development (2-0-1) | 25ECSE301 |
| 5. | Parallel Computing (3-0-0) | 17ECSE307 |
| 6. | Quantum Computing Fundamentals (3-0-0) | 17ECSE306 |
| 7. | Applied Computational Medicine (2-0-1) | 24ECSE320 |
| 8. | Quantum Algorithms and Cryptography (2-0-1) | 25ECSE336 |
| **Electives for Skill Enhancement** | | |
| 1. | Algorithmic Problem Solving (2-0-4) | 24ECSE309 |
| 2. | Semantic Web (3-0-0) | 19ECSE303 |
| 3. | DevOps (1-0-2) | 24ECSE310 |
| 4. | MLOps (1-0-2) | 25ECSE337 |
| 5. | Theories of Intelligent Systems (2-0-1) | 25ECSE338 |

## Curriculum Content- Course wise

**Semester - I**

| | | |
|---|---|---|
| **Program: Bachelor of Engineering** | | **Semester - I** |
| **Course Title: Single Variable Calculus** | | **Course Code: 18EMAB101** |
| **L-T-P: 4-1-0** | **Credits: 05** | **Contact Hours: 6hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** |
| **Teaching Hours: 50** | **Tutorial/Practical: 28hrs** | **Exam Duration: 3hrs** |

| | | |
|---|---|---|
| | **Unit I** | |
| **1** | **Introduction to Mathematical Modeling:** What is Mathematical modeling, why Mathematical modeling, use of Mathematical modeling, Process of mathematical modeling, types of modeling with simple examples | **04 hrs** |
| **2** | **Functions, Graphs and Models:** Functions, types of functions, transformations and models (Linear, exponential, trigonometric).<br>**MatLab**: Graphing functions, Domain-Range and Interpreting the models | **05 hrs** |
| **3** | **Calculus of functions and models:** Limit of a function, Infinite limits-graph, Continuity and discontinuity, Intermediate value theorem statement, Roots of the equation using Bisection Method and Newton-Raphson Method<br>Interpretation of derivative as a rate of change, All the rules of derivatives (List only), Maxima, Minima and optimization problems. Curvature and Radius of Curvature, Indeterminate forms, L- Hospital's rule-Examples<br>**MatLab:** optimization problems. Curvature problems | **11 hrs** |
| | **Unit II** | |
| **4** | **Infinite Series:** Definition, Convergence of series, Tests of convergence – p-series, Alternating series. Power series, radius of convergence, Taylor's and Maclaurin's series, Applications of Taylor's and Maclaurin's series<br>**MatLab:** Convergence of series | **06 hrs** |
| **5** | **Integral calculus:** Tracing of standard curves in Cartesian form, Parametric form and Polar form; Beta and gamma function, relation between them, evaluation of integrals using Beta and gamma functions; Applications to find arc length, Area, Volume and surface area (Cartesian, parametric and polar curves). Approximate integration- Trapezoidal rule, Simpson's 1/3 rule<br>**MatLab**: problems on arc length, area, volume and surface area | **14 hrs** |

| Unit III | | |
|---|---|---|
| **6** | **Ordinary differential equations of first order:** (a) Introduction to Initial Value problems. Linear and Bernoulli's equations, Exact equations and reducible to exact form, Numerical solution to Initial Value problems- Euler's method, Modified Euler's method and Runge-Kutta method<br>(b) Applications of first order differential equations-Orthogonal trajectories growth and decay problems, mixture problems, Electrical circuits, falling bodies.<br>**MatLab:** Solve differential equations | **10 hrs** |
| **Text Books**<br>1. Early Transcendentals Calculus- James Stewart, Thomson Books, 7e 2010 | | |
| **Reference Books:**<br>1. Hughues- Hallett Gleason, Calculus Single and Multivariable, 4ed, Wiley India, 2009.<br>2. Thomas Calculus, George B Thomas, Pearson India, 12ed, 2010 | | |

BACK

| Program: Bachelor of Engineering | | Semester - I |
|---|---|---|
| Course Title: Engineering Physics | | Course Code: 22EPHB101 |
| L-T-P: 3-0-0 | Credits:3 | Contact Hrs: 3hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 40 | Tutorial/Practical: -- | Exam Duration: 3 Hrs |

| | Unit I | |
|---|---|---|
| 1 | **Conduction in semiconductors**<br>**Atomic theory:** The atom, electron orbits and energy levels, energy bands,<br>**Conduction in solids:** Electron motion and hole transfer, conventional current and electron flow<br>**Conductors, semiconductors and insulators:** Bonding force between atoms, Energy bands in different materials.<br>**n-type and p-type Semiconductors:** Doping, n-Type material, p-Type material, Majority and minority charge carriers, Effects of heat and light, charge carrier density.<br>**Semiconductor conductivity:** Drift current, diffusion current, charge carrier velocity, conductivity, Hall Effect.<br>(Text 1 Page No 1-33) | **05 hrs** |
| 2 | **Junctions**<br>**The pn-Junctions:** Junction of p-Type and n-Type, Barrier voltage, depletion region, Qualitative theory of p-n Junction<br>**Biased junctions:** Reverse biased junction, forward biased junction, junction temperature effects.<br>**Junction currents and voltages:** Shockley equation, junction currents, junction voltages.<br>**p-n Junction Diode characteristics and parameters:** Forward and reverse characteristics, diode parameters.<br>**Diode approximations:** Ideal diode and practical diodes, piecewise linear characteristics, DC equivalent circuits.<br>**DC load line analysis:** DC load line, Q-Point, calculating load resistance and supply voltage.<br>**Temperature Effects:** Diode power dissipation, forward voltage drop, dynamic resistance.<br>**Diode AC models:** Junction capacitance, AC-equivalent circuits (Reverse biased and forward biased), reverse recovery time.<br>**Diode specifications:** Diode data sheets, low power diodes, rectifier diodes | **10 Hrs** |

| | | |
|---|---|---|
| | **Diode testing:** Ohmmeter tests, use of digital meter, plotting diode characteristics.<br>**Zener diodes:** Junction break down, circuit symbols and packages, characteristics and parameters, data sheet, equivalent circuits.<br>(Text 1 Page No 34-71) | |
| | **Unit II** | |
| **3** | **Electrostatics**<br>**Review on vectors:** Coordinate Systems, Vector and Scalar Quantities, Properties of Vectors, Components of a Vector and Unit Vectors<br>(Text 2 Page No 59-77)<br>**Electric Fields:** Properties of Electric Charges, Charging Objects by Induction, Coulomb's Law, Analysis Model: Particle in a Field (Electric), Electric Field of a Continuous Charge Distribution, Electric Field Lines Motion of a Charged Particle in a Uniform Electric Field<br>**Gauss's Law:** Electric Flux, Gauss's Law, Application of Gauss's Law to Various Charge Distributions, Conductors in Electrostatic Equilibrium<br>**Electric Potential:** Electric Potential and Potential Difference, Potential Difference in a Uniform Electric Field, Electric Potential and Potential Energy Due to Point Charges, Obtaining the Value of the Electric Field from the Electric Potential, Electric Potential Due to Continuous Charge Distributions Electric Potential Due to a Charged Conductor, Applications of Electrostatics<br>**Capacitance and Dielectrics:** Definition of Capacitance, Calculating Capacitance, Combinations of Capacitors, Energy Stored in a Charged Capacitor, Capacitors with Dielectrics, Electric Dipole in an Electric Field, An Atomic Description of Dielectrics<br>(Text 2 Page No 690-807) | **15 Hrs** |
| | **Unit – III** | |
| **4** | **Electromagnetics**<br>**Magnetic Fields:** Analysis Model: Particle in a Field (Magnetic), Motion of a Charged Particle in a Uniform Magnetic Field, Applications Involving Charged Particles Moving in a Magnetic Field, Magnetic Force Acting on a Current-Carrying Conductor, Torque on a Current Loop in a Uniform Magnetic Field,<br>**Sources of the Magnetic Field:** The Biot–Savart Law, The Magnetic Force Between Two Parallel Conductors, Ampere's Law, The Magnetic Field of a Solenoid, Gauss's Law in Magnetism, Magnetism in Matter<br>**Faraday's Law:** Faraday's Law of Induction, Motional emf, Lenz's Law, Induced emf and Electric Fields Generators and Motors, Eddy Currents<br>(Text 2 Page No 868-969) | **10 Hrs** |

**Text Book:**

1. David A Bell, “Electronics Devices and Circuits”, Fifth Edition, Oxford University Press.
2. Serway and Jewett, “Physics for Scientists and Engineers-with Modern Physics”, 9th Edition, CENGAGE learning. 2014

**References:**

1. Jacob Millman and Christos Halkias, “Electronic Devices and Circuits” TMH
2. R P Feynman, Robert B Leighton, Matthew Sands, The Feynman Lectures on Physics Vol-II, Norosa Publishing House (1998).
3. Ben G Streetman, Solid State Electronic Devices, Prentice Hall, 1995

BACK

| | | |
|---|---|---|
| **Program: Bachelor of Engineering** | | **Semester - I** |
| **Course Title: Engineering Mechanics** | | **Course Code: 15ECVF101** |
| **L-T-P: 4-0-0** | **Credits:4** | **Contact Hrs: 4hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** |
| **Teaching Hrs: 50** | **Tutorial/Practical: --** | **Exam Duration: 3 hours** |

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|---|---|---|
| | **Unit I** | |
| **1** | **Overview of Civil Engineering**<br>**Evolution of Civil Engineering**: Specialization, scope and role.<br>**Impact of Civil Engineering on:** National economy, environment and social & cultural fabric.<br>**Challenges and Opportunities for Civil Engineers:** Civil Engineering Marvels, Future challenges, Higher education and Research. | **04 hrs** |
| **2** | **Coplanar concurrent force system**<br>**Introduction to Engineering Mechanics:** Basic idealizations – Particle, Continuum, Body, Rigid body, Deformable body, Definition of force and its elements; Laws of Mechanics – Parallelogram law of forces, Principle of transmissibility, Law of Superposition, Newton's laws of motion. Classification of force systems<br>**Resultant of coplanar concurrent force system:** Definitions – Resultant, composition & Resolution of a force, Equilibrium, Equilibrant, Formulae for resultant of forces and resolution of a force. Numerical problems on resultant of forces.<br>**Equilibrium of coplanar concurrent force system:** Conditions of equilibrium, Action & Reaction, Free body diagram, Lamis' theorem. Numerical problems on equilibrium of forces. | **12 hrs** |
| **3** | **Coplanar non-concurrent force system**<br>**Resultant of a force system:** Moment, moment of a force, couple, moment of a couple, Characteristics of couple, Equivalent force-couple system, Numerical problems on moment of forces and couples, on equivalent force-couple system. Varignons principle of moments, Resultant of coplanar- non-concurrent force systems and numerical problems. | **05 hrs** |
| | **Unit II** | |
| **4** | **Equilibrium of a force system (Chapter 3 contd..) :** Conditions of equilibrium, types of support and loading for a statically determinate beam, Reactions at support connections, Numerical problems on equilibrium of force systems and support reactions for a statically determinate beam. | **5 hrs** |

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| **5** | **Static Friction:** Introduction, types of friction, definition, limiting friction, coefficient of friction, laws of Coulomb friction, angle of friction and angle of repose, cone of friction. Wedge and belt friction theory. Derivation of belt friction formula. Numerical problems on, impending motion on horizontal and inclined planes (including connected bodies); wedge friction; Ladder friction and Belt friction. | 8 hrs |
| **6** | **Simple Stress and Strain:** Introduction, Properties of Materials, Stress, Strain, Elasticity, Elastic limit, Hooke's law & Young's modulus, Stress – Strain Diagram for structural steel, working stress and Factor of safety. Deformation of a bar due to force acting on it. Law of super position. Stresses in bars of uniform & varying cross sections. Composite sections. Problems connected to above topics. | **6 hrs** |
| | **Unit – III** | |
| **7** | **Centroid of Plane Figures:** Introduction, Definition, Methods of determining the centroid, axis of reference, axis of symmetry, Locating the centroid of simple plane figures (triangle, semicircle, quarter of a circle and sector of a circle etc,.) using method of integration, Numerical problems on Centroid of simple built up sections. | **5 hrs** |
| **8** | **Chapter 8: Second moment of area (Plane figures):** Introduction, Definition, Method of determining the second moment of area, Section Modulus, Radius of gyration, perpendicular and Parallel axis theorems, Polar second moment of area, second moment of area of simple plane figures (triangle, rectangle, semicircle, circle etc,.) using method of integration, Numerical problems on MI of simple built up sections. | **5 hrs** |

**Text Book:**


1. Beer, F.P. and Johnston, R., Mechanics for Engineers: Statics, McGraw Hill Company, New York, 1988.
2. Bhavikatti, S.S., and Rajasshekarappa K.G., Engineering Mechanics, 3Ed., New Age International Pub. Pvt. Ltd., New Delhi, 2008.
3. Kumar, K.L., Engineering Mechanics, 3ed., Tata McGraw Hill Publishing Company, New Delhi, 2003.
4. Punmia, B.C., Jain, A. and Jain, A., Mechanics of Materials, Lakshmi Publications, New Delhi, 2006

**References:**


1. Jagadeesh, T.R. and Jayaram, *Elements of Civil Engineering*, Sapna Book House, Bangalore, 2006.
2. Ramamrutham, S., *Engineering Mechanics*, Dhanpat Rai Publishing Co., New Delhi, 1998.
3. Singer, F.L., *Engineering Mechanics*, 3rd edition Harper Collins, 1994.
4. Timoshenko, S.P. and Young, D.H., *Engineering Mechanics*, 4th edition, McGraw Hill Publishing Company, New Delhi, 1956.
5. Irving H Shames, *Engineering Mechanics*, 3rd edition, Prentice-Hall of India Pvt. Ltd, New Delhi- 110 001, 1995.


BACK

| | | |
|---|---|---|
| **Program: Bachelor of Engineering** | | **Semester - I** |
| **Course Title: C Programming for Problem Solving** | | **Course Code: 18ECSP101** |
| **L-T-P: 0-0-3** | **Credits: 3** | **Contact hrs: 6 Hrs/week** |
| **ISA Marks: 80** | **ESA Marks: 20** | **Total Marks: 100** |
| **Teaching : --** | **Tutorial/Practical: 84hrs** | **Exam Duration: 3 Hrs** |

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|---|---|---|
| **1** | **Introduction to Problem Solving:** Introduction to algorithms / flowcharts and its notations, top down design, elementary problems. | **3 hrs** |
| **2** | **Basics of C programming language:** Characteristics and uses of C, Structure of C program, C Tokens: Keywords, Identifiers, Variables, Constants, Operators, Data-types, Input and Output statements. | **15 hrs** |
| **3** | **Decision Control Statements:** Conditional branching statements: if statement, if else statement, else if ladder, switch statement, unconditional branching statements**:** break, continue.<br>Introduction to Debugging Skills<br>Introduction to Test Driven Programming. | **12 hrs** |
| **4** | **Iterative Statements:** while, do while, for, nested statements | **10 hrs** |
| **5** | **Functions:** Introduction, Function declaration, definition, call, returns statement, passing parameters to functions, introduction to macros.<br>Introduction to Coding Standards | **10 hrs** |
| **6** | **Arrays and Strings:** Introduction, Declaration, Accessing elements, Storing values in arrays, Operations on one dimensional array, Operations on two dimensional arrays,<br>Introduction to Code Optimization and refactoring | **15 hrs** |
| **7** | **Pointers:** Introduction, declaring pointer, pointer variables, pointer expression and arithmetic, passing arguments to functions using pointers, pointers and arrays, passing an array to a function. | **08 hrs** |
| **8** | **Structures and Unions:** Introduction, passing structures to functions, Array of structures, Unions | **05 hrs** |

**Text Books**

1. R.G. Dromey, How to Solve it by Computer, 1ed, PHI, 2008.
2. Yashvant Kanetkar, Let us C, 15th ed, BPS Publication, 2016.

**Reference Books:**

1. B W Kernighan, D M Ritchie, The Programming language C, 2ed, PHI, 2004.
2. B S Gottfried, Programming with C, 2ed, TMH, 2006.
3. B.A. Forouzan, R.F. Gilberg, A Structured Program Approach Using C, 3ed, CENGAGE Learning, 2008.

BACK

| Program: Bachelor of Engineering | | Semester - I |
|---|---|---|
| Course Title: Basic Electrical Engineering | | Course Code: 18EEEF101 |
| L-T-P: 3-0-0 | Credits: 3 | Contact: 3hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching : 40 Hrs | Tutorial/Practical: -- | Exam Duration: 3 Hrs |

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|---|---|---|
| | **Unit-I** | |
| **1** | **Overview of Electrical Engineering:** Specialization, scope & role, impact of Electrical Engineering on national economy, environment, Sources of generation, sustainability, challenges and opportunities for electrical engineers, electrical engineering marvels, future challenges. | **02 hrs** |
| **2** | **DC Circuits:** Voltage and current sources, Kirchoff's current and voltage laws, loop and nodal analysis of simple circuits with dc excitation. Time-domain analysis of first-order RL and RC circuits. | **05 hrs** |
| **3** | **AC Circuits:** Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase series and parallel R-L-C ac circuits. Three-phase balanced circuits, voltage and current relations in star and delta connections. power measurement using two watt meters | **08 hrs** |
| | **Unit-II** | |
| **4** | **Electrical Actuators:** Electromagnetic principles, Solenoid, Relays, classification of Electric motors, DC motors-shunt, series, compound, separately excited, PMDC motors – Speed Control, Stepper Motors, BLDC motors, three phase induction motor, Characteristics and applications, selection of motors for various applications. | **9 hrs** |
| **5** | **Power Electronics** (Text1, chapter 45): Introductory, Thyristor, Some thyristor circuits, Limitations to thyristor operation, The thyristor in practice, The fully controlled AC/DC converter, AC/DC inversion, Switching devices in inverters, Three-phase rectifier networks, The three-phase fully controlled converter, Inverter-fed induction motors, Soft-starting induction motors, DC to DC conversion switched-mode power | **6 hrs** |

| Unit-III | | |
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| **6** | **Electrical Wiring, Safety and protection(Ref :Text3-page 1 to 10):** Types of wires and cables for internal wiring, Types of switches and Circuits, Types of wiring, Safety precautions and rules in handling electrical appliances, Electric shock, first aid for electrical shocks, Importance of grounding and earthing, Methods for earthing, Fuses, MCB, ELCB and Relays, Lockout and Tagout, Electrical Codes and Standards. | **05 hrs** |
| **7** | **Batteries:** Basics of lead acid batteries, Lithium Ion Battery , Battery storage capacity, Coulomb efficiency, Numerical of high and low charging rates, Battery sizing. Numericals. | **05 hrs** |

**Text Books**


1. Hughes, Electrical & Electronic Technology, 8th , Pearson Education, 2001
2. P C Sen, Principals of Electrical Machines and Power Electronics, 2nd, Wiley Publications
3. Gilbert M Masters, Renewable and efficient Electrical Power systems, Published by John Wiley & Sons 2004 edition
4. Frank D. Petruzella, Electric Motors and Control Systems, McGraw Hill Education Private Limited 2009 Edition


**Reference Books:**


1. D C Kulshreshtha, Basic Electrical Engineering, Mc Graw Hill Publications
2. David G Alciatore and Michel B Histand, Introduction to Mechatronics and Measurement Systems, 3rd, Tata McGraw Hill Education Private Limited, New Delhi., 2005
3. Vincent Del Toro, Electrical Engineering Fundamentals, 2nd edition Prentice Hall India


BACK

| Program: Bachelor of Engineering | | Semester - I |
|---|---|---|
| Course Title: Design Thinking for Social Innovation | | Course Code: 20EHSP101 |
| L-T-P: 0-1-1 | Credits: 2 | Contact Hrs: 4hrs/week |
| ESA Marks: 80 | ISA Marks: 20 | Total Marks: 100 |
| Teaching Hrs: -- | Tutorial/Practical: 56 hrs | Exam Duration: 3 hrs |

| Module | | Topics | Assignments | Support activities / Tools |
|---|---|---|---|---|
| KNOWLEDGE, TOOLS & DEVELOPMENT | Course sensitization | 1. Introduction to Social Innovation:<br>• Awakening social consciousness **(www.yourstory.com )**<br>• Social Innovation and Leadership<br>• Engineering& Social innovation (EPICS) **(Connecting SI Course to Mini Project, Capstone Project, Campus Placements)**<br>• Course Overview<br>• **Students' Self Introduction Activity**<br>• Group formation **Activity** | **Reading assignments**<br>• Read the handout on "The Process of Social Innovation" by Geoff Mulgan<br>• Design thinking for Social Innovation<br>**Written Assignments**<br>• **Writing about Akshaya Patra in class. (Background information about Akshaya patra and the Social Cuase it is addressing)**<br>• **Brainstorming Session on Social Innovators in Class** | • Class activity on Behavioral Blocks to Innovation **Discussion on the behavioural blocks.**<br>• **Introducing oneself with three Adjectives- Appreciating diversity and discovering self**<br>• **Group Formation Activity (Forming square) (Making four equilateral triangles out of popsicle sticks to enhance group cohesiveness amongst the group mates)** |
| | Create Mindsets | **Seven Mindsets:**<br>1. Empathy **(Example of The Boy and the Puppies)**<br>2. Optimism | **Reading assignments**<br>• Handout on " Create Mindsets" | • **(How to train the Dragon? Common Video for all the mindsets)**<br>• **Watching in Class TED Talk on "How** |

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| | | **( Person Paralyzed waist down / Glass Halh full Half Empty)**<br>3. Iteration<br>**(Thomas Alva Edison)**<br>4. Creative Confidence<br>**(Origamy – Josef Albers)**<br>5. Making it<br>6. Embracing Ambiguity<br>**(Confusion is the Welcome doormat at the door of Creativity)**<br>7. Learning from Failure<br>**(Designing Website first and then asking the stakeholders about the website)**<br>**(Spending one lakh for the business which is never launched)** | | **to build youir Creative Confidence by David Kelley – IDEO Founder)** |
| | | | | |
| | **Process of Social Innovation** | **Engage**<br>Community study and Issue Identification | **<u>Reading assignments</u>**<br>• Handout on Community Study and Issue Identification<br>• Case Study on "EGramSeva"<br>• Case Study on "Janani Agri Serve"<br>**<u>Class Presentations</u>**<br>• Initial observations being made by the group<br>**( Literature Survey of Places of Hubli-Dharwad)**<br>**www.readwhere.com** | • Activity on Observation skills To know how to use one's observation skills in understanding the social conditions<br>• Experience sharing by senior students<br>• Brainstorming Deliberations on the initial observations and arrive at the "Social Issue"<br>• Familiarization of the respective |

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| | | | • Detailed interaction / engagements with the society and finalize the social issue for intervention<br>**Use template 1: Frame your Design Challenge** | templates with the help of sample case study |
| | | **PEER REVIEW** | | |
| | | **2. Inspiration**<br>• Plan for the Research<br>• Development of Interview guide<br>• Capture your Learnings | **<u>Reading assignments</u>**<br>• Handout on Overview of Inspiration<br>**<u>Class Presentations</u>**<br>• Entirety of the Social Issue<br>• Identification of the Stake Holders **(Examples on Fluoroscent Curtain and Students' Punctuality for Class)**<br>• Interview Questions **(Role Play on Interview with Stakeholders)**<br>• Category wise Learnings capture<br>**Use template 2: Plan your Research**<br>**Template 3. Development of Interview Guide**<br>**Template 4. Capture your Learning** | • Familiarization of the respective templates with the help of sample case study |
| | | | | |
| | | **3. Ideation**<br>**3.1 Synthesis**<br>• Search for meaning | **<u>Reading assignments</u>**<br>• Handout on Overview of Ideation-Synthesis | • Familiarization of the respective templates with |

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| | | • Create "How might we" question | **Class Presentations**<br>• Create insights<br>• "How might we" questions<br>**Use template 5: Create Insights**<br>**Template 6: Create "How Might We' Questions** | the help of sample case study |
| | | | | |
| | | **3.0 Ideation**<br>**3.2 Prototyping**<br>• Generate Ideas<br>• Select Promising Ideas<br>• Determine what to prototype<br>• Make your prototype<br>• Test and get feedback | **Reading assignments**<br>• Handout on Overview of Ideation-Prototyping<br>**Class Presentations**<br>• Story board-demonstrating the possible solutions<br>**Use template 7: Select your best ideas**<br>**Template 8 : Determine what to prototype** | • Brain storming<br>• Familiarization of the respective templates with the help of sample case study<br>• Activity on Risk management<br>• Activity on Resource management<br>Structure building games |
| | | **PEER REVIEW** | | |
| | | **4.0 Implementation**<br>• Create an action plan<br>• Community Partners (if any)<br>• Budgeting & Fundraising<br>1. **Peer to Peer**<br>2. **Crowd Funding**<br>3. **Giving Kiosks**<br>4. **Donation**<br>5. **Envelop Funding**<br>6. **Marathons/ Walkathons** | **Reading assignments**<br>• Handout on Overview of Implementation<br>**Class Presentations**<br>• Pilot implementation plan with required resources and Budget indicating stake holders & their engagement | • Familiarization of the respective templates with the help of sample case study |

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| | | **7. Conducting Yoga Classes**<br>**( www.causevox.com / www.blog.fundly.com)**<br>• Duration<br>• Ethical concerns<br>• Launch your solution<br>• Feedback (Impact**)** | | |
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| | | **5.0 Reflect**<br>Reflection of the overall learning by the students | **<u>Reading assignments</u>**<br>• Handout on Overview of students Reflection<br>**Use template 9: Reflection on the Process**<br>**<u>Class Presentations</u>**<br>Final Presentation- After Implementation | • Familiarization of the respective templates with the help of sample case study |
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BACK

| Program: Bachelor of Engineering | | Semester - I |
|---|---|---|
| Course Title: Applied Physics Lab | | Course Code: 21EPHP101 |
| L-T-P: 0-0-1 | Credits : 1 | Contact Hrs.: 02 Hrs/Week |
| ISA Marks: 80 | ESA Marks: 20 | Total Marks: 100 |
| Teaching Hrs: -- | Tutorial/Practical: 28hrs | Exam Duration: 3 Hrs. |

| Experiments | |
|---|---|
| 1. | Four probe method |
| 2. | V-I characteristics of p-n junction diode |
| 3. | Zener diode characteristics |
| 4. | Hysteresis loss |
| 5. | Transistor characteristics |
| 6. | Measurement of dielectric constant |
| 7. | Resonance frequency of LCR circuits |
| 8. | Study of frequency response of passive components |
| 9. | Calibration of thermocouple |
| 10. | Calibration of electrical meters |

BACK

**II Semester**

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|---|---|---|
| **Program: Bachelor of Engineering** | | **Semester - II** |
| **Course Title: Multivariable calculus** | | **Course Code: 18EMAB102** |
| **L-T-P: 4-1-0** | **Credits: 05** | **Contact Hours: 6hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** |
| **Teaching Hours: 50** | **Tutorial/Practical: 28hrs** | **Exam Duration: 3hrs** |

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|---|---|---|
| | **Unit-I** | |
| **1** | **Partial differentiation:** Function of several variables, Partial derivatives, Level curves, Chain rule, Errors and Approximations. Extreme value problems. Lagrange's multipliers. | **12 hrs** |
| **2** | **Double integrals:** Double integrals- Rectangular and polar coordinates, Change the order of integration. Change of variables, Jacobian. Application of double integrals<br>**Matlab:** optimization problems, application of double integrals | **08 hrs** |
| | **Unit-II** | |
| **3** | **Triple integrals:** Triple integrals, Cartesian, change to Cylindrical and Spherical coordinates Application of Triple integrals | **07 hrs** |
| **4** | **Calculus of Vector Fields:** Vector fields, Gradient and directional derivatives. Line and Surface integrals. Independence of path and potential functions. Green's theorem, Divergence of vector field, Divergence theorem, Curl of vector field. Stokes theorem.<br>**Matlab:** application of Triple integrals, Vector calculus problems | **13 hrs** |
| | **Unit III** | |
| **5** | **Differential equations of higher orders:** (a) Linear differential equations of second and higher order with constant coefficients The method of Variation of parameters. Initial and boundary value problems.<br>(b) Applications of second order differential equations-Newton's 2nd law, electrical circuits, Simple Harmonic motion. Series solution of differential equations. Validity of Series solution of Differential equations.<br>**Matlab:** application of differential equations | **(5+5) hrs** |

**Text Books :**

1. Early Transcendental Calculus- James Stewart, Thomson Books, 7ed 2010

**Reference Books:**

1. Hughues- Hallett Gleason, Calculus Single and Multivariable, 4ed, Wiley India, 2009.
2. Thomas Calculus, George B Thomas, Pearson India, 12ed, 2010

BACK

| | | |
|---|---|---|
| **Program: Bachelor of Engineering** | | **Semester - II** |
| **Course Title: Engineering Chemistry** | | **Course Code: 22ECHB102** |
| **L-T-P: 3-0-0** | **Credits: 03** | **Contact Hours: 3hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** |
| **Teaching Hours: 40** | **Tutorial/Practical: --** | **Exam Duration: 3hrs** |

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|---|---|---|
| | **Unit-I** | |
| **1** | **Chemical Bonding:** Introduction, Ionic bond, factors influencing the formation of Ionic bond: Ionization energy. Electron affinity & electro negativity and properties of Ionic compounds. Covalent bond: Valence Bond theory & Molecular Orbital theory – formation of hydrogen molecule, factors influencing the formation of covalent bond, polar and non-polar covalent bond, dipole moment, problems on calculation of percentage of Ionic character and properties of covalent compounds, Co-ordinate bond: formation of hydronium ion and ammonium ion. | **04 hrs** |
| **2** | **Electrochemical Energy Systems:** Electrode potential, Nernst equation, formation of a cell; Reference electrodes – Calomel electrode, Determination of electrode potential, numerical problems on E, $E_{cell}$ & $E^0_{cell}$. Batteries: Classification, Characteristics, Lead - acid, Lithium ion battery. Fuel cells - Methonol-$O_2$ fuel cell. | **06 hrs** |
| **3** | **Polymers:** Introduction, polymerization; mechanism of polymerization taking ethylene as an example. Determination of molecular weight of a polymer – numerical problems. Commercial polymers - Plexi glass, PS, polyurethane. Polymer composites: Carbon fiber and Epoxy resin – synthesis, properties and applications. Introduction to conducting polymers, mechanism of conduction in poly acetylene and applications. | **06 hrs** |
| | **Unit-II** | |
| **4** | **Plating Techniques:** Introduction, technological importance. Electroplating, Principles of electroplating. Factors affecting nature of electrodeposit, throwing power, Numerical problems on throwing power, Electroplating process of gold by acid cyanide bath. Electro less plating, advantages of electro less plating over electroplating. Electro less plating of Cu and its application in the manufacture of PCB. | **04hrs** |
| **5** | **Wafer Technology:** Introduction, physical and chemical properties of silicon. Purification of silicon; chemical vapor deposition (CVD) process, zone refining process. Crystal growth; preparation of single crystal silicon by Czhochralski crystal pulling technique – numerical problems. Crystal slicing and wafer preparation. | **09 hrs** |

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| | Fabrication process: thermal oxidation, diffusion, ion implantation – numerical problems, epitaxial growth, masking and photolithography, wet etching, dry etching. | |
| **6** | **Material Chemistry:** Liquid Crystals – Types of liquid crystals, applications of Liquid Crystal in Display system.<br>Fluorescence and Phosphorescence – Jablonski diagram, Thermoelectric and Piezoelectric materials – meaning, properties and applications | **03 hrs** |
| | **Unit-III** | |
| **7** | **Instrumental methods of measurement:** Advantages over conventional methods. Electro analytical methods: Potentiometer - principle, methodology and applications. Optoanalytical methods: Colorimeter - Principle, methodology and applications.<br>Spectral methods of analysis : UV – Spectrophotometer - Instrumentation and applications | **04 hrs** |
| **8** | **Environmental Chemistry:** Water: Sources and ill effects of water pollutants – fluoride and nitrate; determination of total hardness of water by EDTA method – numerical problems. ,<br>Sewage: Determination of Biological Oxygen Demand by Winkler's method – numerical problems and determination of Chemical Oxygen Demand – numerical problems. | **04 hrs** |

**Text Books :**


1. A text Book of Engineering Chemistry, 1st edition, Dara. S. S, S. Chand & Co. Ltd., 2009, New Delhi.
2. A text Book of Engineering Chemistry, 16th edition, Jain P.C and Jain M, Dhanpat Rai Publications, 2006, New Delhi


**Reference Books:**


1. Text book of Inorganic Chemistry, P.L.Soni, Sultan Chand, 1999, New Delhi.
2. Hand book of batteries, David Linden, Thomas B Reddy, 3rd edition Mc Graw Hill publications, 2001, New York.
3. Polymer Science, 6th Edition, Gowariker V.R., Viswanathan N.V., Sreedhar J., New Age International (P) Ltd, 2007, New Delhi.
4. Solid State Devices& Technology, 4thEdition, V.Suresh Babu, sanguine Technical Publishers, 2005, Bangalore.
5. Material Science & Engineering: An Introduction, 9th Edition, Calister William D, John Wiley and sons, 2007, New York.
6. Instrumental methods of Chemical nalysis, 5th Edition, Gurudeep R Chatwal, Shan K Anand, Himalaya Publishing House Pvt. Ltd, 2010, Mumbai.
7. VLSI Technology, 2nd Edition, S.M.Sze, McGraw Hill Series in electrical and computer engineering, 1998, New York.


BACK

| | | |
|---|---|---|
| **Program: Bachelor of Engineering** | | **Semester - II** |
| **Course Title: Problem Solving with Data Structures** | | **Course Code: 18ECSP102** |
| **L-T-P: 0-0-3** | **Credits: 3** | **Contact: 6 hrs/week** |
| **ISA Marks: 80** | **ESA Marks: 20** | **Total Marks: 100** |
| **Teaching hrs : --** | **Tutorial/Practical: 84hrs** | **Exam Duration: 3 Hrs** |

| | | |
|---|---|---|
| **1** | **Pointers, Structures and Files:** Recap of basics: Pointers ,Structures; Self-referential structures, dynamic memory management Files – File manipulation programs | **12 hrs** |
| **2** | **Stacks and Recursion:** Stack: Definition, Operations, Stack ADT Implementation of stack operations. Applications of stack. Recursion- Need for Recursion and problems on Recursion. | **16 hrs** |
| **3** | **Queues:** Definitions of Linear, Circular queues, Queue ADT Linear and circular queue operations Definition and working of Priority queue, Double ended queue; Applications of queues. | **16 hrs** |
| **4** | **Lists:** Concept of lists and dynamic memory management lists, definitions and representations: singly, doubly, circular lists. Dynamic Implementation of lists and its operations, Applications of linked lists | **18 hrs** |
| **5** | **Binary trees:** Binary Tree: Definition, Terminology and representation, Tree Traversals both recursive and iterative. Binary Search Tree and its applications. | **16 hrs** |

**Text Books**

1. Data Structures with C -- Seymour Lipschutz, Schaum's Outline Series
2. Data Structures Using C and C++ -- Langsam and Tanenbaum, PHI Publication
3. Data Structures Through C -- Yashavant P Kanetkar, BPB Publication

**Reference Books:**

1. Data Structures, Algorithms and Applications In C++ -- Satraj Sahani
2. Data Structures and Algorithms Made Easy – Narshiman Karumunchi, Career Monk

BACK

| Program: Bachelor of Engineering | | Semester - II |
|---|---|---|
| Course Title: Engineering Exploration | | Course Code: 22ECRP101 |
| L-T-P: 0-0-3 | Credits: 3 | Contact Hrs.: 6hrs/week |
| ISA Marks: 80 | ESA Marks: 20 | Total Marks: 100 |
| Teaching Hrs: -- | Tutorial/Practical: 84hrs | ESA Exam Duration: 3 hrs |

| No | Content | Sessions |
|---|---|---|
| 1 | Introduction to Engineering and Engineering Study | 1 |
| 2 | Role of Analysis in Engineering, Analysis Methodology | 2 |
| 3 | Data Analysis Graphing | 2 |
| 4 | Basics of Engineering Design, Multidisciplinary Nature of Engineering Design | 5 |
| 5 | Project Management | 1 |
| 6 | Sustainability in Engineering | 2 |
| 7 | Ethics | 1 |
| 8 | Modeling, Simulation and Data Acquisition using Software Tool | 1 |
| 9 | Platform based development : Arduino | 3 |
| 9 | Course Project | 3 |

**Reference Books:**

1. Engineering Fundamentals & Problem Solving by Arvid Eide, Roland Jenison, Larry Northup, Steven, Mc GrawHill Higher Education, 6th Edition ( 2011)
2. Engineering Exploration ( Edited Book, 2008) by Pearson Publication

**Evaluation Scheme**

| Chapter No | Name | Weightage in percentage |
|---|---|---|
| 1 | Introduction to Engineering and Engineering Study | - |
| 2 | Role of Analysis in Engineering | 10 |
| 3 | Analysis Methodology | |
| 4 | Data Analysis Graphing | 10 |
| 5 | Basics of Engineering Design | 20 |
| | Multidisciplinary Nature of Engineering Design | |
| 6 | Project Management | 5 |
| 7 | Sustainability in Engineering | 10 |
| 8 | Ethics | 5 |
| 9 | Modelling, Simulation and Data Acquisition using Software Tool | - |
| 10 | Platform Based Development: Arduino | - |
| 10 | Course Project | 40 |

BACK

| Program: Bachelor of Engineering | | Semester - II |
|---|---|---|
| Course Title: Basic Electronics | | Course Code: 18EECF101 |
| L-T-P: 4-0-0 | Credits: 4 | Contact Hours: 4 Hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 50 | Tutorial/Practical: -- | Exam Duration: 3 Hrs. |

| | | |
|---|---|---|
| | **Unit-I** | |
| **1** | **Trends in Electronic Industries:** Introduction, Roadmap of electronic sector, scope and opportunities in various segments of electronics (i.e., Consumer, Telecom, IT, Defense, Industrial, Medical and Automobiles), Government and private sectors, Growth profile of Electronic industries, Standards and PoliISAs, Electronic System Components | **03 hrs** |
| **2** | **Basic Components, Devices and Applications:** Diode: PN junction characteristics; modeling as a circuit element, ideal and practical diode. AC to DC converter: Half wave and full wave rectifier (centre tap and bridge), capacitor filter and its analysis, numerical examples. Zener diode and its applications (Voltage reference and voltage regulator). Realization of simple logic gates like AND and OR gates. | **10 hrs** |
| **3** | **Transistor:** BJT, transistor voltages and currents, Signal amplifier (Fixed bias, Collector base bias, Voltage divider bias, CE configuration). DC load line. Voltage, current and power gains. Transistor as a switch: NOT Gate, Basic (DTL) NAND gate. Transistor as a Small Signal Amplifier (Single Stage and Two Stage RC-coupled Amplifier). | **07 hrs** |
| | **Unit-II** | |
| **4** | **Digital Logic:** Number systems: Decimal, Binary, Octal and Hexadecimal number systems, Conversions, Binary Operations-Addition and subtraction in binary number systems. Logic gates: Realization of simple logic functions using basic gates (AND, OR, NOT), Realization using universal gates (NAND, NOR). Boolean algebra: Theorems and postulates, DeMorgan's Theorems , simplification of logical expressions, Karnaugh Maps, Use of Karnaugh Maps to Minimize Boolean Expressions (2 Variables, 3 Variables and 4 Variables ), Design of Half Adder and Full Adder, Parallel Adder using full adders. | **14 hrs** |
| **5** | **Chapter 5: Operational Amplifier:** OPAMP characteristics (ideal and practical), Linear and non-linear applications: Inverting amplifier, Non inverting amplifier, Voltage follower, Integration, Differentiation, Adder, Subtractor, ZCD and Comparator. | **06 hrs** |
| | **Unit-III** | |
| **6** | **Communication Systems:** Basic block diagram of communication system, types of modulation. Amplitude modulation: Time-Domain description, | **07 hrs** |

| | | |
|---|---|---|
| | Frequency-Domain description. Generation of AM wave: square law modulator. Detection of AM waves: envelope detector. Double side band suppressed carrier modulation (DSBSC), Generation of DSBSC wave: balanced modulator, Super heterodyne principle. | |
| **7** | **Linear Power Supply, UPS & CRO:** Working principle of linear power supply, UPS and CRO. Measurement of amplitude, frequency and phase of a given signal. | **03 hrs** |

**Text Book:**


1. David A Bell, Electronic devices and Circuits, PHI New Delhi, 2004
2. K.A Krishnamurthy and M.R.Raghuveer, Electrical, Electronics and Computer Engineering for SISAntist and Engineers, 2, New Age International Publishers, 2001
3. A.P. Malvino, Electronic Principles, Tata McGraw Hill, 1999


**References:**


1. George Kennedy, Electronic Communication Systems, Tata McGraw Hill, 2000
2. Morris Mano, Digital logic and Computer design , 21st Indian print Prentice Hall India, 2000
3. Floyd, Digital fundamentals, 3, Prentice Hall India, 2001
4. BoylesteadNashelsky, Electronic devices & Circuit theory, Prentice Hall India, 2000
5. RamakantGaikawad , Operational Amplifiers & applications, PHI, 2000


BACK

| Program: Bachelor of Engineering | | | Semester - II | |
|---|---|---|---|---|
| Course Title: Basic Mechanical Engineering | | | Course code: 22EMEF101 | |
| L-T-P: 2-1-0 | Credits: 3 | | Contact Hrs: 4hrs/week | |
| ISA Marks: 50 | ESA Marks: 50 | | Total Marks: 100 | |
| Teaching Hrs: 50 | Tutorial/Practical: 28hrs | | Exam Duration: 2 hrs | |
| **Chapter** | **Contents** | **Hours** | **Tutorial** | **Sessions** |
| | **UNIT I** | | | |
| 1 | **Introduction to Mechanical Engineering:**<br>Definition of engineering, Mechanical Engineering, Branches of Mechanical Engineering, Who are Mechanical Engineers?, Mechanical Engineers' top ten achievements. | 2 | Visit to Workshop and Machine Shop, Tools, Safety Precautions<br>Video presentations | 1 |
| 2 | **Manufacturing Engineering: Basics of Manufacturing**<br>What is manufacturing?, The main manufacturing sectors, The importance of the main manufacturing sectors to the Indian economy, Scales of production<br>Classification of manufacturing Processes.<br>Advances in Manufacturing: CNC machines, Mechatronics and applications | 8 | Demonstration on working of Lathe, milling, drilling, grinding machines<br>Demonstration on Welding (Electric Arc Welding, Gas Welding, Soldering)<br>Demonstration and Exercises on Sheet metal work.<br>Visit to Learning Factory | 5 |
| | **UNIT II** | | | |
| 3 | **Design Engineering: Power Transmission Elements**<br>Overview<br>Design Application:<br>• Belt Drives. Types, Length of Belt. Velocity Ratio, Initial Tension. Ratio of Tensions. Power Transmitted, Numerical Problems. | 6 | Design Problems like a moving experience, aluminium can crusher<br>Video presentations | 5 |

| | | | | |
|---|---|---|---|---|
| | • Gears. Spur Gear, Rack and Pinion, Worm Gear, Bevel Gear, Helical Gears. Speed, Torque, and Power in Gear pair. Simple and Compound Gear trains. Numerical Problems.<br>• Ball and Roller Bearings, Types, Applications. | | | |
| 4 | **Thermal Engineering 1: Prime Movers.**<br>Internal Combustion Engines: Classification, IC engine parts, 2 stroke SI and CI engine, 4 Stroke SI and CI Engine, PV diagrams of Otto and Diesel cycles, Comparison of 2 stroke and 4 stroke engine, comparison of CI and SI engine, Problems on Engine Performance, Future trends in IC engines. | 4 | Case study on power requirement of a bike, car or any machine<br>Video presentations | 1 |
| | **UNIT III** | | | |
| 5 | **Thermal Engineering 2: Thermal Systems' Applications**<br>Refrigeration system, Air conditioning system, Pumps, Blowers and Compressors, Turbines, and their working principle and specifications. | 5 | Case study on selection of various thermal systems<br>Video presentations | 1 |

**Text Books:**

1. Jonathan Wickert and Kemper Lewis, An Introduction to Mechanical Engineering, Third Edition, 2013- Cengage Learning.4
2. K.R. Gopalkrishna, Sudhir Gopalkrishna, S.C. Sharma. A Text Book of Elements of Mechanical Engineering, 30th Edition, Oct 2010,–Subhash Publishers, Bangalore.

**Reference Books:**

1. Course Material developed by the Department of Mechanical Engineering.
2. SKH Chowdhary, AKH Chowdhary, Nirjhar Roy, The Elements of Workshop Technology - Vol I & II, 11th edition 2001, Media Promoters and Publishers.
3. Basic Manufacturing, Roger Timings, Third edition, Newnes, An imprint of Elsevier

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Computational Medicine** | | **Course Code: 24ECSE340** | |
| **L-T-P: 3-0-0** | **Credits: 3** | **Contact Hrs: 3hrs/week** | |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** | |
| **Teaching Hrs: 40** | **Practical Hrs: --** | **Exam Duration: 3hrs** | |
| **Unit –I** | | | |
| **1** | **Introduction to Cell Organization:** Cell Theory, Prokaryotic and Eukaryotic Cells, Organelles, Cell Membrane, Cell Cycle, Tissue, Organs, Organ Systems, Homeostasis. | | **6 hrs** |
| **2** | **Systems Biology:** Systems Biology, Modelling Biological Systems, Network Biology, Omics Technologies, Systems Biology Applications. | | **6 hrs** |
| **3** | **Biological Networks:** Protein-Protein Interaction Networks (PPINs), Gene Regulatory Networks (GRNs), Metabolic Networks, Metabolic Networks. | | **6 hrs** |
| **Unit –II** | | | |
| **4** | **Molecular Interactions:** Protein-Protein Interactions, Protein-DNA Interactions, Protein-Ligand Interactions, Molecular Dynamics Simulations. | | **8 hrs** |
| **5** | **Introduction to modelling health and disease:** Principles of Computational Physiology, Integrating Molecular Networks into Physiological Models, Animal Models and Human Translation. | | **8 hrs** |
| **Unit –III** | | | |
| **6** | **Introduction to Computational Anatomy:** Case Studies : Computational Anatomy of the Brain and Computational Anatomy of the Heart. | | **5 hrs** |
| **Text Books: NA** | | | |
| **Reference:**<br>1. Lecture Notes and Handouts<br>2. Some reference papers / Slides/ Videos | | | |

**Computational Medicine Laboratory Plan**

| Sl. No | Exercise | No of Slots(2 hrs) |
|---|---|---|
| 1 | ● Lab sessions on cell observation (microscopy) and tissue analysis.<br>● Group projects on modelling biological systems. | 1 |
| 2 | ● Case studies on diseases related to cellular dysfunction.<br>● Bioinformatics exercises using publicly available datasets. | 1 |
| 3 | ● Computational exercises in network analysis using available software tools.<br>● Case studies of network-based drug discovery and development. | 1 |
| 4 | ● Data mining and analysis of biological network datasets.<br>● Integration of network analysis with experimental validation. | 1 |
| 5 | Hands-on experience with computational modelling software. | 1 |

| | | |
|---|---|---|
| 6 | Development of simplified models to understand core concepts. | 1 |
| 7 | Analysis of real-world data to parameterize and validate models. | 1 |
| 8 | Collaboration with experimental biologists and clinicians. | 1 |
| 9 | Hands-on experience with medical image processing software. | 1 |
| 10 | Development of image analysis pipelines for specific clinical problems. | 1 |
| 11 | Application of machine learning techniques for image analysis. | 1 |
| 12 | Collaboration with clinicians for data interpretation and clinical validation | 1 |

**Evaluation Scheme**

**ISA Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| In Semester Assessment (ISA-1) | 40 | 15 |
| In Semester Assessment (ISA-2) | 40 | 15 |
| Laboratory Assessment | 20 | 20 |
| Total | | 50 |

**ESA Scheme**

| **Assessment** | **Conducted for marks** | **Weightage** |
|---|---|---|
| ESA (Theory) | 100 | 50 |
| **Total** | | **50** |

BACK

| Program: Bachelor of Engineering | | Semester - II |
|---|---|---|
| Course Title: Professional Communication | | Course Code: 15EHSH101 |
| L-T-P: 1-1-0 | Credits: 2 | Contact Hrs.: 3hrs/week |
| ESA Marks: 50 | ISA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 20 | Tutorial/Practical: 28hrs | Exam Duration: 3 hrs |

| | Content | Hrs |
|---|---|---|
| 1 | **Basics- English Communication:** Course Introduction, Explanation of template mix-ups with correct usages & necessity of grammar in error detection, Usage of tenses | 9 hrs |
| 2 | **Vocabulary and grammar:** Vocabulary, Word Formation and Active and Passive Voice | 6 hrs |
| 3 | **Bouncing Practice:** Definition and types of bouncing and its practice with examples, reading skills, free style speech. Individual presentation. | 6 hrs |
| 4 | **Rephrasing and Structures:** Comprehension and Rephrasing, PNQ Paradigm and Structural practice | 8 hrs |
| 5 | **Dialogues:** Introduction of dialogues, Situational Role plays, | 3 hrs |
| 6 | **Business Communication:** Covering letter, formal letters, Construction of paragraphs on any given general topic. | 9 hrs |

**References:**

1. Collins Cobuild Advanced Learner's English Dictionary
2. Raymond Murphy - Intermediate English Grammar, Cambridge University Press
3. Martin Hewings- Advanced English Grammar, Cambridge University Press.

BACK

**Semester – III**

| | | |
|---|---|---|
| **Program: Bachelor of Engineering** | | **Semester – III** |
| **Course Title: Linear Algebra** | | **Course Code: 24EMAB208** |
| **L-T-P: 3-0-1** | **Credits: 4** | **Contact Hrs: 5hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** |
| **Teaching Hrs: 40** | **Tutorial/Practical: 28hrs** | **Exam Duration: 3 hrs.** |

| | | |
|---|---|---|
| | **Unit – I** | |
| **1** | **Matrices and Gaussian Elimination:** Introduction, The Geometry of Linear Equations, An Example of Gaussian Elimination, Matrix Notation and Matrix Multiplication, Triangular Factors and Row Exchanges, Inverses and Transposes, Special Matrices and Applications. | **08 hrs** |
| **2** | **Vector Spaces and Subspace:** Solving Ax= 0, and Ax= b, Linear Independence, Basis, and Dimension, The Four Fundamental Subspaces, Graphs and Networks, Linear Transformations. | **08hrs** |
| | **Unit – II** | |
| **3** | **Orthogonality:** Orthogonal Vectors and Subspaces, Cosines and Projections onto Lines, Projections, and Least Squares. | **08hrs** |
| **4** | **Eigenvalues and Eigenvectors:** Introduction to Determinants, Properties of the Determinant, Formulas for the Determinant, Applications of Determinants.<br>Introduction, Diagonalization of a Matrix, Difference Equations and Powers $A^k$, Differential Equations and $e^{At}$, Similarity Transformations. | **08hrs** |
| | **Unit – III** | |
| **5** | **Positive Definite Matrices:** Positive Definite Matrices, Minima, Maxima, and Saddle Points, Tests for Positive Definiteness, Singular Value Decomposition | **08hrs** |

**Text Books:**

1. Linear Algebra and its Applications, Gilbert Strang , 4 Edition, Cengage India Private Limited 2005.
2. Linear Algebra and Its Applications, David C. Lay, 5th Edition - Pearson -2023.

**Reference Books:**

1. Boyd, Stephen, and Lieven Vandenberghe. “Introduction to applied linear algebra: vectors, matrices, and least squares”, Cambridge university press, 2018.
2. Linear algebra for computer science “Essential Mathematics for Computer Scientists” M. THULASIDAS, Singapore Management University, 2021.

BACK

| Program: Bachelor of Engineering | | Semester – III |
|---|---|---|
| Course Title: Discrete Mathematical Structures | | Course Code: 24ECSC202 |
| L-T-P: 3-1-0 | Credits: 4 | Contact Hrs: 5 hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 40 | Tutorial/Practical: 28hrs | Exam Duration: 3hrs |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Logic and Proofs:** Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers: Nested Quantifiers, Rules of Inference, Introduction to Proofs. | **8 hrs** |
| **2** | **Counting:** The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Generalized Permutations and Combinations, Generating Permutations and Combinations | **8 hrs** |
| | **Unit –II** | |
| **3** | **Recurrence Relations:** Applications of Recurrence Relations, Formulating Recurrence relations, Solving Linear and nonlinear Recurrence Relations, Generating Functions: recurrence relation, Inclusion–Exclusion, Applications of Inclusion–Exclusion | **8 hrs** |
| **4** | **Number Theory**: Divisibility and Modular Arithmetic, Primes and Greatest Common Divisors: Primes, Trial Division, The Sieve of Eratosthenes, Testing for primality, the Euclidean Algorithm and gcds as Linear Combinations; Solving Congruences: Linear Congruences Chinese Remainder Theorem ; Applications of Congruences: Hashing Functions, Pseudorandom Numbers and Check Digits. | **8 hrs** |
| | **Unit –III** | |
| **5** | **Groups:** Binary Operations, Semi groups, Monoid, Group, Abelian group cyclic groups, rings and Products & Quotients of Semi Groups. | **4 hrs** |
| **6** | **Finite fields:** Fields, Finite fields of the form GF(p), Polynomial Arithmetic and Finite fields of the form GF(2n) | **4 hrs** |

**Text Books**

1. Kenneth H. Rosen, Kamala Krithivasan, Discrete Mathematics and its Applications, 8th Edition, Tata Mc-GrawHill Publication, July 6, 2021.
2. Kolman, Busby and Ross, Discrete Mathematical Structures, 6Ed., Pearson 2018

**Reference Books:**

1. Grimaldi R.P. and Ramana B.V, Discrete and Combinatorial Mathematics- An Applied
2. Introduction, 5 Ed., Pearson Education, 2019 Dr. D.S. Chandrashekar, Discrete Mathematical Structures, 6th Edition. Prism Publication January 2019,
3. William Stallings, Cryptography and Network Security Principles And Practices, 7th Edition, Pearson, 2017

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**Scheme for End Semester Assessment (ESA)**

| Assessment | Weightage in Marks |
|---|---|
| ISA 1 | 15 |
| ISA 2 | 15 |
| Tutorial:<br>Assignment and Activity | 20 |
| **Total** | 50 |

**Tutorial Content:**

| Sl. No | Topic | Number of slots |
|---|---|---|
| 1. | Logic and Proofs | 3 |
| 2. | Functions and Relations | 2 |
| 3. | Counting | 2 |
| 4. | Recurrence Relations | 2 |
| 5. | Groups | 2 |
| 6. | Number theory | 1 |
| 7. | Programming: With C | 2 |

BACK

| Program: Bachelor of Engineering | | Semester – III |
|---|---|---|
| Course Title: Computer Organization and Architecture | | Course Code: 24ECSC201 |
| L-T-P:3-0-1 | Credits: 4 | Contact Hrs: 5hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 40 | Tutorial/Practical: 28hrs | Exam Duration: 3 hrs |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Computer Fundamentals:** Basic Concepts and Computer Evolution: Organization and Architecture, Structure and Function, A Brief History of Computers, The Evolution of the Intel x86 Architecture, Embedded Systems<br>Performance Issues: Two Laws that Provide Insight: Ahmdahl's Law and Little's Law, Basic Measures of Computer Performance, Calculating the Mean, Benchmarks and Spec.<br>A Top-Level View of Computer Function and Interconnection: Computer Components, Computer Function, Interconnection Structures, Bus Interconnection, Point-to-Point Interconnect | **04 hrs** |
| **2** | **Computer System:** Memory: Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design, Semiconductor Main Memory, DDR DRAM<br>Input/Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access | **06 hrs** |
| **3** | **The Central Processing Unit:** Instruction Sets: Characteristics and Functions: Machine Instruction Characteristics, Types of Operands, Types of Operations<br>Instruction Sets: Addressing Modes and Formats: Addressing Modes, Instruction Formats, Assembly Language | **06 hrs** |
| | **Unit –II** | |
| **4** | **The Processor:** Processor Structure and Function: Processor Organization, Register Organization, Instruction Cycle, Instruction Pipelining<br>Instruction-Level Parallelism and Superscalar Processors: Overview, Design Issues, Intel Core Microarchitecture | **08 hrs** |
| **5** | **Parallel Organization:** Parallel Processing: Multiple Processor Organizations, Symmetric Multiprocessors, Cache Coherence and the MESI Protocol, Multithreading and Chip Multiprocessors<br>Multicore Computers: Hardware Performance Issues, Software Performance Issues, Multicore Organization, Heterogeneous Multicore Organization. | **08 hrs** |
| | **Unit –III** | |
| **6** | **General-Purpose Graphic Processing Units:** Cuda Basics, GPU versus CPU, GPU Architecture Overview | **04 hrs** |

| | | |
|---|---|---|
| 7 | **Control Unit Operation:** Micro-Operations , Control of the Processor, Case studies and Projects | **04 hrs** |

**Text Books:**

1. William Stallings, Computer Organization and Architecture Designing for Performance, 10th Ed, Pearson Education, 2016.

**Reference Books:**

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach 5th Edition, Elsevier publication, 2017.
2. Kai Hwang, Advanced Computer Architecture Parallelism Scalability Programmability, Tata McGraw Hill 2008

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1,2,3 | Solve Any **2** |
| II | Q.No.-4, Q.No.-5 | 4,5 | Solve Any **2** |
| III | Q.No.-6 | 6 | Solve Any **1** |
| | Q.No.-7 | 7 | |

**Laboratory Plan**

| Expt/ Job No. | Experiment/ Job details | No. of Lab sessions/batch |
|---|---|---|
| 1. | Logisim Tool Demo | 01 |
| 2. | Combinational Circuits (Half Adder, Full Adder, Decoder, Multiplexer) | 01 |
| 3. | Building ALU | 01 |
| 4. | Building ALU(contd..) | 01 |
| 5. | 1-bit RAM Cell and building bigger RAM | 01 |
| 6. | 1-bit RAM Cell and building bigger RAM(contd..) | 02 |
| 7. | Design and simulation of main memory organization | 01 |
| 8. | Design and simulation of main memory organization(contd..) | 01 |
| 9. | Design and simulation of register organization | 02 |
| 10. | Design and simulation of datapath for processor design. | 01 |
| 11. | Design and simulation of datapath for processor design (contd..) | 01 |
| 12. | Comparative study of contemporary processors | 01 |

BACK

| Program: Bachelor of Engineering | | Semester – III |
|---|---|---|
| Course Title: Design and Analysis of Algorithms | | Course Code: 24ECSC205 |
| L-T-P: 4-0-0 | Credits: 4 | Contact Hrs: 4 hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 50 | Tutorial/Practical: -- | Exam Duration: 3hrs |

| Unit –I | | |
|---|---|---|
| 1 | **Foundations:** Design Philosophy and Intuitions, Space and Time Complexities, Order of an Algorithm, Problem patterns: Recursion, Iteration, Backtrackinvg | 06 hrs |
| 2 | **Computing Principles and Tools:** Pruning, Edge Relaxation, Sets, Traversals, Prefix and Suffix, Union-Find, Hashing and Other Principles | 04 hrs |
| 3 | **Structured Data Management:** Graphs and Trees, Tries, AVL Trees, 2-3 Trees, Red-Black Trees, DFS, BFS, Heap, Array Query, Spare Table, Segment Trees, Fenwick Trees, Skip Lists | 15 hrs |
| 4 | **Sorting and Searching:** Sorting and Searching Devices | 06 hrs |
| 5 | **Graph Algorithms:** Shortest Path and Spanning Trees | 15 hrs |
| 6 | **Problem Assortments**<br>Problem types, Undecidability, Limitations of Algorithm Power | 04 hrs |

**Text Books:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, Fourth Edition, The MIT Press, 2022.
2. Anany V. Levitin, Introduction to the Design and Analysis of Algorithms. Addison-Wesley Longman Publishing Co, 2012.

**Reference Books:**

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education India; 3rd
2. Antti Laaksonen, Competitive Programmers Handbook, 2018
3. Bjarne Stroustrup, C++ Programming Language, Addison-Wesley Educational Publishers Inc; 4th edition.

**Scheme for End Semester Assessment (ESA)**

| Clusters | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1,2,3 | Solve Any **2** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 4,5 | Solve Any **2** |
| III | Q.No.-7 | 6 | Solve Any **1** |
| | Q.No.-8 | 6 | |

BACK

| Program: Bachelor of Engineering | | Semester – III |
|---|---|---|
| Course Title: Database Management System | | Course Code:15ECSC208 |
| L-T-P: 4-0-0 | Credits: 4 | Contact Hrs: 4 hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 50 | Tutorial/Practical: -- | Exam Duration: 3 hrs |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Introduction and ER Model:** Introduction to DBMS; Data Models, Schemas and Instances; Three-Schema Architecture; Database Languages; Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets. Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues. | **06hrs** |
| **2** | **Relational Data Model and Relational Algebra:** Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Binary Relational Operations: CARTESIAN PRODUCT, JOIN: Additional Relational Operations; Relational Database Design Using ER- to-Relational Mapping. | **08hrs** |
| **3** | **SQL:** SQL Data Definition and Data Types; SQL constraints; DDL and DML statements; JOIN operations; Complex SQL Queries, PL/SQL. | **08hrs** |
| | **Unit –II** | |
| **4** | **Database Design:** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; Boyce-Codd Normal Form. | **09 hrs** |
| **5** | **Introduction to Transaction Processing:** Introduction to Transaction Processing; Transactions and System concepts; Desirable Properties of Transactions; Characterizing Schedules Based on- Recoverability, Serializibilty. | **09 hrs** |
| | **Unit –III** | |
| **6** | **Concurrency Control Techniques:** Introduction, Two-phase Locking Techniques for Concurrency Control, Dealing with Dead-lock and Starvation, Concurrency control based on Time stamp Ordering. | **05 hrs** |
| **7** | **Database Security:** Introduction to DB Security Issues, Discretionary Access Control, Mandatory Access Control And Role-Based Access Control, SQL Injections, SQL Attacks | **05 hrs** |

**Text Books:**

1. Elmasri R. and Navathe S., Fundamentals Database Systems, 6th Ed, Pearson Education, 2011.
2. ShashankTiwari , Professional NOSQL, 1st Ed,Wrox, 2011.

**References:**

1. Ramakrishnan S. and Gehrke J., Database Management Systems, 3rd Ed, McGraw Hill, 2007.
2. Silberschatz A., Korth H.F. and Sudharshan S., Database System Concepts, 5th Ed, Mc- GrawHill, 2006.

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1, 2,3 | Solve Any **2** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 4,5 | Solve Any **2** |
| III | Q.No.-7 | 6 | Solve Any **1** |
| | Q.No.-8 | 7 | |

BACK

| Program: Bachelor of Engineering | | Semester – III |
|---|---|---|
| Course Title: Database Applications Lab | | Course Code: 15ECSP204 |
| L-T-P: 0-0-1.5 | Credits: 1.5 | Contact Hrs: 3 hrs/week |
| ISA Marks: 80 | ESA Marks:20 | Total Marks: 100 |
| Teaching Hrs: 36 | Tutorial/Practical: 42hrs | Exam Duration: 3 hrs |

**List of experiments/jobs planned to meet the requirements of the course.**

| | |
|---|---|
| 4- Demonstration | • Introduction to RDBMS/Case study/ basic SQL commands.<br>• Set theory, logical operators and aggregate functions.<br>• Group by , Having clause, Views and index<br>• Basics of PL/SQL. |
| 5-Exercises | • SQL queries on set theory, logical operators and join operations.<br>• SQL queries queries on aggregate functions, group by and having clause.<br>• SQL queries on Views and nested query operations.<br>• PL/SQL queries using triggers and cursors.<br>• PL/SQL queries using procedures and functions. |
| 3-Structured Enquiry | • Database Design |
| 1-Open Ended Experiment | • Database design & implementation |

**Text Book:**

1. Elmasri R. and Navathe S., Fundamentals Database Systems, 7th edition, Pearson Education, 2012.
2. Steven Feuerstein, Bill Pribyl Oracle PL/SQL Programming, 6th Edition , O'Reilly Media,2014.

**References:**

1. Ramakrishnan S. and Gehrke J., Database Management Systems, 3rd edition, McGraw Hill, 2007.
2. PL/SQL User's Guide and Reference 10g Release 1 (10.1) December 2003.

**Evaluation:**

Students Assessment through ISA (80%) + ESA (20%)

| **Internal Semester Assessment (80%)** | **Assessment** | **Weightage in Marks** |
|---|---|---|
| | Exercises | 50 |
| | Structured Enquiry | 20 |
| | Open Ended Experiment | 10 |
| **End Semester Assessment (20%)** | ESA | **20** |
| | **Total** | **100** |

BACK

| Program: Bachelor of Engineering | | Semester – III |
|---|---|---|
| Course Title: Algorithms Lab | | Course Code: 24ECSP205 |
| L-T-P: 0-0-2 | Credits: 2 | Contact Hrs: 4 hrs/week |
| ISA Marks: 80 | ESA Marks: 20 | Total Marks: 100 |
| Teaching Hrs:-- | Tutorial/Practical: 56hrs | Exam Duration: 03 |

| Sl. No. | Experiment | No. of Slots |
|---|---|---|
| 1 | Objected Oriented Programming Using C++ Basics | 2 |
| 2 | Introduction and Efficiency Analysis | 1 |
| 3 | Trees | 1 |
| 4 | Structured Data Management | 1 |
| 5 | Searching and Sorting | 1 |
| 6 | Graph Algorithms | 2 |
| 7 | Project Work | 6 |

**Text Books:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, Fourth Edition, The MIT Press, 2022.
2. Anany V. Levitin, Introduction to the Design and Analysis of Algorithms. Addison-Wesley Longman Publishing Co, 2012.

**Reference Books:**

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education India; 3rd edition, 2007.
2. Antti Laaksonen, Competitive Programmers Handbook, 2018
3. Bjarne Stroustrup, C++ Programming Language, Addison-Wesley Educational Publishers Inc; 4th edition.

**Evaluation Scheme**

| Sl. No. | Experiment | Marks |
|---|---|---|
| 1 | Exercise | 20 |
| 2 | Structured Inquiry | 30 |
| 2 | Project Work (ISA – 30, ESA - 20) | 50 |
| | **Total** | **100** |

BACK

| Program: Bachelor of Engineering | | Semester – III |
|---|---|---|
| Course Title: Corporate Communications (AUDIT) | | Course Code: 24EHSA201 |
| L-T-P: 0-0-0 | Credits: 0 | Contact Hrs: 1 hr/week |
| ISA Marks: 100 | ESA Marks: NA | Total Marks: 100 |
| Teaching Hrs: 16 | Tutorial/Practical: -- | Exam Duration: NA |

**Unit –I**

| | | |
|---|---|---|
| 1 | **Communication Skills:** Tools of Communication, Listening, Body Language, Common Postures and Gestures, Open and Closed Body Language, Body Language to be used in Corporate Scenarios, Voice: Pitch, Pace, and Pause, Verbal Language: Positive & Negative Vocabulary, Corporate Conversations | **4 hrs** |
| 2 | **Presentation Skills:** Zero Presentation, Individual Presentations, and feedback, Making Presentations Interactive, Types of Questions, Taking off and Signing off differently, Captivating your Audience, Corporate Presentations | **4 hrs** |
| 3 | **Spoken English:** Phonetic and Non-Phonetic Languages, Introduction to IPA, Sounds in English, Syllables, Word Stress, Rhythm, Pausing, and Intonation | **4 hrs** |
| 4 | **Written English:** Vocabulary Enhancement Strategies, Root Words in English, Grammar Improvement Techniques, Dictionary Usage, Similar and Contradictory Words | **4 hrs** |

**Text Books:**

NA

**Reference Books:**

1. Diana Booher - Communicate With Confidence, Mc Graw Hill Publishers
2. Norman Lewis – Word Power Made Easy, Goyal Publishers
3. Cambridge Advanced Learner's Dictionary, Cambridge University Press.

BACK

**Semester- IV**

| **Program: Bachelor of Engineering** | | **Semester - IV** |
|---|---|---|
| **Course Title: Probability and Statistics** | | **Course Code: 24EMAB209** |
| **L-T-P: 3-1-0** | **Credits: 4** | **Contact Hrs: 5 hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** |
| **Teaching Hrs:40 hrs** | **Tutorial/Practical: 28hrs** | **Exam Duration: 3 hrs** |

| | | |
|---|---|---|
| | **Unit - I** | |
| **1** | **Description of data:** Introduction: Data, Type of Variables, mean, weighted mean, median, mode, Quartiles, Variance, Coefficient of variation, skewness, Histogram, Box plots, Normal Quantile-Quantile plots | **10 hrs** |
| **2** | **Probability:** Introduction: Definition, Interpretation of probability value, addition rule, multiplication rule, Bayes' rule. Bayesian Classification. | **06 hrs** |
| **3** | Lab: Introduction to Data handling and Data visualization (Histogram, Skewness, Boxplot, QQ-norm, Measures of central tendency and dispersion) | **08 hrs** |
| | **Unit - II** | |
| **4** | **Random variables and Probability Distribution:** Random variables, simple Examples, Discrete and continuous random variables; Theoretical distributions: Binomial, Poisson, Normal Introduction to bivariate distribution, joint probability distribution, marginal distribution, and covariance. | **07 hrs** |
| **5** | **Statistical Inference I:** Introduction: Sampling, SRSWR, SRSWOR, Cluster Sampling, Stratified Sampling, Basic terminologies of testing hypothesis, Confidence interval, Sample size determination, Hypothesis test for proportions, means (single and differences), using P-value approach | **09 hrs** |
| | **Lab:** Probability distribution, Testing of Hypothesis for proportions, means(single and differences) | **08 hrs** |
| | **Unit - III** | |
| **6** | **Correlation and Regression:** Meaning of correlation and regression, coefficient of correlation, Linear regression (ANOVA approach), Multiple linear regression, Logistic Regression. | **04 hrs** |
| **7** | **Statistical Inference II:** Test for independence of attributes (m x n contingency table) Inference based on choice of suitable test procedure (Goodness of fit) | **04 hrs** |

| | | |
|---|---|---|
| | **Lab:** Linear Regression with ANOVA approach, Multiple Regression with ANOVA approach | **04 hrs** |

**Text Books**


1. Douglas C Montgomery, George C Runger, Applied Statistics for Engineers, 5th Edition, John Wiley and Sons
2. Probability and Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye, 9th edition, Prentice Hall
3. J. Susan Milton, Jesse C. Arnold, Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, 4th Ed, TATA McGraw-Hill Edition 2007.


**Reference Books:**


1. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, 2005
2. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, 1ed, Sultan Chand & Sons, New Delhi, 2000.
3. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists


BACK

| Program: Bachelor of Engineering | | Semester- IV |
|---|---|---|
| Course Title: Computer Networks – I | | Course Code: 24ECSC207 |
| L-T-P: 3-1-0 | Credits: 4 | Contact Hrs:5hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 40 | Tutorial/Practical: 28hrs | Exam Duration: 3 hrs |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Introduction:** Introduction to Internet; The Network Edge and Core; Delay, Loss, and Throughput in Packet-Switched Networks; Protocol Layer and Service Models: OSI and TCP/IP. Networks Attacks. | **8 hrs** |
| **2** | **Application Layer:** Principles of Network Applications; The Web and HTTP; Electronic Mail in the Internet - SMTP; The Internet's Directory Service – DNS; Dynamically configuring a host – DHCP; Peer-to-peer applications | **8 hrs** |
| | **Unit –II** | |
| **3** | **Transport-Layer Services:** Introduction, Connectionless Transport, Principles of Reliable Data Transfer Protocol, Connection-Oriented and Connectionless Transport, Principle of Congestion Control, TCP Congestion Control. | **8 hrs** |
| **4** | **Network Layer: Data plane:** Introduction to Data and Control Plane, Virtual Circuit and Datagram Networks, Internet Protocol: Datagram Format, Fragmentation, IP Addressing | **8 hrs** |
| | **Unit –III** | |
| **5** | **Network Layer: Data plane:** NAT, IPv6, Software Defined Network(SDN) | **4 hrs** |
| **6** | **Network Layer: Control Plane and Network Management:** SDN Control Plane, Network Management and SNMP | **4 hrs** |

**Text Books:**

1. J. F. Kurose, K. W. Ross, Computer Networking: A Top-Down Approach, 7th Edition, Pearson Education, 2017.

**Reference Books:**

1. Peterson, Larry L, Computer networks : A Systems Approach, 5th Edition, The Morgan Kaufmann series in networking, 2012
2. Behrouz A. Forouzan, TCP/IP protocol suite, 4th, McGraw Hill, 2010.

**Computer Networks-I Tutorial**

| Sl. No | Exercise | No of Slots |
|---|---|---|
| 1 | Demonstration of n/w commands and tools in command prompt. | 1 |
| 2 | Demonstration of Cisco Packet Tracer network tool: usage of hub, switch, and a router using a simple topology | 2 |
| 3 | Application layer protocol implementation – Manual configuration and DHCP | 1 |
| 4 | Application layer protocol implementation – DNS, SMTP and HTTP | 1 |
| 5 | Demonstration of static routing using Cisco Packet Tracer | 1 |
| 6 | Assessment – 1 (Demonstration of a given topology using Cisco Packet Tracer) | 1 |
| 7 | Demonstration of socket programming using a simple message board application - Connection oriented and connectionless. | 2 |
| 8 | Demonstration of simple banking application using connection oriented socket programming. | 1 |
| 9 | Demonstration of a simple calculator application using connectionless socket programming. | 1 |
| 10 | Practice session for socket programming | 1 |
| 11 | Exercise on usage of Wireshark tool to capture packets in the network. | 1 |
| 12 | Assessment – 2<br>i) Implementation of a given application using socket programming<br>ii) Demonstration of packet capture and network performance analysis using the wireshark tool | 1 |

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1,2 | Solve Any **2** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 3,4 | Solve Any **2** |
| III | Q.No.-7 | 5 | Solve Any **1** |
| | Q.No.-8 | 6 | |

BACK

| Program: Bachelor of Engineering | | Semester- IV |
|---|---|---|
| Course Title: Object Oriented Programming | | Course Code: 24ECSC204 |
| L-T-P: 3-0-0 | Credits: 3 | Contact Hrs: 3 hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 40 | Tutorial/Practical: -- | Exam Duration: 3hrs |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Object Oriented Programming (OOP) Concepts and JAVA Language Fundamentals**: Introduction to OOP, Object Oriented Paradigm, Applications of OOP. Features of JAVA, JVM, JDK, Source File Structure. Programming constructs and String Handling. Class Diagrams-UML notations. Types of relations between classes. | **4 hrs** |
| **2** | **Classes and Objects:** Class Fundamentals, Declaring objects, Assigning object reference variables, Introducing methods, Constructors, this key word, Garbage collection: The finalize method. A closer Look at Methods and Classes: Overloading: Methods, Constructors. Using objects as Parameters, Returning objects, Access control. Understanding static and final keywords. Introducing nested and inner classes. | **6 hrs** |
| **3** | **Inheritance and Polymorphism: Inheritance:** Basics, Usage of super key word, Method overriding, Dynamic method dispatch, Abstract classes, Object class. | **6 hrs** |
| | **Unit –II** | |
| **4** | **Packages, Interfaces &Exception handling:** Packages and Interfaces**:** Packages, Access protection, Importing packages. Interfaces. Exception Handling: Fundamentals, Exception Types, Using try, catch, throw, throws and finally, Multiple catch, Nested try statements, user defined exceptions. | **6 hrs** |
| **5** | **Collections Framework**: Introduction, List Interface, List Implementation Classes, Set Interface, Set Implementation Classes, The Map Interface, Map Implementation Classes. | **4 hrs** |
| **6** | **Lambda Expressions & Streams API:** Functional programming, Functional interface, Bulk operations on collections. Basics of Streams, Reduction operations, Iterators and Streams | **6 hrs** |
| | **Unit –III** | |
| **7** | **Spring Boot:** Overview, key features, architecture, setting-up a Spring Boot, RESTful API, spring data JPA, CRUD Operations. | **4 hrs** |
| **8** | **Design Patterns:** Creational, Structural and Behavioral design patterns. | **4 hrs** |

| **Textbooks** |
|---|
| 1. Herbert Schildt, "The Complete Reference", 9th Edition, McGraw-Hill. |
| **Reference Books** |
| 1. Kathy Sierra and Bert Bates, Head First JAVA, 2, O'Reilly Media.<br>2. Introduction to Java Programming, Liang Y D, Pearson, 7th Edition. |

**Evaluation Scheme**

**ISA Scheme**

| Assessment | Weightage in Marks |
|---|---|
| ISA-1 | 20 |
| ISA-2 | 20 |
| Activity(Design) | 10 |
| **Total** | 50 |

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1,2& 3 | Solve Any **2** out of **3** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 4,5&6 | Solve Any **2** out of **3** |
| III | Q.No.-7 | 7 | Solve Any **1** out of **2** |
| | Q.No.-8 | 8 | |

BACK

| Program: Bachelor of Engineering | | Semester- IV |
|---|---|---|
| Course Title: Principles of Compiler Design | | Course Code:19ECSC203 |
| L-T-P:3-1-0 | Credits: 4 | Contact Hrs: 5hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 40 | Tutorial/Practical: 28hrs | Exam Duration: 03 hrs |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Introduction to compilers:** Brief History Of Compilers, Translation Process, Major Data Structures In Compilers, Chomsky Hierarchy, Lexical Analysis: Scanning Process, Regular Expressions For Tokens, Lexical Errors, Applications Of Regular Expressions. | **06 hrs** |
| **2** | **Finite Automata:** Introduction: Language, Automata, From Regular Expressions To Deterministic Finite Automata (DFA): Є-Nondeterministic Finite Automata (Є-NFA), NFA, DFA, DFA Optimization, Finite Automata As Recognizer, Implementation Of Finite Automata | **06 hrs** |
| **3** | **Introduction to Syntax Analysis:** Introduction To Grammars, Context-Free Grammars (CFGs), Ambiguity In Grammars And Languages, Role Of Parsing. | **04 hrs** |
| | **Unit –II** | |
| **4** | **Top Down Parsing:** Introduction, Left Recursion, Left Factoring, LL (1) Parsing, FIRST And FOLLOW Sets, Error Recovery In Top Down Parsing. | **08 hrs** |
| **5** | **Bottom up Parsing:** Introduction, SLR (1) Parsing, General LR (1) And LALR (1) Parsing, Error Recovery In Bottom Up Parsing. | **08 hrs** |
| | **Unit –III** | |
| **6** | **Semantic Analysis:** Attributes And Attributes Grammars, Algorithm For Attribute Computation, Symbol Table, Data Types And Data Checking. | **04 hrs** |
| **7** | **Intermediate Code Generation:** Intermediate Code And Data Structure For Code Generation, Code Generation Of Data Structure References, Code Generation Of Control Statements. | **04 hrs** |

**Text Book:**

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman, Compilers - Principles, Techniques and Tools, 2nd Edition, Pearson, 2023.
2. Kenneth C Louden: Compiler Construction Principles & Practice, Cengage Learning, 1997.

**References:**

1. Andrew W Apple, Modern Compiler Implementation in C, Cambridge University Press, 1999.
2. Charles N. Fischer, Richard J. leBlanc, Jr, Crafting a Compiler with C, Pearson, 2011.
3. Peter Linz, An Introduction to formal languages and Automata, IV edition, Narosa, 2016.
4. Basavaraj S Anami, Karibasappa K.G, Formal Languages and Automata Theory, First, Wiley India, 2011.

**Tutorial tentative plan**

| Expt/Job No | Brief description of experiments | No of slots 1 slot = 2hrs |
|---|---|---|
| 1 | Regular expressions. | 01 |
| 2 | NFA, DFA and DFA optimization. | 02 |
| 3 | Regular and Context free grammars. | 01 |
| 4 | Implementation of lexical analyser using LEX tool. | 02 |
| 5 | Implementation of syntax analyser using YACC tool. | 02 |
| 6 | Top down parsing | 01 |
| 7 | Bottom up parsing | 01 |
| 8 | Implementation of parsing algorithms using C language | 02 |

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1, 2 ,3 | Solve Any **2** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 4 ,5 | Solve Any **2** |
| III | Q.No.-7 | 6 | Solve Any **1** |
| | Q.No.-8 | 7 | |

BACK

| Program: Bachelor of Engineering | | Semester- IV |
|---|---|---|
| Course Title: Operating Systems Principles and Programming | | Course Code:24ECSC209 |
| L-T-P: 4-0-1 | Credits: 5 | Contact Hrs: 6 hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 50 | Tutorial/Practical: 28hrs | Exam Duration: 3 Hrs |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Fundamentals of Process:** Operating System Functions and Characteristics, Process Concept, Process Control and Operations, System Call, Inter Process Communication. | **07 hrs** |
| **2** | **CPU Scheduling:** Basic Concepts, Schedulers, Scheduling Criteria, Scheduling Algorithms, Multithreading models and Thread API, Thread library. | **07 hrs** |
| **3** | **Process Synchronization:** Synchronization, Producer Consumer problem, The critical section problem, Semaphores, Classical problems of synchronization. | **06 hrs** |
| | **Unit –II** | |
| **4** | **Deadlocks:** Deadlock System Model and Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock | **06 hrs** |
| **5** | **File Management:** UNIX File Types, File systems and File Attributes, I-nodes in UNIX, UNIX Kernel Support for Files, Directory Files, Hard and symbolic filenames, General File APIs. File and Record Locking. | **07 hrs** |
| **6** | **Memory Management:** Memory management strategies, Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation. | **07 hrs** |
| | **Unit –III** | |
| **7** | **Virtual Memory Management:** Virtual Memory Management, Background, Demand paging, Page replacement. | **5 hrs** |
| **8** | **Case study:** Windows 10, Design Principles, System Components Influential Operating Systems: Macintosh Operating System and IBM OS/360 | **5 hrs** |

**Text Books:**


1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 10 ed., Wiley-India, 2018.
2. W. Richard Stevens, Stephen A. Rago, “Advanced Programming in the UNIX Environment”, 3 ed. Addison Wesley Professional, 2013


**Reference Books:**


1. William Stallings, “Operating System Internals and Design Principles”, 1 ed.,Pearson Education, Asia, 2015
2. Gary Nutt,” Operating System”, 3 ed., Pearson Education,2009
3. Terrence Chan, “Unix System Programming Using C++”, 1 ed., Prentice Hall India, 2014
4. Marc J. Rochkind, “Advanced Unix Programming”, 2 ed., Pearson Education, 2005.

**List of Experiments**

| Expt./Job No. | Experiment/job Details | No. of Labs. Session/s per batch |
|---|---|---|
| 1. | Demonstrate the usage of process management API's viz fork, vfork, exec, exit. | 1 |
| 2. | Demonstrate Inter Process Communication (IPC) using PIPE / FIFO. | 1 |
| 3. | Implementation Critical Section Problem using Semaphore. | 1 |
| | **REVIEW -1** | |
| 4. | Demonstrate file related system calls OPENDIR, READDIR, and CLOSEDIR. | 1 |
| 5. | Implement cp commands of an operating system. | 1 |
| 6. | Demonstrate file locking using 'fcntl' system call. | 1 |
| | **REVIEW -2** | |
| | Practice Programs | |
| 7. | Implement FCFS/SJF scheduling algorithms | 1 |
| 8. | Implement the conversion of a virtual address to a physical address. | 1 |
| 9. | Implement paging algorithms | 1 |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage | Weightage in Marks |
|---|---|---|---|
| ISA-1 (Theory) | 40 | 80% | 40 |
| ISA-2 (Theory) | 40 | | |
| Flipped Classroom | 20 | | |
| Laboratory Assessment-1 | 40 | 20% | 10 |
| Laboratory Assessment-2 | 40 | | |
| | | **Total** | **50** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 100 | 50 |
| | **Total** | **50** |

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1,2,3 | Solve Any **2** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 4,5,6 | Solve Any **2** |
| III | Q.No.-7 | 7 | Solve Any **1** |
| | Q.No.-8 | 8 | |

BACK

| Program: Bachelor of Engineering | | Semester- IV |
|---|---|---|
| Course Title: Exploratory Data Analysis | | Course Code: 24ECSC210 |
| L-T-P: 2-0-2 | Credits: 4 | Contact Hrs: 6 hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 30 | Tutorial/Practical: 56hrs | Exam Duration: 2 hrs |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Data Description and Preprocessing:** Ecosystem for data science, Types of data, statistical descriptions of data, data visualization. Data cleaning, data integration, data reduction, data transformation. | **10 hrs** |
| **2** | **Supervised Learning: Regression:** Basic Concepts, Regression: Linear and Logistic, Evaluation metrics: R2score, MSE, RMSE, MAE | **5 hrs** |
| | **Unit –II** | |
| **3** | **Supervised Learning: Classification:** Naive Bayes, K-Nearest Neighbors (KNN), Model evaluation and selection: Accuracy, Precision, Recall, Sensitivity, Specificity, F-Score, Techniques to improve classification Accuracy-Ensemble methods: Bagging, Boosting, AdaBoost. | **8 hrs** |
| **4** | **Clustering:** Partitioning-based: K-Means, K-Medoids, Hierarchical clustering: Agglomerative, Density-based clustering:DBSCAN. | **7 hrs** |

**Reference Books:**


1. Wes McKinney, Python for Data Analysis, 3rd Edition, O'Reilly Media, 2022 (Early Release).
2. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python: Perform EDA techniques to understand, summarize, and investigate your data, Packet Publishing Limited, 27 March 2020.
3. Jiawei Han, MichelineKamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann, 2012.


**Scheme of Evaluation**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 30 | 25 |
| ISA-2 (Theory) | 30 | |
| Lab assessments | 75 | 25 |
| | **Total** | **50** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 25 |
| Lab | 25 | 25 |
| | **Total** | **50** |

**Lab Schedule**

| S.No | Chapter and Topics | Activity | Lab slots |
|---|---|---|---|
| 1 | Revisit of Python basics, Numerical and vectorized computing data manipulation<br>Watch: Home Assignment<br>From Couch to Jupyter: A Beginner's Guide to Data Science Tools & Concepts \| WiDS Worldwide | Demonstration on python basics. Demonstration on scientific libraries | 1 |
| 2 | Chapter 1: Data Preprocessing | Demonstration on Data Description:<br>- Count, Pie plot, Histogram, Scatter, plot, line plot, Box plot | 1 |
| 3 | Chapter 1:Data Preprocessing | Data Pre-Processing:<br>• Filling missing values(binning)<br>• min_max & z score normalization,<br>• linear regression, feature selection | 1 |
| 4 | Assessment 1 | Assessment on Data description and Data Preprocessing | 1 |
| 5 | **Course Project/WiDS Datathon Review – 01** | Demonstration and presentation of course project | 1 |
| 6 | Chapter 3: Supervised Learning: Regression | • Demonstration and Practice of building Regression models<br>• Model's evaluation using metrics | 1 |
| 7 | Chapter 4: Supervised Learning: Classification<br>Watch:<br>Home Assignment<br>https://youtu.be/J2iqDVpbpeo | Demonstration and Practice on Classification models Model's evaluation using metrics | 1 |
| 8 | Course Project /WiDS Datathon Review – 02 | Demonstration and presentation of course project | 1 |
| 9 | Assessment 2 | Assessment on Classification/Regression | 1 |
| 10 | Chapter 4: Clustering | Practice on Clustering Algorithms (K means, DBSCAN) | 1 |
| 11 | Assessment 3 | Assessment on Clustering | 1 |
| 12 | Course Project /WiDS Datathon Review – 03 | Demonstration of complete working project | 1 |
| 13 | Review of portfolio/term paper | | 1 |
| 14 | Submission of portfolio and term paper | | 1 |

| Program: Bachelor of Engineering | | Semester- IV |
|---|---|---|
| Course Title: Object Oriented Programming Lab | | Course Code: 24ECSP203 |
| L-T-P: 0-0-1.5 | Credits: 1.5 | Contact Hrs: 3 hrs/week |
| ISA Marks: 80 | ESA Marks: 20 | Total Marks: 100 |
| Teaching Hrs: -- | Practical: 42 hrs | Exam Duration: 3hrs |

| Experiments Number | Lab assignments/experiment | Number of Slots |
|---|---|---|
| 1 | Demonstration: Introduction to Eclipse/Any other tool IDE (Integrated Development Environment), java programming basics. | 5 |
| 2 | Exercise: Classes and objects, Inheritance, Polymorphism, Exceptions Handling and Collection framework/lambda expressions | 4 |
| 3 | Structured Enquiry: Classes and objects, Inheritance, Polymorphism, Exceptions Handling, Lambda expressions | 2 |
| 4 | Open Ended: Data types, Classes and Objects, Inheritance polymorphism, Exception Handling. Design patterns | 3 |

**Text Book:**

1. Herbert JAVA The Complete Reference, Herbert Schildt, 10th Ed, 2017, McGraw-Hill.

**Reference Books:**

1. Kathy Sierra and Bert Bates, Head First Java: A Brain-Friendly Guide, 2nd Edition, O'Reilly Media.
2. Introduction to Java Programming, Liang Y D, Pearson, 11th Edition.

**Evaluation:**

**Students Assessment through ISA (80%) + ESA (20%)**

| | Assessment | Weightage in Marks |
|---|---|---|
| **Internal Semester Assessment (80%)** | Exercises | 40 |
| | Structured Enquiry | 20 |
| | Open Ended Experiment | 20 |
| **End Semester Assessment (20%)** | Structured Enquiry | **20** |
| | **Total** | **100** |

BACK

| Program: Bachelor of Engineering | | Semester- IV |
|---|---|---|
| Course Title: Problem Solving and Analysis (AUDIT) | | Course Code: 24EHSA202 |
| L-T-P: 0-0-0 | Credits: 0 | Contact Hrs: 1hr/week |
| ISA Marks: 100 | ESA Marks: NA | Total Marks: 100 |
| Teaching Hrs: 16 | Tutorial/Practical: -- | Exam Duration: NA |

**Unit –I**

| | | |
|---|---|---|
| **1** | **Analytical Thinking:** Analysis of Problems, Puzzles for practice, Human Relations, Direction Tests; Looking for Patterns: Number and Alphabet Series, Coding Decoding; Diagrammatic Solving: Sets and Venn diagram-based puzzles; Visual Reasoning, Clocks and Calendars | **4 hrs** |
| **2** | **Mathematical Thinking:** Number System, Factors and Multiples, Using Simple Equations for Problem Solving, Ratio, Proportion, and Variation | **4 hrs** |
| **3** | **Verbal Ability:** Problem Solving using Analogies, Sentence Completion | **4 hrs** |
| **4** | **Discussions & Debates:** Team efforts in Problem Solving; A Zero Group Discussion, Mock Group Discussions, and Feedback; Discussion v/s Debate; Starting a Group Discussion: Recruitment and other Corporate Scenarios; Evaluation Parameters in a Recruitment Group Discussion, Types of Initiators: Verbal and Thought, Conclusion of a Discussion | **4 hrs** |

**Text Books:**

NA

**Reference Books:**


1. R. S. Aggarwal, “A Modern Approach to Verbal and Non – Verbal Reasoning”, Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, “Quantitative Aptitude”, Sultan Chand and Sons, New Delhi, 2018
3. Chopra, “Verbal and Non – Verbal Reasoning”, MacMillan India
4. M Tyra, “Magical Book on Quicker Maths”, BSC Publications, 2018
5. Diana Booher - Communicate With Confidence, Mc Graw Hill Publishers
6. Norman Lewis – Word Power Made Easy, Goyal Publishers
7. Cambridge Advanced Learner’s Dictionary, Cambridge University Press.
8. Kaplan’s GRE guide


BACK

**Semester – V**

| **Program: Bachelor of Engineering** | | **Semester- V** |
|---|---|---|
| **Course Title: Machine Learning and Deep learning** | | **Course Code: 24ECSC306** |
| **L-T-P: 2-0-2** | **Credits: 4** | **Contact Hrs: 6 hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical Hrs: 60** | **Exam Duration: 2 hrs** |

| | **Unit –I** | |
|---|---|---|
| **1** | **Introduction and Regression:** Fundamentals of ML, linear, ridge, lasso, elastic-net regression, evaluation. | **04 hrs** |
| **2** | **Classification**: Linear discriminant analysis, logistic regression, support vector machines, decision tree, extra trees, Bayesian networks, evaluation. | **05 hrs** |
| **3** | **Ensemble learning:** Bagging, boosting, stacking, random forest, resampling methods, regularization for linear and logistic regression. | **06 hrs** |
| | **Unit –II** | |
| **4** | **Neural networks:** Perceptron, gradient descent, optimization algorithms, backpropagation, hyper parameters, regularization. | **05 hrs** |
| **5** | **Deep neural networks:** convolutional neural networks, various CNN architectures, model selection and evaluation, bias-variance. | **06 hrs** |
| **6** | **Seq2Seq models:** Recurrent neural networks, long short-term memory, auto encoders. | **04 hrs** |

**Text Books:**

1. Tom Mitchell., Machine Learning, Mc Graw Hill, McGraw-Hill Science, 3rd edition.
2. Ian Goodfellow and Yoshua Bengio and Aaron Courville: Deep Learning, MIT Press, 2016.

**Reference Books:**

1. Aurelian Gerona, Hands-On Machine Learning with Scikit-Learn and Tensor Flow, Concepts, Tools, and Techniques to Build Intelligent Systems, Publisher: O'Reilly Media, July 2016.
2. Luca Pietro Giovanni Antiga, Thomas Viehmann, Eli Stevens, Deep Learning with PyTorch Manning Publications, 2020.

**List of Experiments:**

| Expt. No. | Experiments | No. of Slots |
|---|---|---|
| 1 | Introduction to Regression, regularization | 2 |
| 2 | Classification algorithms | 2 |
| 3 | Ensemble learning models | 2 |
| 4 | Perceptron networks, neural network training | 2 |
| 5 | Convolutional Neural Networks, State-of-the-art DNN models | 2 |
| 6 | Sequence models | 2 |
| 7 | Course Project | 3 |

**Scheme for End Semester Assessment (ESA)**

| UNIT | 6 Questions to be set of 15 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1, 2,3 | Solve Any **2** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 4,5,6 | Solve Any **2** |
| III | Lab exam (Course Project) | 1,2,3,4,5,6 | Lab exam evaluation |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA -I | 30 | 25 |
| ISA – II | 30 | |
| Lab Evaluation | 20 | 10 |
| Course Project | 30 | 15 |
| **Total** | | **50** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 25 |
| Lab | 50 | 25 |
| | **Total** | **50** |

BACK

| Program: Bachelor of Engineering | | Semester: V |
|---|---|---|
| Course Title: Computer Networks - 2 | | Course Code: 24ECSC303 |
| L-T-P: 3-0-0 | Credits: 3 | Contact Hrs: 3 hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 40 | | Exam Duration: 3hrs |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Network Layer- Routing Algorithms:** The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP. Broadcast and Multicast Routing, Broadcast Routing Algorithms. | **8 hrs** |
| **2** | **Network Layer – Queuing theory:** Router structure, Buffering strategies: Input queuing, Output queuing, Application of queuing theory for performance of queuing mechanisms: M/M/1 system, M/M/m system, M/M/1/B system. | **8 hrs** |
| | **Unit –II** | |
| **3** | **Data Link Layer:** Introduction to the Link Layer, Error-Detection and -Correction Techniques : Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC)binary and polynomial, ,Hamming Code, Multiple Access Links and Protocols: Channel Partitioning Protocols, Random Access Protocols: Aloha, Slotted Aloha, CSMA, CSMA/CD, CSMA/CA, Taking-Turns Protocols, The Link-Layer Protocol for Cable Internet Access. | **8 hrs** |
| **4** | **Switched Local Area Networks:** Link-Layer Addressing and ARP, Ethernet 802.3, Token ring 802.5, FDDI and LAN standards, Link-Layer Switches, Virtual Local Area Networks (VLANs), Multiprotocol Label Switching (MPLS). | **8 hrs** |
| | **Unit –III** | |
| **5** | **Wireless and Mobile Networks:** Wireless Links and Network Characteristics, 802.11 Wireless LANs, Architecture, MAC Protocol, Frame, Mobility, Personal Area Networks: Bluetooth and Zigbee. Cellular Networks and Internet Access, Mobility, Mobile IP, Managing Mobility in Cellular Network. | **4 hrs** |
| **6** | **Multimedia Networking:** Multimedia Networking Applications, Streaming Stored Video, Voice-over-IP, Protocols for Real-Time Conversational Applications. | **4 hrs** |

**Text Books**

1. J. F. Kurose, K. W. Ross, "Computer Networking, A Top-Down Approach", 8th Edition, Pearson Education, 2021.
2. Raj Jain, "Performance evaluation of computer systems", Wiley, 1991.
3. Theodore S Rappaport: Wireless Communications, Principles and Practice, 2nd Edition, Pearson Education Asia, 2002.

**Reference Books:**

1. Behrouz A. Forouzan , "Data Communications and Networking with TCPIP Protocol Suite", 6th Edition , McGraw Hill, 2021
2. Larry Peterson, Bruce Davie "Computer networks: a systems approach", 6th Edition, 2021.

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1 & 2 | Solve Any **2** out of **3** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 3 & 4 | Solve Any **2** out of **3** |
| III | Q.No.-7, Q.No-8 | 5 & 6 | Solve Any **1** out of **2** |

**Evaluation Scheme (ISA)**

| Assessment | Conducted for Marks | Weightage in Marks |
|---|---|---|
| ISA1 (Theory) | 40 | 20 |
| ISA2 | 40 | 20 |
| Activity | 10 | 10 |
| | **Total** | **50** |

**Evaluation Scheme (ESA)**

| Assessment | Conducted for Marks | Weightage in Marks |
|---|---|---|
| Theory | 100 | 50 |
| | **Total** | **50** |

BACK

| Program: Bachelor of Engineering | | Semester-V |
|---|---|---|
| Course Title: Web Technologies Lab | | Course Code: 24ECSP304 |
| L-T-P: 0-0-2 | Credits: 2 | Contact Hrs: 4hrs/week |
| ISA Marks: 80 | ESA Marks: 20 | Total Marks: 100 |
| Teaching hrs: | Practical Hrs: 60 | Exam Duration: 3hrs |

| | |
|---|---|
| 1 | **Introduction to HTML basics, JavaScript:** Introduction to World Wide Web, Web Application Architecture, HTML Basics, Cascading Style Sheets, JavaScript Basics, Bootstrap |
| 2 | **RESTful API using NodeJS and Express:** Introduction to Node.js.Building servers using the http and net modules, Node modules and events, Express, REST API client, Postman, Accessing Data, Data Security using Bcrypt. API security using JWT tokens. |
| 3 | **React:** Introduction to ReactJS, Setting up the development environment, ReactJS Ecosystem,<br>Fundamental Concepts: JSX, Components, State and Lifecycle Handling events, Conditional Rendering.<br>Advanced ReactJS Concepts: Hooks, Context API, Routing, Error Boundaries, Form handling, State Management Libraries, Fetching data from API's. |

**Reference Books:**


1. Robert W. Sebesta." Programming the World Wide Web", Pearson Publications 8th Edition, 2014.
2. AzatMardan, "Practical Node.js: Building Real-World Scalable Web Apps", 2nd Edition Apress, 2018.
3. Robin Wieruch, The Road to React: Your journey to master plain yet pragmatic React.js, 2024.


**Lab Plan**

| Expt./ Job No. | Lab assignments/experiment | No. of Lab. Slots per batch (estimate) |
|---|---|---|
| 1 | Demonstration on HTML, CSS, Bootstrap, JavaScript | 03 |
| 2 | Exercise on HTML, CSS, JavaScript | 01 |
| 3 | Demonstration on Typescript | 01 |
| 4 | Demonstration on NodeJS | 02 |
| 5 | Exercise on NodeJS with Typescript | 01 |
| 6 | Structured Enquiry on Nodejs | 01 |
| 7 | Demonstration on React | 03 |
| 8 | Exercise on React | 01 |
| 9 | Open Ended Experiment | 02 |

***Evaluation:***

**Students Assessment through ISA (80%) + ESA (20%)**

| | Assessment | Weightage in Marks |
|---|---|---|
| **In Semester Assessment (80%)** | Exercise (Problem execution, Viva, Observation Book, etc.) | 15+10+10 = **35** |
| | Structured Enquiry | **20** |
| | Open ended experiment | **25** |
| | **Total (ISA)** | **80** |
| **End Semester Assessment (20%)** | Exercise | **20** |
| | **Total** | **100** |

BACK

| Program: Bachelor of Engineering | | Semester: V |
|---|---|---|
| Course Title: Cloud Computing | | Course Code: 25ECSC305 |
| L-T-P:2-0-1 | Credits: 3 | Contact Hrs: 4 hrs/week |
| ISA Marks: 67 | ESA Marks: 33 | Total Marks: 100 |
| Teaching Hrs: 30 | Practical Hrs: 28 | Exam Duration: 2 hrs |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Introduction:** Motivation for cloud computing, elastic computing and its advantages: Business models for cloud providers, Types of clouds: multi-cloud, cloud platforms. Data center infrastructure: Network equipment and multi-port server interfaces, Leaf spine network topology. | **5 hrs** |
| **2** | **Virtualization and containerization:** Virtual Machines: approaches to virtualization, levels of trust, live migration of virtual machines. Advantages and disadvantages of virtual machines, isolation facilities in an operating system, Linux namespaces used for isolation, container approach for isolated apps, Docker containers, Docker software components, items in a Dockerfile. Monolithic applications in a data center. | **5 hrs** |
| **3** | **Automation and Orchestration:** Automation in data centers, levels of automation, zero touch provisioning and Infrastructure as code, automation tools, Orchestration: Automation with a larger scope, Kubernetes: An example container orchestration system, Kubernetes cluster model, Kubernetes pods: creation, templates, and binding time, Kubernetes nodes and control plane, worker node software components. | **5 hrs** |
| | **Unit –II** | |
| **4** | **Microservices:** The Microservices approach, advantages and disadvantages of Microservices, Microservices Granularity, Communication protocols used for Microservices, communication among Microservices, creating a Microservices, server mesh proxy. | **5 hrs** |
| **5** | **Serverless computing and event processing:** Traditional client-server architecture, scaling a server in a cloud environment, Serverless computing approach, stateless servers and containers, Architecture of a Serverless infrastructure, An example of Serverless processing, advantages and disadvantages of Serverless computing. | **5 hrs** |
| **6** | **DevOps for cloud:** Introduction to DevOps, DevOps tools: Puppet, Chef and Ansible. Configuration management using Ansible, Ansible- Modules, Ad Hoc, Playbooks, Ansible for IT automation. | **5 hrs** |

| |
|---|
| **Text Books:**<br>1. Douglas Comer, "The Cloud Computing: The Future of Computing", 1st ed, Chapman and Hall/CRC 1 July 2021.<br>2. Dan C. Marinescu, Cloud Computing Theory and Practice, 3rd Edition, Elsevier - February 15, 2022. |
| **Reference Books:**<br>1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, McGraw Hill, 2013.<br>2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw Hil, 2010. |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

**Laboratory Plan**

| Expt./Job No. | Brief description about the experiment/job | No. of tutorial Slots per batch |
|---|---|---|
| 1 | Hypervisors (Type-I and Type-II). Virtual machines with Para/Full Virtualization | 03 |
| 2 | Implementation of cloud service models (IaaS,PaaS,SaaS) | 03 |
| 3 | Live Migration of VM's and containerization using dockers | 02 |
| 4 | Building Kubernetes cluster | 03 |
| 5 | Create Microservice based web service | 02 |
| 6 | Ansible for IT automation. | 02 |

BACK

| Program: Bachelor of Engineering | | Semester - V |
|---|---|---|
| Course Title: Software Engineering | | Course Code: 25ECSC301 |
| L-T-P: 3-0-0 | Credits: 3 | Contact Hrs: 3hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 40 | Practical Hrs: -- | Exam Duration: 3 hrs |

| | | |
|---|---|---|
| | **Unit - I** | |
| **1** | **Software Engineering Process and Requirements Engineering**: Software process models, Process activities, Agile versus traditional method comparisons. Functional and non-functional requirements, Use case diagrams and use case description, software requirements, requirement specification, requirements engineering processes and requirements elicitation. | **06 hrs** |
| **2** | **Agile Frameworks:** Agile Manifesto and its 12 Principles, Benefits, and Challenges of Agile, Scrum, Extreme Programming (XP), SAFe (Scaled Agile Framework) | **05 hrs** |
| **3** | **Agile Planning and Estimation:** User Stories and Epics, INVEST Model, Story Points and Planning Poker, Release Planning and Roadmaps, Velocity and Capacity Planning. | **05 hrs** |
| | **Unit - II** | |
| **4** | **System Modeling & Design:** Context models, Interaction models, Structural models, and Behavioral models. Architectural Design Decisions, Architectural views, Architectural patterns, Application Architectures. | **08 hrs** |
| **5** | **Testing:** Software testing techniques, The Agile lifecycle and its impact on testing, Functionality Testing, UI Testing, Performance Testing, Security Testing, Test Driven Development (TDD). | **08 hrs** |
| | **Unit - III** | |
| **6** | **Introduction to DevOps and CI/CD:** DevOps Principles, Lifecycle, Delivery pipeline, Technical challenges, and DevOps Tools. | **04 hrs** |
| **7** | **Continuous integration and continuous delivery (CI/CD):** Essentials of continuous integration, Jenkins architecture, Jenkins security management, Jenkins master-slave architecture, Jenkins delivery pipeline. | **04 hrs** |

**Text Books**

1. Software Engineering by Ian Sommerville, 10th edition, Pearson publication-24 May 2017.
2. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation by Jennifer Davis & Ryn Daniels, 1st Edition, Addison-Wesley Signature Series (Fowler), 27 July 2010.

**Reference Books:**

1. Robert C. Martin, "Agile Software Development: Principles, Patterns, and Practices" by, Person New International Edition 17 July 2013.
2. Andrew Stellman, Jennifer Greene - Learning Agile: Understanding Scrum, XP, Lean, and Kanban, O Reilly, 2015.
3. Software Engineering: A Practitioner's Approach, 8/eby Bruce R. Maxim, Roger S. Pressman, McGraw Hill Education; 19 March 2019.
4. Software Engineering at Google: Lessons Learned from Programming Over Time by Titus Winters, Tom Manshreck & Hyrum Wright, 1st edition, O'Reilly Media - 28 February 2020.

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 40 | 30 |
| ISA-2 (Theory) | 40 | |
| Activity | 20 | 20 |
| Total | | 50 |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 100 | 50 |
| | Total | 50 |

BACK

| Program: Bachelor of Engineering | | Semester: V |
|---|---|---|
| Course Title: Computer Networks Lab | | Course Code: 25ECSP305 |
| L-T-P:0-0-1 | Credits: 1 | Contact Hrs: 2 hrs/week |
| ISA Marks: 80 | ESA Marks: 20 | Total Marks: 100 |
| Teaching hrs: -- | Practical Hrs: 28 | Exam Duration: 2 hrs |

**List of Experiments**

| Sl. No. | Title | No. of slots |
|---|---|---|
| **Exercises** | | |
| 1 | Introduction to Junos and Demonstration of Initial Configuration | 1 |
| 2 | Configuration and analysis of VLAN. | 1 |
| 3 | Configuration and analysis of DHCP | 1 |
| 4 | Configuration and analysis of OSPF | 1 |
| **Structured Enquiry** | | |
| 5 | Introduction to SONiC and Demonstration of Initial Configuration | 1 |
| 6 | Configuration and analysis of VLAN using SONiC | 1 |
| 7 | Configuration and analysis of OSPF using SONiC | 1 |
| 8 | Assessment: Implementation of a given topology using SONiC | 2 |
| **Open Ended Experiment** | | |
| 9 | Phase 1: Case Study Overview and survey report | 1 |
| 10 | Phase 2: Design a solution and implementation | 2 |
| 11 | Phase 3: Creating a poster and final demonstration | 2 |
| | **Total** | **14** |

**Evaluation**

**Students Assessment through ISA (80%) + ESA (20%)**

| | Assessment | Weightage in Marks |
|---|---|---|
| **Internal Semester Assessment (80%)** | Exercises | 30 |
| | Structured Enquiry | 20 |
| | Open Ended Experiment | 30 |
| **End Semester Assessment (20%)** | Structured Enquiry | **20** |
| | **Total** | **100** |

BACK

| Program: Bachelor of Engineering | | Semester- V |
|---|---|---|
| Course Title: Mini Project | | Course Code: 15ECSW301 |
| L-T-P: 0-0-3 | Credits: 3 | Contact Hrs: 3 hrs/week |
| CIE Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching hrs: | Practical Hrs: 42(135) | Exam Duration: 3 Hrs |

**Student Evaluation Matrix**

| Sl. No | Continuous Internal Evaluation | Assessment | Weightage in Marks |
|---|---|---|---|
| 1 | Review 1 : | Problem identification & Defining a problem statement, test plan and Construction of software system | 15 |
| 2. | Review 2 : | Software Requirement Specification (SRS) | 10 |
| 3. | Review 3 : | Software Design | 05 |
| 4. | Review 4 : | Construction (as per design) & testing | 10 |
| 5. | Review 5 & peer review: | Final Demo & exhibition<br>Peer review will be done after review 1 & review 4) | 10 |
| **Total** | | | **50** |

**Scheme for End Semester Assessment (ESA)**

**ESA Evaluation (50 Marks)**

| Sl. No | Description | Marks |
|---|---|---|
| 1 | Write up – Learning from Project, Personal Contribution to project | 05 |
| 2 | Final demo & Presentation( Solution approach to the identified problem, testing and results) | 35 |
| 3 | Individual Contribution to the team | 10 |
| **Total** | | **50** |

BACK

| Program: Bachelor of Engineering | | Semester - V |
|---|---|---|
| Course Title: Arithmetical Thinking and Analytical Reasoning (AUDIT) | | Course Code: 23EHSA303 |
| L-T-P: 0-0-0 | Credits: 0 | Contact Hrs: 1 hr/week |
| ISA Marks: 100 | ESA Marks: 00 | Total Marks: 100 |
| Teaching Hrs: 16 hrs | | Exam Duration: NA |

**Unit – I**

| | | |
|---|---|---|
| 1 | **Analytical Thinking:** Importance of Sense of Analysis for Engineers, Corporate Methodology of Testing Sense of Analysis, Puzzles for practice: Analytical, Mathematical, Classification Puzzles, Teamwork in Problem Solving | 4 hrs |
| 2 | **Mathematical Thinking I:** Problems on Finance: Percentages, Gain and Loss, Interest; Distribution and Efficiency Problems: Averages, Time Work, Permutations Combinations | 4 hrs |
| 3 | **Mathematical Thinking II:** Distribution Problems: Permutations Combinations | 2 hrs |
| 4 | **Verbal Ability:** Comprehension of Passages, Error Detection and Correction Exercises, Common Verbal Ability questions from Corporate Recruitment Tests | 6 hrs |

**Text Book: NA**

**References:**


1. George J Summers, “The Great Book of Puzzles & Teasers”, Jaico Publishing House,1989
2. Shakuntala Devi, “Puzzles to Puzzle You”, Orient Paper Backs, New Delhi, 1976
3. R. S. Aggarwal, “A Modern Approach to Logical Reasoning”, Sultan Chand and Sons, New Delhi, 2018
4. M Tyra, “Magical Book on Quicker Maths”, BSC Publications, 2018
5. Cambridge Advanced Learner’s Dictionary, Cambridge University Press.
6. Kaplan’s GRE guide


**Evaluation Scheme**

**ISA Scheme**

| Assessment | Weightage in Marks |
|---|---|
| Minor Exam 1 | 50 |
| Minor Exam 2 | 50 |
| **Total** | **100** |

KLE Technological University | Creating Value, Leveraging Knowledge

**Course Unitization for Minor Exams and End Semester Assessment**

| Sl No | Chapter | Teaching Hours | No. of Questions in ESA |
|---|---|---|---|
| 1 | Analytical Thinking | 4 | N.A. |
| 2 | Mathematical Thinking I | 4 | N.A. |
| 3 | Mathematical Thinking II | 4 | N.A. |
| 4 | Verbal Ability | 4 | N.A. |

**Note*** All questions are compulsory.

BACK

**Semester - VI**

| | | | |
|---|---|---|---|
| **Program: Bachelor of Engineering** | | | **Semester: VI** |
| **Course Title: Generative AI** | | | **Course Code: 25ECSC314** |
| **L-T-P: 3-0-1** | **Credits: 4** | | **Contact Hrs: 05 hrs/week** |
| **ISA Marks: 63** | **ESA Marks: 37** | | **Total Marks: 100** |
| **Teaching Hrs: 40** | **Practical: 28 hrs** | | **Exam Duration: 3 hrs** |
| **Unit –I** | | | |
| **1** | **Introduction to Generative AI:** Evolution from discriminative to generative learning, and applications across text, image, and data synthesis. | | **05 hrs** |
| **2** | **Sequence-to-Sequence and Transformer Models:** Machine Translation, Seq2Seq architecture, Attention mechanisms, Autoencoders/Decoders, Transformer architecture for text generation. | | **04 hrs** |
| **3** | **Diffusion Models and Training Paradigms:** Continuous vs discrete diffusion, deterministic vs stochastic models, generative denoising, and applications in creative synthesis. | | **07 hrs** |
| **Unit –II** | | | |
| **4** | **Large Language Models (LLMs):** Transformer-based large-scale pretraining, fine-tuning, instruction tuning, and model alignment (GPT, BERT, T5). | | **05 hrs** |
| **5** | **Retrieval-Augmented Generation (RAG):** Architecture, embeddings, vector databases, context retrieval, and integration using frameworks. | | **05 hrs** |
| **6** | **Multimodal Generative AI:** Text-to-Image (Stable Diffusion, DALL·E), Text-to-Video (Sora, Pika), and Audio Generation Models. | | **06 hrs** |
| **Unit –III** | | | |
| **7** | **Synthetic Data Generation and Augmentation:** Creating domain-specific training datasets, bias control, and privacy-preserving generation. | | **04 hrs** |
| **8** | **Evaluation, Ethics, and Deployment:** Evaluation metrics, hallucination analysis, responsible AI, copyright, and deployment on cloud/edge. | | **04 hrs** |

**Text Books:**


1. David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, O'Reilly, 2022.
2. Andriy Burkov, Generative AI: From Basics to Advanced, 2024 Edition.
3. Lewis et al., Retrieval-Augmented Generation for Knowledge-Intensive Tasks, Meta AI Research, 2020.

**References:**

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press.
2. Lilian Weng, Understanding Diffusion Models, OpenAI Blog.
3. Harrison Chase, LangChain Documentation & Applications, 2024.
4. Andrew Ng et al., Generative AI for Everyone, Deep Learning.AI.Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning. MIT Press.

**Evaluation Scheme ISA**

| Assessment | Conducted for Marks | ISA Weightage |
|---|---|---|
| **ISA1** | 40 | 40 |
| **ISA2** | 40 | |
| **Lab + Course Project** | 40 | 23 |
| **Total** | 120 | 63 |

**Evaluation Scheme ESA**

| Assessment | Conducted for Marks | ISA Weightage |
|---|---|---|
| **ESA Theory Exam** | 100 | 37 |

**List of Experiments:**

| Experiment No. | Brief description about the experiment | Number of slots |
|---|---|---|
| 1. | Experiments on Text Classification- word2vec, Language Modeling, Machine Translation, Text Summarization | 2 |
| 2. | Experiments on Machine Translation - seq2seq model, Text Summarization | 2 |
| 3. | Experiments on Part-of-Speech (POS) Tagging, Question Answering Systems, Topic Modeling | 2 |
| 4. | • Implementing a Basic Diffusion Model<br>• Training a Diffusion Model<br>• Image Denoising Using Diffusion Models | 2 |
| 5. | Data pre-processing and Tokenization, Building a Simple Language Model | 1 |
| 6. | Implementing Attention Mechanisms, Exploring Transformer Architectures | 1 |

| | | |
|---|---|---|
| 7. | • Fine-Tuning for Specific Tasks<br>• Ethical Considerations and Bias Detection<br>• Real-World Application Development<br>• Performance Optimization and Scaling | 4 |

BACK

| Program: Bachelor of Engineering | | | Semester - VI |
|---|---|---|---|
| Course Title: Wireless and Mobile Networks | | | Course Code: 25ECSC311 |
| L-T-P: 3-0-1 | | Credits: 04 | Contact Hours: 5hrs/week |
| ISA Marks: 63 | | ESA Marks: 37 | Total Marks: 100 |
| Teaching Hours: 40 | | Tutorial/Practical: 28hrs | Exam Duration: 3 hrs |
| **Unit I** | | | |
| **1** | **Wireless Networks:** Wireless Links and Network Characteristics, CDMA, Wi-Fi: 802.11 Wireless LANs, The 802.11 Architecture, The 802.11 MAC Protocol, The IEEE 802.11 Frame, Mobility in the Same IP Subnet, Advanced Features in 802.11, Personal Area Networks: Bluetooth and Zigbee. | | **04 hrs** |
| **2** | **Cellular Networks:** Cellular network evolution (1G to 4G), System Design Fundamentals, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations. Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference. | | **06 hrs** |
| **3** | **Mobile Radio Propagation:** Introduction to radio wave propagation, Free space propagation model, Relating power to electric field, Reflection, Diffraction, Scattering. | | **06 hrs** |
| **Unit II** | | | |
| **4** | **5G Architecture and applications:** 5G Standards and Specifications: ITU-R, ITU-T and IMT-2020, 3GPP; 5G Architecture and Use Cases: NGMN 5G Architecture Framework, 3GPP 5G Architecture. Enhanced Mobile Broadband, Massive Machine Type Communications, Ultra-Reliable and Low-Latency Communications. | | **06 hrs** |
| **5** | **Radio Access Network:** RAN Architecture, RAN–Core Functional Split, RAN Protocol Architecture. | | **05 hrs** |
| **6** | **Network Slicing:** Core Network Requirements, Network Functional Architecture, Network Slicing. | | **05 hrs** |
| **Unit III** | | | |
| **7** | **NR Air Interface:** Wireless Transmission, Line-of-Sight Transmission, Line-of-Sight Transmission Impairments. | | **04 hrs** |
| **8** | **Multi-Access Edge Computing:** MEC Architectural Concepts, MEC Support for Network Slicing, MEC Use Cases. | | **04 hrs** |

**Text Books**


1. J. F. Kurose, K. W. Ross, "Computer Networking, A Top-Down Approach", 8th Edition, Pearson Education, 2021.
2. Theodore S. Rappaport, "Wireless Communications Principles and Practice", Cambridge University Press, 2024.
3. William Stallings, "5G Wireless: A Comprehensive Introduction", 1st Edition, Addison-Wesley, 2021.


**Reference Books:**


1. Erik Dahlman, Stefan Parkvall, Johan Skold, "5G NR: The next generation wireless access technology", 2nd Edition, Academic Press Inc, 2020.
2. Cory Beard and William Stallings, "Wireless Communication Networks and Systems", Global Edition 1, Pearson, 5 January 2016.


**Evaluation Scheme**

**ISA Scheme**

| Assessment | Conducted for marks | Weightage |
|---|---|---|
| ISA-1 (Theory) | 30 | 38 |
| ISA-2 (Theory) | 30 | |
| Laboratory Assessment | 60 | 25 |
| **Total** | | **63** |

**ESA Scheme**

| Assessment | Conducted for marks | Weightage |
|---|---|---|
| ESA (Theory) | 100 | 37 |
| **Total** | | **37** |

**Lab experiments:**

| Expt./Job No. | Brief description about the experiment/job | No. of Lab Slots |
|---|---|---|
| **1** | **Packet analysis** of Wi-Fi and Bluetooth | 02 |
| **2** | **Mobile network Use Case Simulation**<br>○ Simulate eMBB, mMTC, and URLLC traffic scenarios using NS-3 or MATLAB.<br>○ Measure latency, throughput, and packet loss. | 02 |
| **3** | **Network Slicing**<br>○ Create virtual network slices using Mininet or Kubernetes for isolated services. | 04 |

| | | |
|---|---|---|
| | ○ Demonstrate how slices are used for different use cases (e.g., IoT, video streaming). | |
| **4** | **Radio Access Network**<br>○ Simulate centralized vs distributed RAN using srsRAN or OpenAirInterface (OAI).<br>○ Identify performance trade-offs. | 03 |
| **5** | **Simulate Mobile Edge Compute with Network Slicing**<br>○ Combine MEC and network slicing: assign slices to different edge applications and analyze performance. | 03 |

BACK

| Program: Bachelor of Engineering | | Semester-VI |
|---|---|---|
| Course Title: Embedded Systems and IoT | | Course Code: 24ECSC308 |
| L-T-P: 2-0-1 | Credits: 3 | Contact Hrs: 4 hrs/week |
| ISA Marks: 67 | ESA Marks: 33 | Total Marks: 100 |
| Teaching Hrs: 30 | Practical Hrs: 28 | Exam Duration: NA |

| | Unit – I | |
|---|---|---|
| 1 | **Introduction to Embedded Systems:** Characteristics of Embedded Systems, Embedded system architecture: CPU, memory, peripherals, Hardware Components and Interfaces: Sensors, Actuators, and Communication Interfaces, Communication Protocols: UART, SPI, I2C, CAN. | **5 hrs** |
| 2 | **IoT Architecture and Protocols:** IoT Architecture, Protocol Stack, Application Layer Protocols: HTTP, CoAP, MQTT, AMQP, Network Layer Protocols: 6LoWPAN, RPL, Link Layer Protocols: Wi-Fi, BLE, Zigbee, Z-Wave, LoRaWAN | **6 hrs** |
| 3 | **IoT Platforms:** Introduction to IoT Boards, IoT deployment for Raspberry Pi /Arduino/ARM-Mbed/Beaglebone/Jetson Nano/Node-MCU Equivalent platform – Interfacing of Sensors and actuators | **4 hrs** |
| | | |
| 4 | **IoT Connectivity and Communication Technologies:** Short-Range Communication Technologies: Wi-Fi, Bluetooth, Zigbee, Long-Range Communication Technologies: LPWAN, LoRa, NB-IoT, Cellular IoT: LTE-M, NB-IoT, 5G. | **6 hrs** |
| 5 | **IoT Physical Servers & Cloud Offerings:** Introduction to Cloud Storage models and communication APIs, Webserver – Web server for IoT, Cloud for IoT, Designing a RESTful web API. | **5 hrs** |
| 6 | **Case studies:** Home automation, Smart Cities, Environment, Energy, Agriculture, Health, Retail with emphasis on data analytics and security. Industrial IoT (IIoT), Role of AI/ML in IoT (AIoT). | **4 hrs** |

**Text Books (List of books as mentioned in the approved syllabus)**

1. R. Suganya, Bhogadi Lokeswara Rao, M. Krishnaraj, S. Bharathidasan, “Embedded Systems and IoT”, RK Publication, 2024.
2. Grace, J & Sharma, Sandeep, “EMBEDDED SYSTEMS AND IoT”, Publisher: San, December 2024.

**References**

1. Abu Husin, Norhidayuwati, “EMBEDDED INTERNET OF THINGS IoT for Beginner”, Publisher: Politeknik Muadzam Shah, June 2024.

2. Arshdeep Bahga, Vijay Madisetti “Internet of Things (A Hands-on-Approach)” Universities Press- 2014.
3. Pravin Goyal, “Internet of Things and Embedded Systems”, TechKnowledge Publications, 30 June 2023.
4. Hands-On IoT: Wi-Fi and Embedded Web Development by Erwin Ouyang, Jun 2020.

**Evaluation Scheme**

**ISA Scheme**

| Assessment | Conducted for marks | Weightage |
|---|---|---|
| ISA-1 (Theory) | 30 | 34 |
| ISA-2 (Theory) | 30 | |
| Laboratory Assessment | 60 | 33 |
| **Total** | | **67** |

**ESA Scheme**

| Assessment | Conducted for marks | Weightage |
|---|---|---|
| ESA (Theory) | 60 | 33 |
| **Total** | | **33** |

**List of Experiments:**

| Expt. No. | Experiments | No. of Slots |
|---|---|---|
| 1. | Embedded System Development Boards (Arduino/Raspberry Pi/ESP32). | 1 |
| 2. | Sensor and actuator interfacing: Multiple sensors, motors and relays. | 1 |
| 3. | Communication Protocols: UART, SPI, I2C Programming. | 2 |
| 4. | MQTT Protocol implementation for IoT Data Publishing/Subscribing. | 2 |
| 5. | Designing an IoT system for sensor data acquisition and cloud-based storage and analytics. | 2 |
| 6. | Wireless Communication Setup: Wi-Fi, BLE | 2 |
| 7. | Data Visualization Using IoT Dashboards (Node-RED, ThingsBoard) | 1 |
| 8. | Edge AI using TinyML: Object/person detection using Node-RED and Raspberry Pi/ NodeMCU. | 1 |
| 9. | Course Project ( Reviews -03, Demonstration of project-01) | 4 |

BACK

| Program: Bachelor of Engineering | | Semester: VI |
|---|---|---|
| Course Title: Minor Project | | Course Code: 24ECSW302 |
| L-T-P: 0-0-6 | Credits: 6 | Contact Hrs: 3 hrs/week |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: -- | Practical: 42 hrs | Exam Duration: 3 hrs |

The objective of the minor project is to develop deeper understanding of the chosen area of technology vertical and develop applications with a comprehensive and systematic approach.

**Project Domains:**

| Networking | Data Engineering | System Engineering | AI & ML | Industry/Domain |
|---|---|---|---|---|
| Internet of Things | Data Analytics | Parallel Computing | Supervised Learning | As per industry requirements |
| Software Defined Network | Data Processing (Image/Video/Audio/Text) | High Performance Computing | Unsupervised Learning | - |
| Cloud Computing | Natural language processing | Quantum Computing | Deep Learning | - |
| Blockchain | Computer Vision | - | Generative Models | - |
| 5G, Wireless Ad-hoc & Sensor Networks | - | - | - | - |
| **Any other related themes** | | | | |

**Student Evaluation Matrix:**

Project will have 3 internal reviews as follows:

| Assessment Weightage in Marks | | Assessment Weightage in Marks |
|---|---|---|
| ISA | Review-1 | **10** |
| | Review-2 | **20** |
| | Review-3 | **20** |
| **ESA** | | **50** |
| **Total** | | **100** |

**Scheme for In-Semester Assessment (ISA)**

| ISA (periodic reviews) | Review Expectation | Guide Marks | Reviewer Marks | Total Marks |
|---|---|---|---|---|
| Review-1 | Identification of problem, objectives, requirement analysis and report. | **5** | **5** | **10** |
| Review-2 | Design and Implementation: coding as per standards, module testing. | **10** | **10** | **20** |
| Review-3 | System testing and demo of the final project, quality of code, result analysis and project report. | **10** | **10** | **20** |
| **Total** | | **25** | **25** | **50** |

**Scheme for End Semester Assessment (ESA)**

| Parameters | PI's | Max Marks | CO | BL |
|---|---|---|---|---|
| Write up (Problem statement, solution framework and Individual Contribution to the project) | 14.3.1 | 20 | 1 | 4 |
| Project demonstration with solution approach to the identified problem | 6.1.2 | 15 | 3 | 3 |
| Presentation | 9.3.1 | 10 | 5 | 3 |
| Report | 10.1.2 | 05 | 4 | 3 |
| **Total = 50** | | | | |

BACK

| | | |
|---|---|---|
| **Program: Bachelor of Engineering** | | **Semester: VI** |
| **Course Title: Professional Aptitude and Logical Reasoning** | | **Course Code: 16EHSC301** |
| **L-T-P: 3-0-0** | **Credits: 3** | **Contact Hrs: 3hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** |
| **Teaching Hrs: 40** | | **Exam Duration: 3 hrs** |

| | | |
|---|---|---|
| **Unit –I- Arithmetical Reasoning and Analytical Thinking** | | |
| **1** | Arithmetical Reasoning | **10hrs** |
| **2** | Analytical Thinking | **4 hrs** |
| **3** | Syllogistic Logic | **3hrs** |
| **Unit –II** | | |
| **4** | Verbal Logic | **4 hrs** |
| **5** | Non-Verbal Logic | **4 hrs** |
| **Unit –III- Lateral Thinking** | | |
| **6** | Lateral Thinking | **4 hrs** |

**Text Books:**

1. A Modern Approach to Verbal and Non – Verbal Reasoning – R. S. Aggarwal, Sultan Chand and Sons, New Delhi
2. Quantitative Aptitude – R. S. Aggarwal, Sultan Chand and Sons, New Delhi

**Reference Books:**

1.Verbal and Non – Verbal Reasoning – Dr. Ravi Chopra, MacMillan India

2. Lateral Thinking – Dr. Edward De Bono, Penguin Books, New Delhi

**Evaluation Scheme ISA Scheme**

| **Assessment** | **Weight age in Marks** |
|---|---|
| ISA 1 | 15 |
| ISA 2 | 15 |
| Assignments Written | 10 |
| Class Tests | 10 |
| **Total** | **50** |

****The indicated method may be adopted for CIE after due approval from DUGC of Department of Humanities.**

BACK

| | | |
|---|---|---|
| **Program: Bachelor of Engineering** | | **Semester: VI** |
| **Course Title: Industry Readiness & Leadership Skills (AUDIT)** | | **Course Code: 23EHSA304** |
| **L-T-P: 0-0-0** | **Credits: 0** | **Contact Hrs: 1hr/week** |
| **ISA Marks: 100** | **ESA Marks: NA** | **Total Marks: 100** |
| **Teaching Hrs: 16** | | **Exam Duration: NA** |

**Unit –I**

| | | |
|---|---|---|
| **1** | **Written Communication:** Successful Job Applications, Résumé Writing, Emails, Letters, Business Communication, Essay, and Paragraph Writing for Recruitment Tests | **6 hrs** |
| **2** | **Interview Handling Skills:** Understanding Interviewer Psychology, Common Questions in HR Interviews, Grooming, Interview Etiquette | **4 hrs** |
| **3** | **Lateral & Creative Thinking:** Lateral Thinking by Edward de Bono, Fractionation and Brain Storming, Mind Maps, Creativity Enhancement through Activities | **4 hrs** |
| **4** | **Team Building & Leadership Skills:** Communication in a Team, Leadership Styles, Playing a Team member, Belbin's team roles, Ethics, Effective Leadership Strategies | **2 hrs** |

**Text Books:**

NA

**Reference Books:**


1. Diana Booher – E Writing, Laxmi Publications
2. Edward de Bono – Lateral Thinking – A Textbook of Creativity, Penguin UK
3. William Strunk, E B White – The Elements of Style, Pearson
4. John Maxwell – The 17 Essential Qualities of a Team Player, HarperCollins Leadership
5. Robin Ryan – 60 Seconds and You're Hired! – Penguin Books


BACK

**Professional Electives-1, 2 & 3**

| | | | |
|---|---|---|---|
| **Program: Bachelor of Engineering** | | | |
| **Course Title: Signals & Systems** | | **Course Code: 21ECSE313** | |
| **L-T-P: 3-0-0** | **Credits: 3** | **Contact Hrs: 3hrs/week** | |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** | |
| **Teaching Hrs: 40** | | **Exam Duration: 3 hrs** | |
| **Unit –I** | | | |
| **1** | **Signal Representation:** Definition of a signals and systems, classification of signals, (analog and discrete signal, periodic and aperiodic, deterministic and random signals, even and odd signals, energy and power) , basic operation on signals(independent variable, dependent variable , time scaling, multiplication, time reversal), elementary signals (Impulse, step, ramp, sinusoidal, complex exponential), Systems Interconnections(series, parallel and cascade), properties of linear systems. (homogeneity ,superposition, linearity and time invariance, stability, memory, causality) | | **10 hrs** |
| **2** | **LTI System Representation:** Impulse response representation and properties, Convolution, convolution sum and convolution integral. Differential and difference equation Representation, Block diagram representation | | **10 hrs** |
| **Unit –II** | | | |
| **3** | **Fourier representation for signals:** Introduction, Discrete time Fourier series (derivation of series excluded) and their properties. Discrete Fourier transform (derivation of transform excluded) and properties | | **10 hrs** |
| **4** | **Applications of Fourier transform:** Introduction, frequency response of LTI systems, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals. Sampling of continuous time signals. | | **10 hrs** |
| **Unit –III** | | | |
| **5** | **Z-transform:** Definition of z-transform, Properties of ROC, Properties of Z-transforms: Inverse z-transforms (Partial Fraction method, long division method), Unilateral Z-transform, Transform of LTI. | | **10 hrs** |
| **Text Book (List of books as mentioned in the approved syllabus)**<br>1. Simon Haykin and Barry Van Veen, Signals and Systems, 2nd edition Wiley,2007<br>2. Alan V Oppenheim ,Alan S Willsky and S. Hamid Nawab , Signals and Systems, Second, PHI public,1997 | | | |
| **Reference Books:**<br>1. H. P Hsu, R. Ranjan, Signals and Systems, 2nd edition, McGraw Hill ,2017 | | | |

2. Ganesh Rao and Satish Tunga, Signals and Systems 1st edition, Cengage India, 2017
3. M. J. Roberts, Fundamentals of Signals and Systems 2nd edition, McGraw Hill Education, 2017

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1, 2 | Solve Any **2** out of **3** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 3,4 | Solve Any **2** out of **3** |
| III | Q.No.-7 | 5 | Solve Any **1** out of **2** |
| | Q.No.-8 | 5 | |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Fundamentals of Image and Video Processing** | | **Course Code: 24ECSE312** |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 4hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical Hrs: 28** | **Exam Duration: 2 hrs** |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Introduction to Image and Video Processing:** Introduction, 2-dimensional (2D) and 3-dimensional (3D) signals, analog/digital dichotomy, electromagnetic spectrum, and applications. | **4 hrs** |
| **2** | **Signals and Systems:** Fundamentals of 2D signals and systems. Complex exponential signals, linear space-invariant systems, 2D convolution, and filtering in the spatial domain. | **4 hrs** |
| **3** | **Fourier Transform and Sampling:** 2D Fourier transform, sampling, discrete Fourier transform, and filtering in the frequency domain. | **4 hrs** |
| **4** | **Motion Estimation:** Applications of motion estimation, phase correlation, block matching, spatio-temporal gradient methods, and fundamentals of color image processing. | **4 hrs** |
| | **Unit –II** | |
| **5** | **Image Enhancement:** Point-wise intensity transformation, histogram processing, linear and non-linear noise smoothing, sharpening, homomorphic filtering, pseudo-coloring, and video enhancement. | **3 hrs** |
| **6** | **Image Recovery:** Introduction to image and video recovery, image restoration, matrix-vector notation for images, inverse filtering, constrained least squares (CLS), set-theoretic restoration approaches, iterative restoration algorithms, and spatially adaptive algorithms.<br>Wiener restoration filter, Wiener noise smoothing filter, maximum likelihood and maximum a posteriori estimation, and Bayesian restoration algorithms. | **5 hrs** |
| **7** | **Lossless and Lossy Compression:** Elements of information theory, Huffman coding, run-length coding and fax, arithmetic coding, dictionary techniques, and predictive coding. Scalar and vector quantization, differential pulse-code modulation, fractal image compression, transform coding, JPEG, and sub band image compression. | **5 hrs** |
| **8** | **Video Compression:** Motion-compensated hybrid video encoding and video compression standards including H.261, H.263, H.264, H.265, MPEG-1, MPEG-2, and MPEG-4. | **3 hrs** |

| Unit –III | | |
|---|---|---|
| **9** | **Image and Video Segmentation:** Intensity discontinuity and intensity similarity, watersheds and K-means algorithms, and other advanced methods. | **4 hrs** |
| **10** | **Sparsity:** Sparsity-promoting norms, matching pursuit algorithm, smooth reformulations, and an overview of the applications. | **4 hrs** |

**Text Books:**

1. R. C. Gonzalez and R. E. Woods, “Digital Image Processing,” 4th edition, Pearson Education (Asia) Pte. Ltd/Prentice Hall of India, 2018.
2. M. Tekalp, “Digital Video Processing”, 2nd edition, Prentice Hall, USA, 2015.

**Reference Books:**

3. Anil K. Jain, “Fundamentals of Digital Image Processing," Pearson Education (Asia) Pte. Ltd./Prentice Hall of India, 2004.
4. Alan C Bovik “Essential Guide to Video Processing”, AP Elsevier publication, 2009.

**Laboratory Plan**

| Week No | Topics for discussion | Experiments for practical session |
|---|---|---|
| 0 | Overview of the Course, Registration for the MOOC course Fundamentals of Digital and Image Processing. | Guidelines for the lab sessions. |
| 1 | Introduction to course and applications of Image and Video processing | Introduction to lab session, Introduction to Python and OpenCV. Sample basic programs. |
| 2 | Introduction to 2D signals and systems, 2D Convolution and filtering in spatial domain. | filtering in spatial domain (Averaging filter and Median filter) |
| 3 | Fourier Transform and Sampling , DFT | Compute DFT of given function, filtering in the frequency domain (LPF,HPF) |
| 4 | Motion Estimation and color image processing. | Implement Block matching method and Differential method. Illustration and conversion of color models. |
| 5 | Image Enhancement | Intensity transformations, Histogram processing (Equalization and specification), smoothing and sharpening. |
| 6 | Image Recovery - image restoration | Spatial and frequency domain filters. Selection of course project topic. |

| | | |
|---|---|---|
| 7 | Lossless Compression methods | Implementation of lossless image compression methods. |
| 8 | Lossy Compression methods | Implementation of lossy image compression methods. |
| 9 | Image segmentation | Edge detection and region based segmentation. |
| 10 | Video Segmentation | Basic programs on video processing and Shot detection. |
| 11 | Review 1 of Course project | |
| 12 | Review 2 of Course project | |
| 13 | Final review of course project | |
| 14 | Submission of report on learning of MOOC course and course project. | |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| **Assessment** | **Conducted for marks** | **Weightage in Marks** |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| **Assessment** | **Conducted for marks** | **Weightage in Marks** |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Computer Vision** | | **Course Code: 24ECSE339** |
| **L-T-P: 3-0-0** | **Credits: 3** | **Contact Hrs: 3hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** |
| **Teaching Hrs: 40** | **Practical Hrs: --** | **Exam Duration: 3 hrs** |

| | | |
|---|---|---|
| | **Unit – I** | |
| **1** | **Introduction:** Computer Vision Overview, Pixels and image representation, Filters: Linear systems, Convolutions and cross-correlations; Lab: Basics, Filters | **7 hrs** |
| **2** | **Features and filtering:** Edge detection: Gaussian, Sobel filters, Canny edge detector, Features and fitting: RANSAC Local features, Harris corner detection, Feature descriptors: Difference of gaussians, Scale invariant feature transform; Lab: Filters, Edges, Features | **9 hrs** |
| | **Unit – II** | |
| **3** | **Semantic segmentation:** Perceptual grouping, Agglomerative clustering, Super pixels and over segmentation; Clustering: K-means, Mean shift; Visual Bag of Words: Texture features, Visual bag of words; Lab: Resizing, clustering, recognition | **8 hrs** |
| **4** | **Motion:** Optical Flow, Lucas-Kanade method, Horn-Schunk Method, Pyramids for large motion, Tracking: Feature Tracking, Lucas KanadeTomasi (KLT) tracker; Lab: Object detection, optical flow. | **8 hrs** |
| | **Unit – III** | |
| **6** | **Advanced Techniques:** Image stitching, Image pyramids, Object recognition, Dimensionality reduction, Face identification, Detecting objects by parts. | **8 hrs** |

**Reference Books:**


1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011.
2. D. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Pearson Education India, 2nd Ed, 2015.
3. R. I. Hartley and A. Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press, 2nd Edition, 2004.

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 15 | 30 |
| ISA-2 (Theory) | 15 | |
| Activity | 20 | 20 |
| **Total** | | **50** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 100 | 50 |
| | **Total** | **50** |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Responsible AI** | | **Course Code: 25ECSE326** |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 05 hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical: 42 hrs** | **Exam Duration: 2 hrs** |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Fundamentals of Artificial Intelligence and Responsible AI:** Introduction to Artificial Intelligence Fundamentals, Introduction to Responsible AI, Need for Ethics in AI: AI for Society and Humanity. | **05 Hrs** |
| **2** | **Fairness and Bias in AI Systems:** Sources of Biases in AI, Exploratory Data Analysis and Dataset Limitations, Bias Mitigation Techniques: Preprocessing, Inprocessing, Postprocessing, Fairness Metrics: Group Fairness, Individual Fairness, Counterfactual Fairness | **07 Hrs** |
| **3** | **Interpretability and Explainability in AI:** Interpretability through Simplification and Visualization, Intrinsic Interpretable Methods, Post Hoc Interpretability, Explainability through Causality, Model-Agnostic Interpretation Techniques. | **05 Hrs** |
| | **Unit –II** | |
| **4** | **Ethics, Accountability, and Privacy in AI (6 hours):** Auditing AI Models and Fairness Assessment, Principles for Ethical AI Practices, Privacy Concerns in AI and Introduction to Privacy Attacks, Privacy-Preserving Techniques: Differential Privacy, Federated Learning | **06 Hrs** |
| **5** | **Real-World Applications and Case Studies (3 hours):** Case Studies (Pick any 3):<br>Recommendation Systems, Medical Diagnosis, Hiring / Education, Computer Vision, Natural Language Processing | **05 Hrs** |

**Textbooks:**


1. "Fairness and Machine Learning: Limitations and Opportunities", Solon Barocas, Moritz Hardt, Arvind Narayanan
2. "Interpretable Machine Learning",Christoph Molnar
3. "The Ethical Algorithm: The Science of Socially Aware Algorithm Design" Michael Kearns and Aaron Roth
4. "Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way" Virginia Dignum

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

**Lab Plan:**

| Experiment No. | Brief description about the experiment | Number of slots |
|---|---|---|
| 1. | Building and Understanding a Simple AI System | 2 |
| 2. | Bias Detection and Fairness Mitigation in Classification | 2 |
| 3. | Visualize and interpret the Black-Box Models with SHAP and LIME | 2 |
| 4. | Implement Privacy-Preserving Learning | 2 |
| 5. | Ethical Impact Analysis of AI Applications | 2 |
| 6. | • Fine-Tuning for Specific Tasks<br>• Ethical Considerations and Bias Detection<br>• Real-World Application Development<br>Performance Optimization and Scaling | 4 |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Multimodal AI** | | **Course Code: 25ECSE327** |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 04 hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical: 42 hrs** | **Exam Duration: 2 hrs** |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Introduction to Multimodality:** Definitions, scope, and significance; Data Modalities: Text, image, audio, video; Characteristics and challenges; Methods for extracting features from different modalities; Different Learning methods. | **07 Hrs** |
| **2** | **Multimodal Mechanisms:** Self-attention, cross-attention, and their applications, Generative Models: GANs, VAEs, and their multimodal variants, Multimodal Representation Learning: Joint and coordinated representations, Fusion Strategies: Early fusion, late fusion, hybrid fusion techniques, Evaluation Metrics: Assessing the performance | **08 Hrs** |
| | **Unit –II** | |
| **3** | **Multimodal translation**: Multimodal Emotion Recognition, Multimodal Dialogue Systems: Integrating text, speech, and visual inputs in conversational AI, Multimodal Machine Translation: Techniques and challenges in translating across modalities, | **08 Hrs** |
| **4** | **Multimodal Information Retrieval:** Searching and retrieving information from multimodal datasets, Addressing bias, fairness, and privacy in multimodal AI. | **07 Hrs** |

**Reference books:**


1. Zhou, Zheng. Multimodal AI: Algorithms and Applications. Springer, 2021.
2. Baltrusaitis, Tadas, Chaitanya Ahuja, and Louis-Philippe Morency. Multimodal Machine Learning: Techniques and Applications. San Rafael, CA: Morgan & Claypool, 2018


**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: AI in Healthcare** | | | **Course Code: 25ECSE328** |
| **L-T-P: 2-0-1** | **Credits: 03** | | **Contact Hours: 4hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | | **Total Marks: 100** |
| **Teaching Hours: 30** | **Tutorial/Practical: 28 hrs** | | **Exam Duration: 2hrs** |
| **Unit I** | | | |
| **1** | **Fundamentals of AI and Healthcare Systems:** Introduction to AI, ML, and DL, overview of healthcare systems and clinical data, Electronic Health Records (EHRs), structured vs unstructured data, challenges in healthcare data: missing values, privacy, standardization, Ethical issues, data protection (HIPAA/GDPR), and interpretability, AI integration into clinical workflows. | | **07 hrs** |
| **2** | **Signal Processing and AI in Physiological Data Analysis:** Basics of biomedical signal processing, common physiological signals: ECG, EEG, EMG, PPG. **Preprocessing:** Filtering, artifact removal, normalization, Feature extraction (time-domain, frequency-domain, wavelet transforms), AI/ML models for classification/detection in signal data. | | **08 hrs** |
| **Unit II** | | | |
| **3** | **AI in Medical Imaging and Personalized Healthcare:** Deep learning for medical image analysis (CT, MRI, X-ray, Ultrasound), Convolutional Neural Networks for segmentation and classification, transfer learning in healthcare imaging. **Personalized medicine:** Genomics, pharmacogenomics, patient-specific models, AI in wearable tech and remote monitoring, Future of AI in healthcare: Explainable AI (XAI), digital twins. | | **07 hrs** |
| **4** | **Drug discovery and molecular modelling using artificial intelligence**<br>AI in drug discovery, Molecular modelling and databases in artificial intelligence for drug molecules, Computational mechanics ML methods in molecular modelling. Drug characterization using iso potential surfaces. | | **08 hrs** |

**Text Books**

1. "Artificial Intelligence in Healthcare", By Adam Bohr and Kaveh Memarzadeh, Academic Press, 2020.

**Reference Books:**

1. "Biomedical Signal Processing and Artificial Intelligence in Healthcare" – Walid A. Zgallai (Springer, 2021)
2. K. Franks and R. Rudman, *Machine Learning for Healthcare*. Boca Raton, FL, USA: CRC Press, 2021.
3. K. Najarian and R. Splinter, *Biomedical Signal and Image Processing*, 2nd ed. Boca Raton, FL, USA: CRC Press, 2012.

**Online Courses**:

- *AI in Healthcare Specialization* - Coursera by deeplearning.ai
- *WEKA: Exploring Machine Learning for Healthcare* - NPTEL Course

**Scheme for In-Semester Assessment (ISA)**

| Assessment | Conducted for marks | Weightage |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Laboratory Assessment | 60 | 34 |
| | **Total** | **67** |

**Scheme for End Semester Assessment (ESA)**

| Assessment | Conducted for marks | Weightage |
|---|---|---|
| ESA (Theory) | 60 | 33 |
| | **Total** | **33** |

**Lab experiments:**

| Expt./Job No. | Brief description about the experiment/job | No. of Lab. Slots |
|---|---|---|
| 1 | **Introduction**:<br>Exploring Electronic Health Records, Medical Data Visualization, Data Protection etc. | 1 |
| 2 | **Acquisition and Visualization of Physiological Signals**<br>Handling basic physiological signals (ECG, EEG, and EMG signals) using Python | 2 |
| 3 | **Feature Extraction from Physiological Signals**<br>Extract meaningful features from both time and frequency domains of Psychological Signals | 2 |
| 4 | **Medical Image Classification Using Transfer Learning**<br>Apply pre-trained CNN models for classifying medical images (e.g., chest X-rays for pneumonia detection). | 2 |
| 5 | **Semantic Segmentation of Medical Images**<br>Perform segmentation of medical images (e.g., tumor or organ boundaries in MRI) using a CNN-based model. | 2 |
| 6 | **AI for Personalized Healthcare Using Wearable Data**<br>Analyze physiological data from wearables (e.g., heart rate, activity levels) to build a patient-specific model for remote health monitoring. | 2 |
| 7 | **Molecular Property Prediction Using Machine Learning**<br>Use AI/ML models to predict drug-like properties (e.g., solubility, bioavailability, toxicity) from molecular structure data. | 2 |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Informatica-Intelligent Data Management Cloud** | | **Course Code: 24ECSE322** |
| **L-T-P: 1-0-2** | **Credits: 3** | **Contact Hrs: 5 hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hrs: 15** | **Practical Hrs: 56** | **Exam Duration: NA** |

| | **Unit - I** | |
|---|---|---|
| **1** | **Informatica Cloud Overview**: Fundamentals of Data warehouse, Overview of Informatica cloud services, Cloud Data Integration, Cloud Application Integration, Cloud Data Quality, Cloud MDM & 360 Applications, Cloud Data Governance and Catalog, Cloud Integration Hub, Cloud B2B, Cloud Data Marketplace | **3 hrs** |
| **2** | **IDMC Administration Fundamentals**: Informatica Cloud Architecture, Introduction to IICS Services, Administration services, User Management, Agent group and services, Types of connectors, Asset management and Schedule. | **3 hrs** |
| **3** | **Cloud Data Integration Services**: Informatica Cloud Overview, Runtime Environments and Connections, Synchronization Task, Cloud Mapping Designer, Cloud Mapping Designer – Transformations, Mapping Parameters, Expression Macro and Dynamic Linking, Replication Task, (Masking Task), (Mass Ingestion Task), (Task flows), (Hierarchical Connectivity), (Intelligent Structure Model). | **5 hrs** |
| **4** | **Cloud Application Integration Services**: Overview of Cloud Application Integration, Understand the Basics: Process Designer, Working with Assets, Adding Web Services to a Process, Fault Handling, Introduction to Guides Designer, API Management, CAI and CDI Integration, Troubleshooting, Tips & Tricks, Best Practices. | **4 hrs** |

**Text book:**

1. Rahul Malewar: Learning Informatica Cloud Services: Learn the art of implementing ETL on Cloud.

**Reference Weblink:**

1. https://now.informatica.com/Customer-360-SaaS-for-Business-Users-Instructor-Led.html

**Evaluation Scheme (ISA)**

| Assessment | Conducted for Marks | Weightage in Marks |
|---|---|---|
| IS (Theory) | 40 | 33 |
| Lab | 60 | 34 |
| | **Total** | **67** |

**Evaluation Scheme (ESA)**

| Assessment | Conducted for Marks | Weightage in Marks |
|---|---|---|
| Lab | 40 | 33 |
| | **Total** | **33** |

**Laboratory Plan**

| Sl. No. | Experiments | Number of slots |
|---|---|---|
| 1. | Creating Informatica Intelligent Cloud Services (IICS) Setting up Lab Environment, Configure SQL Server Database, Navigating the IICS Interface, Installing Secure Agent | 2 |
| 2. | Creating Flat File Connections using Cloud Data Integration | 1 |
| 3. | Creating a Salesforce Connection, Creating SQL Server Connections, Creating a Synchronization Task, | 2 |
| 4. | Using Filter, Expression, and Lookup in a Synchronization Task, Using Saved Query in a Synchronization Task, Creating a Data Transfer Task | 2 |
| 5. | IICS Transformations, Joiner and Lookup Transformations, Mapplets | 3 |
| 6. | Course Project (Reviews -03, Demonstration of project-01) | 4 |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Augmented and Virtual Reality** | | **Course Code: 25ECSE329** | |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 4 hrs/week** | |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** | |
| **Teaching Hrs: 30** | **Practical Hrs: 28** | **Exam Duration: 2 hrs** | |

| | | |
|---|---|---|
| **1** | Working VR in Unity: Unity XR, headset and controller tracking, loss of tracking, Unity core APIs related to XR functionality | **6 hrs** |
| **2** | Interaction and Locomotion: interact with objects in VR, scene exploration, teleportation, and grab and throw interactions, how to avoid causing nausea and dizziness for your user. | **6 hrs** |
| **3** | VR UX with the Unity API: Text Issues in VR, Optimizing Text Readability, Attaching Displays to a Controller, Interacting with Canvas Elements | **8 hrs** |
| **4** | Moving Constrained Objects with Tracking, Hitting Objects, UX That Moves With You, Triggering Canvas Events from Raycasts, Creating Virtual Controls That Mimic Real World Controls. | **8 hrs** |

**References**


1. Virtual Reality Technology, Gregory C. Burdea & Philippe Coiffet, John, 2nd Edition, 2013 Wiley & Sons, Inc., ISBN: 978-0-471-36089-6
2. Grigore C. Burdea, Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, 2nd Edition, 2006. ISBN: 978-0-471-36089-6
3. Greengard, Samuel. Virtual reality. Mit Press, 2019.


**Lab Experiments**

| Sl. No | Experiments | No of Slots (2 hrs/per week) |
|---|---|---|
| 1 | (AR) app development in Unity entailsthat overlay digital elements onto the real world. | 1 |
| 2 | Create a 3D object and apply different geometric Transformations using Mouse/Keyboard | 1 |
| 3 | Create animation for a 3D object (transformation, color, texture, etc.) | 1 |
| 4 | Bouncing ball on multiple 2D/3D platforms | 1 |
| 5 | Develop First Person Controller to a Scene | 1 |
| 6 | Create a 3D Character movement | 1 |
| 7 | Create a menu driven interface for adding and removing objects from a Scene | 1 |
| 8 | Build a cubic room, whose sides are made out of six planes. The room should be 15x15x15 Unity units. At the center of | 1 |

| | | |
|---|---|---|
| | the roof of the room, place a point source of light. This light should change color by pressing the Tab key. | |
| 9 | Course activity | 4 |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

BACK

| | | |
|---|---|---|
| **Program: Bachelor of Engineering** | | |
| **Course Title: Information Retrieval** | | **Course Code: 25ECSE330** |
| **L-T-P: 2-0-1** | **Credits: 03** | **Contact Hours: 2hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hours: 30** | **Practical: 28hrs** | **Exam Duration: 2hrs** |

| | | |
|---|---|---|
| | **Unit I** | |
| **1** | **Introduction to IR:** Nature of unstructured and semi-structured text, Inverted index and Boolean queries, Index Construction. | **5 hrs** |
| **2** | **Basic IR Models:** Vector space, Term Frequency / Inverted Document Frequency (TF-IDF), Probabilistic, Vector space scoring. | **5 hrs** |
| **3** | **Query Operations & Performance Evaluation:** Relevance feedback, Query expansion, Unranked and ranked retrieval evaluation, test collections, | **5 hrs** |
| | **Unit II** | |
| **4** | **Text Categorization:** Introduction to text classification, Rocchio, and Nearest Neighbor, Spam, Sentiment, and Online Advertising. | **5 hrs** |
| **5** | **Text Clustering:** Clustering Techniques, Analysis & Validation, Application Scenarios for Search Results and Database Clustering. | **5 hrs** |
| **6** | **Search Engine and Link Analysis:** Web search basics, Web crawling and indexes. Search engine techniques, PageRank, Hubs and Authorities. Knowledge graphs, Use of LLMs for retrieval | **5 hrs** |

**Text Books**

1. Manning, Raghavan and Schutze, Introduction to Information Retrieval, Cambridge University Press, 2009.
2. B. Croft, D. Metzier and T. Strohman, “Search Engines Information Retrieval in Practice”, Addison -Wesley, 2009.

**Reference Books:**

1. D. Grossman and O. Frieder, “Information Retrieval: Algorithms and Heuristics”, Springer, 2004.
2. Ceri. S Bozzon, A; Brambilla, M ; Della Valle, E; Fraternali, ;Quarteroni, S “Web Information Retrieval”, 2013.

**Laboratory Plan**

| Expt. No. | Experiments | No. of Slots |
|---|---|---|
| 1 | Introduction to IR : TF, IDF, Score calculation | 2 |
| 2 | Probabilistic, Vector space scoring | 2 |
| 3 | Date Preprocessing and Query Operations | 2 |
| 4 | Implement your own crawler | 2 |
| 5 | Text Classification Techniques | 2 |
| 6 | Language modeling | 2 |
| 7 | Search Operations | 2 |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Agentic AI** | | | **Course Code: 25ECSE331** |
| **L-T-P: 2-0-1** | **Credits: 3** | | **Contact Hrs:** |
| **ISA Marks: 67** | **ESA Marks: 33** | | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical Hrs: 28** | | **Exam Duration: 2 hrs** |
| **Unit –I** | | | |
| **1** | **Basics of Agentic AI:** Introduction, Flipped Interaction Pattern, The Agent Loop, Adding Structure to AI Agent Outputs | | **08 hrs** |
| **2** | **AI Agents, Tools, Actions and Language:** GAIL - Goals, Actions, Information, Language, Giving Agents Tools, Tool Descriptions and Naming, Tool Results and Agent Feedback | | **07 hrs** |
| **3** | **GAME: A conceptual Frameworks for AI Agents:** Overview of the GAME Framework, Simulating Agents in ChatGPT | | **07 hrs** |
| **Unit –II** | | | |
| **4** | **AI Tool Management**: Keeping Agent Tools Up to Date with Python Decorators, Tool Organization for Agents, Refactoring Our README Agent | | **04hrs** |
| **5** | **Rethinking How software is built in the age of AI Agents:** Build the Impossible with AI Agents, Rethinking How We Teach Innovation, Hallucination is a New Form of Computing, New Ways to Access and Extract Information | | **04hrs** |
| **Text Books:**<br>1. Agentic AI - Maria Johnsen - Google Books (2025) https://books.google.co.in/books?id=bMg7EQAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false<br>2. Agentic Artificial Intelligence: Harnessing AI Agents to Reinvent Business, Work and Life by Pascal Bornet (2025) https://www.amazon.com/Agentic-Artificial-Intelligence-Harnessing-Reinvent-ebook/dp/B0F1DS36YC | | | |
| **References:**<br>1. https://www.coursera.org/learn/ai-agents-python | | | |

**Agentic AI Lab Plan:**

| Experiment No. | Brief description about the experiment | Number of slots |
|---|---|---|
| 1 | Design and implement Programmatic Prompting and Customer Service Agent | 2 |
| 2 | Simulate agents by role-playing different GAME elements via prompting. | 4 |

| | | |
|---|---|---|
| 3 | Simulate collaboration between multiple agents using the GAME framework. | 4 |
| 4 | Evaluate and improve agent simulations. | 2 |
| 5 | Fine-Tuning for Specific Tasks<br>Ethical Considerations and Bias Detection<br>Real-World Application Development<br>Performance Optimization and Scaling | 2 |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| **Assessment** | **Conducted for marks** | **Weightage in Marks** |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| **Assessment** | **Conducted for marks** | **Weightage in Marks** |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Reinforcement Learning** | | **Course Code: 25ECSE332** | |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 4hrs/week** | |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** | |
| **Teaching Hrs: 30** | **Practical Hrs: 28** | **Exam Duration: 2 hrs** | |
| **Unit –I** | | | |
| **1** | **Introduction to Reinforcement Learning:** What is RL, difference from supervised/unsupervised learning, Real-world applications: robotics, gaming, recommendation systems, Agent-Environment Interface, Rewards, States, Actions, and Returns, Markov Decision Processes (MDPs) | | **04 hrs** |
| **2** | **Dynamic Programming & Model-Based Methods:** Value Functions: State-value and Action-value, Bellman Equations (expectation and optimality), Policy Evaluation, Improvement, and Iteration, Value Iteration & Policy Iteration | | **06 hrs** |
| **3** | **Model-Free Prediction and Control:** Monte Carlo Methods, Temporal Difference (TD) Learning, SARSA vs Q-Learning, Exploration vs Exploitation (ε-greedy, softmax) | | **05 hrs** |
| **Unit –II** | | | |
| **4** | **Policy Optimization & Deep RL:** Policy Gradient Theorem, REINFORCE Algorithm, Actor-Critic methods, Introduction to Deep Q-Networks (DQN), Stability tricks: Experience Replay, Target Networks | | **07 hrs** |
| **5** | **Advanced Concepts & Applications:** Exploration Strategies (UCB, entropy regularization), Multi-agent RL (brief intro). Hierarchical RL & Options, Introduction to RL in Vision / NLP, Reinforcement Learning from Human Feedback (RLHF), Current trends and open research problems | | **08 hrs** |

Text Books:

1. "Reinforcement Learning: An Introduction", Richard S. Sutton and Andrew G. Barto, 2nd Edition
2. "Probability, Statistics, and Random Processes for Electrical Engineering", 3rd Edition, Alberto Leon-Garcia
3. "Machine Learning: A Probabilistic Perspective", Kevin P. Murphy

Reference: IIT Kharagpur

**Lab Plan:**

| Experiment No. | Brief description about the experiment | Number of slots |
|---|---|---|
| 1 | Implement a simple bandit problem in Python | 2 |
| 2 | Implement value and policy iteration on Gridworld | 2 |
| 3 | Build an agent using SARSA/Q-learning | 2 |
| 4 | Implement REINFORCE for CartPole | 2 |
| 5 | DQN for Atari game or simple vision task | 2 |
| 6 | Fine-Tuning for Specific Tasks<br>Ethical Considerations and Bias Detection<br>Real-World Application Development<br>Performance Optimization and Scaling | 4 |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Human Computer Interaction** | | **Course Code: 25ECSE333** |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 4hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical hrs: 28** | **Exam Duration: 2 hrs** |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Introduction to HCI:** Definition and importance of HCI, Evolution of HCI, Human-centered design, Concept of usability - definition and elaboration, HCI and software engineering, Prototyping techniques. | **06 hrs** |
| **2** | **Model-based Design and evaluation:** Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN-GOMS), Fitts' law and Hick-Hyman's law, | **06 hrs** |
| **3** | **Guidelines in HCI:** Shneiderman's eight golden rules, Norman's seven principles, Norman's model of interaction, Nielsen's ten heuristics with example of its use, Heuristic evaluation, Contextual inquiry, Cognitive walkthrough, Empirical research methods in HCI. | **08 hrs** |
| | **Unit –II** | |
| **4** | **Dialog Design:** Introduction to formalism in dialog design, design using FSM (finite state machines), State charts and Petri Nets in dialog design. | **05 hrs** |
| **5** | **Cognitive architecture:** Introduction to CA, CA types, relevance of CA in IS design, Model Human Processor (MHP). | **05 hrs** |

**Text Book**


1. Helen Sharp, Yvonne Rogers, and Jenny Preece. Interaction Design: Beyond Human-Computer Interaction (6th Edition), Wiley, 2023
2. C. R. Becker, Learn Human-Computer Interaction: Solve Human Problems and Focus on Rapid Prototyping and Validating Solutions through User Testing. Birmingham: PACKT Publishing Limited, 2020.


**References:**


1. Qi, X., & Yu, J. Participatory Design in Human-Computer Interaction: Cases, Characteristics, and Lessons. In CHI Conference on Human Factors in Computing Systems (CHI '25), April 26–May 01, 2025
2. Ben Shneiderman. Designing the User Interface: Strategies for Effective Human-Computer Interaction (6th Edition), Pearson, 2016
3. Bhattacharya, S., & Yammiyavar, P. G. (n.d.). *Human-Computer Interaction* [Online course]. NPTEL. https://archive.nptel.ac.in/courses/106/103/106103115/
4. Stanford University. (n.d.). *Human-Computer Interaction* [Online course]. Coursera. https://www.coursera.org/learn/human-computer-interaction

| Lab Experiments | |
|---|---|
| Lab 1: Usability Evaluation of a Simple Web Application | **Objective**: Understand the concept of usability.<br>**Activity**: Conduct a usability test on a website using Nielsen's heuristics.<br>**Outcome**: Identify usability issues and write a usability report. |
| Lab 2: Prototyping Techniques | **Objective**: Create low- and high-fidelity prototypes.<br>**Activity**: Design a basic user interface for a mobile app.<br>**Outcome**: Understand the iterative nature of prototyping in HCI. |
| Lab 3: Modeling with GOMS (KLM & CMN-GOMS) | **Objective**: Apply GOMS models to predict user behavior.<br>**Activity**: Model a common task (e.g., sending an email) using KLM and CMN-GOMS.<br>**Outcome**: Analyze cognitive load and task efficiency. |
| Lab 4: Fitts' Law and Hick-Hyman's Law Experiment | **Objective**: Explore laws of human motor and decision-making behavior.<br>**Activity**: Create a simple UI to test button sizes (Fitts') and menu choices (Hick-Hyman).<br>**Outcome**: Record reaction time and decision-making speed. |
| Lab 5: Heuristic Evaluation | **Objective**: Apply Nielsen's 10 heuristics to a system (e.g., ATM UI or online form).<br>**Activity**: Identify violations and categorize by severity.<br>**Outcome**: Document a heuristic evaluation report. |
| Lab 6: Modeling with Model Human Processor (MHP) | **Objective**: Apply MHP for a real task.<br>**Activity**: Choose a daily computer task (e.g., searching in Google), break it down into perceptual, cognitive, and motor actions.<br>**Outcome**: Time and analyze task steps using MHP components. |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Multimedia Networks** | | | **Course Code:21ECSE311** |
| **L-T-P: 3-0-0** | **Credits: 3** | | **Contact Hrs: 3hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | | **Total Marks: 100** |
| **Teaching Hrs: 40** | | | **Exam Duration: 3 hrs** |
| **Unit –I** | | | |
| **1** | **Introduction to Multi media:** Media and Data stream: Perception Media, Representation Media, Presentation Media, Storage Media; Key properties of Multimedia, Characterizing data streams and Continuous Media Data Streams. | | **4 hrs** |
| **2** | **Graphics and Image Data representation:** Graphics / Image data types, popular file formats, color science, color models in images, color models in video, Image analysis: Color, Texture identification, Edge detection using sobel operators, canny edge detection method, Image segmentation: pixel oriented, edge oriented, Region oriented, Image recognition. Image synthesis, Radon transforms. | | **6 hrs** |
| **3** | **Fundamental concepts of Video and Audio:** Types of video signal, digital video, Digitization of audio, MIDI standard, Quantization and transmission of audio | | **6 hrs** |
| **Unit –II** | | | |
| **4** | **Image compression techniques:** Lossless compression algorithms: Run-Length Coding, Variable-Length Coding (VLC), Shannon–Fano Algorithm, Huffman Coding, Adaptive Huffman Coding, Arithmetic Coding, Lossless JPEG, Lossy compression algorithms: Distortion Measures, The Rate-Distortion Theory, Quantization, Uniform Scalar Quantization, Non-uniform Scalar Quantization, Vector Quantization, Transform Coding, Discrete Cosine Transform (DCT), Introduction, Continuous Wavelet Transform, Discrete Wavelet Transform | | **6 hrs** |
| **5** | **Video compression techniques:** Video compression based on motion compensation, H.261, H.263, MPEG -1. Basic audio compression techniques | | **6 hrs** |
| **6** | **Computer based Animation:**Basic concepts, specifications of animations, methods of controlling animation, display, transmission of animation, VRML | | **4 hrs** |
| **Unit –III** | | | |
| **7** | **Optical storage media:** Basic technology, video disc, CDDA, CDROM, CDR/W, DVD | | **4 hrs** |
| **8** | **Content Analysis:** Simple and complex features: text recognition, similarity based search in image database, analysis of individual images, image sequences, applications. | | **4 hrs** |

**Text Books:**

1. Ze-Nian Li & Mark S.Drew, Jiangchuan Liu, “Fundamentals of Multimedia”, Second Edition, Springer, 2014.
2. Ralf Steinmetz, Klara Narstedt, “Multimedia Fundamentals: Vol 1-Media Coding and Content Processing”, 2nd Edition, Pearson Education / PHI, 2003.

**Reference Books:**

1. James E Shuman, “Multimedia in Action” 2nd Indian reprint 2008, Cengage learning.

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1,2,3 | Solve Any **2** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 4,5,6 | Solve Any **2** |
| III | Q.No.-7 | 7 | Solve Any **1** |
| | Q.No.-8 | 8 | |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Cyber Security** | | **Course Code: 25ECSE325** | |
| **L-T-P: 3-0-0** | **Credits: 03** | **Contact Hours: 3hrs/week** | |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** | |
| **Teaching Hours: 40** | **Practical Hrs: --** | **Exam Duration: 3hrs** | |

| | | |
|---|---|---|
| | **Unit - I** | |
| **1** | **Introduction to Cyber Security:** Overview of Cybersecurity, Importance and Goals of Cybersecurity, Cybersecurity Threat Landscape, Cybersecurity Fundamentals, Overview of Domain-specific Security, Threat Intelligence and Incident Response. | **8 hrs** |
| **2** | **Cyber-crimes and Cyber Laws**: Classification of cyber-crimes, Common cyber-crimes – targeting computers, mobiles, crimes against women and children, financial frauds, social engineering, malware and ransomware, zero-day and zero-click attacks, cybercriminals' modus operandi, reporting, remedial measures, legal perspective, IT Act 2000 and amendments, cyber offences, organizations dealing with cybercrime and cybersecurity in India, case studies. | **7 hrs** |
| | **Unit - II** | |
| **3** | **Network and Web Security**: Identifying and protecting critical web assets, cookies, wireless network vulnerabilities, Application software and data integrity issues, OWASP top 10 threats, Mitigating web risks, Overview of network security, Multilevel Security Models, Firewalls and Intrusion Detection Systems. | **8 hrs** |
| **4** | **Security Operations**: Security Operations Centre (SOC) Fundamentals, Key SOC Roles and Responsibilities, SOC Components (People, Processes, Technology), Cyberthreats and the impact of a Breach, Investing in Security and Establishing a Baseline, Fundamental Security Capabilities and Industry Threat Models, Standards, Guidelines, and Frameworks, Vulnerabilities, Risk & Business Challenges. | **7 hrs** |
| | **Unit - III** | |
| **5** | **Development of SOC:** SOC Maturity Model, Key SOC Functions: Threat Detection, Incident Response, Forensics, Planning and Designing a SOC Facility, Network Considerations for SOC, Disaster Recovery & Business Continuity in SOC. | **5 hrs** |
| **6** | **Security Information and Event Management (SIEM)**: Key SIEM Components, Introduction to SIEM solutions, Key Features, SIEM Architecture, Log collection methods, Incident Detection in SIEM: Detecting Malware, Phishing, Insider Threats, Automated Incident Response with SIEM and SOAR. | **5 hrs** |

**References**


1. Cybersecurity Essentials by Charles J. Brooks, Christopher Grow, Philip Craig, and Donald Short was published on October 5, 2018.
2. Principles of Information Security by Michael E. Whitman and Herbert J. Mattord (7th edition) was published on June 27, 2021.
3. Computer Security: Principles and Practice by William Stallings and Lawrie Brown (4th edition, Global Edition) was published on June 21, 2018.


**Evaluation Scheme**

**In-Semester Assessment Scheme**

| **Assessment** | **Conducted for marks** | **Weightage in Marks** |
|---|---|---|
| ISA-1 | 15 | 30 |
| ISA-2 | 15 | |
| Activity | 20 | 20 |
| **Total** | | **50** |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Software Defined Networks** | | **Course Code: 25ECSE334** | |
| **L-T-P : 2-0-1** | **Credits: 3** | **Contact Hrs: 4hrs/week** | |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** | |
| **Teaching Hrs: 30** | **Practical Hrs: 28** | **Exam Duration: 2 hrs** | |

| | | |
|---|---|---|
| | **Unit – I** | |
| **1** | **Introduction:** Evolving network requirements, Types of Network and Internet Traffic, The SDN approach, Data plane functions and protocols | **05 hrs** |
| **2** | **OpenFlow:** OpenFlow logical network device, OpenFlow protocol, OpenFlow messages, OpenFlow events. | **05 hrs** |
| **3** | **Control Plane:** SDN Control plane architecture, POX architecture, OpenDaylight architecture, REST, Mininet based examples, | **05 hrs** |
| | **Unit-II** | |
| **4** | **Programming SDNs:** Components in POX, POX APIs, Registering Components, The Event System: Handling Events, Creating Your Own Event Types**,** Raising Events**,** Binding to Components, Events. | **06 hrs** |
| **5** | **Software Application plane:** SDN Application Plane Architecture, Traffic Engineering, Measurement and Monitoring. | **04hrs** |
| **6** | **Network Functions Virtualization (NFV):** OpenFlow VLAN Support, Virtual Private Networks, Network Virtualization: A Simplified Example, Network Virtualization Architecture. | **05 hrs** |

**Laboratory Plan: Experiments**

| Lab Slot | Experiment | Correlation to Unitization |
|---|---|---|
| 1. | Introduction to Mininet. | **UNIT-I** |
| 2. | Setting up the Environment and Implementation of Controllers. | |
| 3. | Custom Topology: POX, ODL, Floodlight. | |
| 4. | Legacy Network: BGP Example. | |
| 5. | Early efforts of SDN: MPLS Example. | **UNIT-II** |
| 6. | Configuration of SDN Networks. | |
| 7. | Configuring VXLAN. | |
| 8. | Open flow Protocol Management. | |
| 9. | Interaction between Legacy Networks and SDN Networks. | |
| 10. | Configuring VPLS. | **UNIT-II** |
| 11. | Network function virtualization | |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Blockchain and Distributed Ledgers** | | **Course Code: 24ECSE324** | |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 4 hrs/week** | |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** | |
| **Teaching Hrs: 30** | **Tutorial/Practical: 28hrs** | **Exam Duration: 2 hrs** | |
| **Unit –I** | | | |
| **1** | **Introduction:** Overview of blockchain, Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Types of blockchain, blockchain platforms, Blockchain Architecture, Blockchain Use Cases: Finance, E-Governance, Supply chain management, Healthcare management and cyber security. | | **05 hrs** |
| **2** | **Cryptography Basics:** Introduction to cryptography, Public key crypto: Introduction, RSA, Public key infrastructure, Hash Functions: Properties of Hash Functions, SHA, Digital signature Schemes, Merkle trees. | | **06 hrs** |
| **3** | **Consensus Mechanisms and Mining –Permissionless:** Consensus in Distributed Systems, Consensus mechanisms in Permission less blockchain: Proof of Work, Proof of Stake (POS), Proof of Activity, Delegated POS, Proof of Elapsed Time. | | **04 hrs** |
| **Unit –II** | | | |
| **4** | **Consensus Mechanisms and Mining – Permissioned:** RAFT, Practical Byzantine Fault Tolerance (PBFT), Scalability of consensus algorithms. | | **04 hrs** |
| **5** | **Ethereum and Smart Contracts:** Ethereum transactions, accounts, smart contracts, smart contract development, Solidity basics, basic contracts, distributed storage and IPFS, Ethereum scaling, Applications of Ethereum Smart contracts: Tokens and Token Standards, Fungible and Non-Fungible Tokens, crowd funding | | **06 hrs** |
| **6** | **Enterprise Blockchain Platforms:** Hyperledger Fabric: Introduction, Architecture, Identity, Membership and Peer Management, Chain codes. Corda: Principal Features, Architecture, CorDapp. Consensus Mechanisms in Hyperledger Fabric and Corda. | | **05 hrs** |

**Text Books:**

1. Imran Bashir "Mastering Blockchain", 3st Edition, PacktMedia, 2020.
2. William Stallings “Cryptography and network security principles and practice”, 7th edition Global edition.

**Reference Books:**

1. Melanie Swan, “Blockchain: Blueprint for New Economy", 1st Edition, O'Reilly Media, 2014.
2. Arshdeep Bhaga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", 1st Edition, VPT, January 31, 2017.

**Evaluation Scheme**

**ISA Scheme**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Laboratory Assessment | 60 | 34 |
| **Total** | | **67** |

**ESA Scheme**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ESA (Theory) | 60 | 33 |
| **Total** | | **33** |

**List of Exercises**

| Expt./ No. | Brief description about the experiment/job | No. of Lab. Slots |
|---|---|---|
| 1. | Overview and Demonstration of Ethereum smart contracts | 1 |
| 2. | Solidity programming- Data types<br>Primitive Data Types- Integer, Floating Point, Character, Boolean Composite/Derived Data Types- String, Array, Structure (struct). | 1 |
| 3. | Solidity programming- control structures and functions | 1 |
| 4. | Remix with Ganache and Meta mask | 1 |
| 5. | Deploying contract using external blockchain using Remix, ganache and Metamask (Evaluation 1) | 1 |
| 6. | Demonstration on block chain use cases ( Regarding Open-ended Experiment) | 1 |
| 7. | Creating smart contract on RSA and D_H, SHA-512, Digital signature. Structured Enquire : Cryptography | 1 |
| 8. | Creating custom Ethereum blockchain using Geth. | 1 |
| 9. | Connecting to Geth node using Web3 | 1 |
| 10. | Structured Enquire : Case study (specified in chapter 1) implementation using Geth (Evaluation 2) | 1 |
| 11. | Create distributed storage using IPFS. | 1 |
| 12. | Connect IPFS to Ethereum or Hyperledger Fabric (Evaluation 3) | 1 |
| 13. | Open ended Experiment: Problem statement, Backend Design and Front end design | 1 |
| 14. | Open ended Experiment: Implementation and Results (Evaluation 4) | 1 |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Security Operations** | | **Course Code: 24ECSE321** | |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 4 hrs/week** | |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** | |
| **Teaching Hrs: 30** | **Tutorial/Practical: 28hrs** | **Exam Duration: 2 hrs** | |
| **Unit –I** | | | |
| **1** | **Introduction to Security Operations:** Security Operations Center (SOC) Fundamentals, Key SOC Roles and Responsibilities, SOC Components (People, Processes, Technology), Cyberthreats and the impact of a Breach, Investing in Security and Establishing a Baseline, Fundamental Security Capabilities and Industry Threat Models, Standards, Guidelines, and Frameworks, Vulnerabilities, Risk & Business Challenges, | | **07 hrs** |
| **2** | **Development of SOC:** SOC Maturity Model, Key SOC Functions: Threat Detection, Incident Response, Forensics, Planning and Designing a SOC Facility, Network Considerations for SOC, Disaster Recovery & Business Continuity in SOC, Security Considerations, Guidelines and Recommendations for Securing SOC | | **08 hrs** |
| **Unit –II** | | | |
| **3** | **Security Information and Event Management** (SIEM)**:** Key SIEM Components, Introduction to SIEM solutions, Overview and Key Features, SIEM Architecture, Log collection methods, Security Event Correlation and Rule Writing. | | **07 hrs** |
| **4** | **Incident Detection and Response :** Incident Detection in SIEM: Detecting Malware, Phishing, Insider Threats, Detecting Lateral Movement (MITRE ATT&CK Framework), Incident Response: Automated Incident Response with SIEM and SOAR, Generating and Managing SIEM Alerts | | **08 hrs** |

**Text Books:**

1. J. Muniz, A. Lakhani, O. Santos, and M. Frost, The Modern Security Operations Center: The People, Process, and Technology for Operating SOC Services, 1st ed. O'Reilly Media, 2021

**Reference Books:**

1. R. MacDougall and R. Lain, The Security Operations Handbook: Managing a SOC and Detecting Threats, Packt Publishing, 2021.
2. E. Al-Shaer, Automated Security Operations: Threat Hunting, Detection, and Response at Scale, Pearson, 2020.

**Evaluation Scheme**

**ISA Scheme**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Laboratory Assessment | 60 | 34 |
| **Total** | | **67** |

**ESA Scheme**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ESA (Theory) | 60 | 33 |
| **Total** | | **33** |

**Lab Experiments**

| S. No | Experiments | No of Lab Slots |
|---|---|---|
| 1 | Installing and configuring WAZUH. | 01 |
| 2 | Configure log sources and forwarding logs to SIEM component. | 01 |
| 3 | Log collection methods and analysis. | 01 |
| 4 | Malware detection. | 01 |
| 5 | Intrusion detection. | 01 |
| 6 | Phishing attack analysis. | 01 |
| 7 | Insider threat monitoring. | 03 |
| 8 | Network attack detection. | 02 |
| 9 | SIEM alert management. | 03 |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Edge Computing** | | **Course Code: 24ECSE323** | |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 4 hrs/week** | |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** | |
| **Teaching Hrs: 30** | **Tutorial/Practical: 28hrs** | **Exam Duration: 2 hrs** | |
| **Unit –I** | | | |
| **1** | **Introduction:** Definition and key concepts, Difference between edge, fog and cloud computing Importance and benefits of edge computing, Case studies and real-world applications, Edge computing architecture. | | **07 hrs** |
| **2** | **Edge Computing Technologies:** Edge hardware and devices: IoT devices, gateways, edge servers, Sensors and actuators, edge hardware platforms, Software for Edge Computing: operating systems and middleware, edge computing platforms and frameworks, development tools and SDKs. Wireless technologies for edge: for Wi-Fi, Zigbee, LoRa, 5G, mmWave, LiFi. Communication protocols: MQTT, CoAP, AMQP, BLE | | **08 hrs** |
| **Unit –II** | | | |
| **3** | **Edge Cloud:** Introduction to Edge Data Center, use cases and applications, Lightweight edge clouds and its services, Edge cloud architectures using Kubernetes, Edge Networking: 5G Architecture, SDN, NFV, SFC and AI. | | **07 hrs** |
| **4** | **Mobile Edge Computing (MEC):** Architecture, computational model, offloading policy, Integration of MEC into 5G/6G, Case study, Applications and Challenges, simulation tools, MEC for industrial IoT, Edge intelligence at device, edge and core layers using ML/FL. | | **08 hrs** |

**Text Books:**

1. Yan Zhang, "Mobile Edge Computing", 1st Edition, Springer, 2021.
2. Buyya R., Srirama S.N., “Fog and Edge Computing”, Wiley, 2019.

**Reference Books:**

1. Sabella D., Reznik A., Frazao R., “Multi-access Edge Computing in Action”, 1st edition, 2019
2. Al-Turjman F. (ed.): “Edge Computing: from hype to reality”, Springer, 2019.

**Evaluation Scheme**

**ISA Scheme**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Laboratory Assessment | 60 | 34 |
| | **Total** | **67** |

**ESA Scheme**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ESA (Theory) | 60 | 33 |
| | **Total** | **33** |

**Lab Experiments**

| S. No | Experiments | No of Lab Slots |
|---|---|---|
| 1 | Kubernetes Setup – Single node | 01 |
| 2 | KubeEdge Setup | 01 |
| 3 | LF Edge | 01 |
| 4 | Edge Cloud- Multi-node | 01 |
| 5 | Edge Application Deployment on KubeEdge- IoT | 01 |
| 6 | Edge Application Deployment on KubeEdge- Video Streaming | 01 |
| 7 | MEC- Edge device, Edge cloud and private 5G integration | 03 |
| 8 | Open Ended Activity | 04 |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Web Security** | | **Course Code: 25ECSE335** |
| **L-T-P:2-0-1** | **Credits: 3** | **Contact Hrs: 4 hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical: 28hrs** | **Exam Duration: 2 hrs** |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Introduction to Web Security:** Security Goals for Web Applications, The fundamentals and state-of-the-art in web security. Common Threats and Vulnerabilities, Attacks and countermeasures | **04 hrs** |
| **2** | **Authentication and Session Management :** User Authentication Methods : Passwords, OTPs, OAuth, Biometrics Session Management and Attacks : Session Hijacking, Fixation Secure Login Mechanisms, Multi-Factor Authentication (MFA) | **05 hrs** |
| **3** | **Web Application Vulnerabilities:** Injection Attacks: SQL Injection, Command Injection, Cross-Site Scripting (XSS): Stored, Reflected, DOM-based, Cross-Site Request Forgery (CSRF)<br>File Upload Vulnerabilities, Broken Access Control, Insecure Direct Object References (IDOR) | **06 hrs** |
| | **Unit –II** | |
| **4** | **Web Server and Hosting Security:** Web Server Hardening , HTTPS and SSL/TLS Configuration, Content Security Policy (CSP), Web Application Firewalls (WAF) | **05 hrs** |
| **5** | **Secure APIs and Web Services:** REST and SOAP Security, API Authentication :JWT, OAuth2, Limiting and Throttling, Common API Vulnerabilities | **04 hrs** |
| **6** | **Secure Web Development Practices:** Input Validation and Output Encoding, Error Handling and Logging, Secure Coding Principles: Least Privilege, Fail Secure, Framework-Specific Security: Django, Node.js, React | **06 hrs** |

**Reference Books:**


1. Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook, 2nd Edition Wiley, ISBN: 978-1118026472, 2011.
2. Malcolm McDonald Web Security for Developers, No Starch Press, 1st Edition , ISBN: 978-1718501041, 2020
3. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Java, .NET, and PHP, 1st Edition (2020) O'Reilly Media, ISBN: 978-149205311

**Evaluation Scheme**

**Scheme for In Semester Assessment (ISA)**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Laboratory Assessment | 60 | 34 |
| | **Total** | **67** |

**Scheme for End Semester Assessment (ESA)**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ESA (Theory) | 60 | 33 |
| | **Total** | **33** |

**Lab Experiments**

| S.No | Experiments | No of Lab Slots |
|---|---|---|
| 1 | Introduction to Web security Tools: XAMPP/LAMP stack, OWASP Juice Shop, DVWA | 02 |
| 2 | Implementing and Bypassing Login Authentication | 01 |
| 3 | Session Hijacking using Cookies | 01 |
| 4 | Web Vulnerabilities | 02 |
| 5 | Input Validation and Output Encoding | 02 |
| 6 | Implement HTTPS Using Self-Signed Certificates | 02 |
| 7 | Testing a REST API for Injections and Misconfigurations | 02 |
| 8 | Implementing Content Security Policy (CSP) | 02 |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Computational Medicine** | | | **Course Code: 24ECSE319** |
| **L-T-P: 2-0-1** | **Credits: 3** | | **Contact Hrs: 4hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Tutorial/Practical: 28 hrs** | | **Exam Duration: 2 hrs** |
| **Unit –I** | | | |
| **1** | **Introduction to Cell Organization:** Cell Theory, Prokaryotic and Eukaryotic Cells, Organelles, Cell Membrane, Cell Cycle, Tissue, Organs, Organ Systems, Homeostasis | | **5 hrs** |
| **2** | **Systems Biology:** Systems Biology, Modelling Biological Systems, Network Biology, Omics Technologies, Systems Biology Applications. | | **5 hrs** |
| **3** | **Biological Networks:** Protein-Protein Interaction Networks (PPINs), Gene Regulatory Networks (GRNs), Metabolic Networks, Metabolic Networks | | **5 hrs** |
| **Unit –II** | | | |
| **4** | **Molecular Interactions:** Protein-Protein Interactions, Protein-DNA Interactions, Protein-Ligand Interactions, Molecular Dynamics Simulations. | | **5 hrs** |
| **5** | **Introduction to modelling health and disease:** Principles of Computational Physiology, Integrating Molecular Networks into Physiological Models, Animal Models and Human Translation | | **5 hrs** |
| **6** | **Introduction to Computational Anatomy:** Case Studies : Computational Anatomy of the Brain and Computational Anatomy of the Heart | | **5 hrs** |
| **Text Books: NA** | | | |
| **Reference:**<br>1. Lecture Notes and Handouts<br>2. Some reference papers / Slides/ Videos | | | |

**Hands-On - Lab Work**

| |
|---|
| • Lab sessions on cell observation (microscopy) and tissue analysis. |
| • Group projects on modelling biological systems. |
| • Case studies on diseases related to cellular dysfunction. |
| • Bioinformatics exercises using publicly available datasets. |
| • Computational exercises in network analysis using available software tools. |
| • Case studies of network-based drug discovery and development. |
| • Data mining and analysis of biological network datasets. |
| • Integration of network analysis with experimental validation. |
| • Hands-on experience with computational modelling software. |
| • Development of simplified models to understand core concepts. |
| • Analysis of real-world data to parameterize and validate models. |
| • Collaboration with experimental biologists and clinicians. |

| |
|---|
| • Hands-on experience with medical image processing software. |
| • Development of image analysis pipelines for specific clinical problems. |
| • Application of machine learning techniques for image analysis. |
| • Collaboration with clinicians for data interpretation and clinical validation. |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: The ARM Architecture** | | **Coursecode:19ECSE308** |
| **L-T-P: 2-1-0** | **Credits: 3** | **Contact Hrs: 4 hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Tutorial Hrs: 28** | **Exam Duration: 3 hrs** |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **ARM Embedded Systems and Processor Fundamentals:** The RISC Design Philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions, Architecture Revisions, ARM Processor Families | **06 hrs** |
| **2** | **Introduction to the ARM Instruction Set & Assembly Programming:** Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants, ARMv5E Extensions, Conditional Execution, Thumb instruction set. | **06 hrs** |
| | **Unit –II** | |
| **3** | **Efficient C Programming:** Overview of C Compilers and Optimization, Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing, Structure Arrangement, Bit-fields,<br>Unaligned Data and Endianness, Division. | **06 hrs** |
| **4** | **Writing and Optimizing ARM Assembly Code:** Writing Assembly Code, Profiling and Cycle Counting, Instruction Scheduling, Register Allocation, Conditional Execution, Looping Constructs, Bit Manipulation, Efficient Switches, Handling Unaligned Data. | **06 hrs** |
| | **Unit –III** | |
| **5** | **Introduction to LPC-2148 controller:** Input output Ports, Pin select registers, Input output select registers, direction control and control registers, Introduction to interfacing standards | **03 hrs** |
| **6** | **ARM Interfacing:** ARM interfacing to peripherals like LED, LCD, Seven segments, Motors, Converters, Keypad. | **03 hrs** |

**Text Books**

1. Andrew N.Sloss et al, ARM System Developer's Guide- Designing and Optimizing System Software

**Reference Books:**

1. Marilyn Wolf, Computers as Components: Principles of embedded computing system design, Morgan Ka, 2012
2. Steve Furber, ARM System-on-chip Architecture, 2, Pearson, 2000

**Tutorial Plan**

| Expt./ Job No. | Assignments/Experiment | No. of Lab. Slots |
|---|---|---|
| 1 | ALP on arithmetic instructions set | 01 |
| 2 | ALP on logical instructions set | 01 |
| 3 | ALP on loop and branch instructions | 02 |
| 4 | Interface LED and Seven segments to ARM for displaying message. | 02 |
| 5 | Interface LCD to ARM for displaying message. | 02 |
| 6 | Interface Keypad to read the characters | 02 |
| 7 | Rotate DC and stepper motor for variable speed and direction | 02 |
| 8 | Interface DAC to ARM controller | 02 |

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1,2 | Solve Any **2** out of **3** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 3,4 | Solve Any **2** out of **3** |
| III | Q.No.-7, 8 | 5 | Solve Any **1** out of **2** |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Embedded Intelligent Systems** | | **Course code: 24ECSE302** |
| **L-T-P: 1-0-2** | **Credits: 3** | **Contact Hrs: 5 hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hrs : 15** | **Practical Hrs: 56** | **Exam Duration: NA** |

| | | |
|---|---|---|
| **1** | **ML Frameworks lab with the target device:** TensorFlow, PyTorch, TF Lite machine learning frameworks & architecture, Model parsing, feature support and flexibility, supported layers, advantages and disadvantages with each of these frameworks, Android NN architecture overview, Full stack compilation and execution on embedded device. | **5 hrs** |
| **2** | **Model Development and Optimization:** Significance of on device AI, Quantization, pruning, weight sharing, Distillation, Various pre-trained networks and design considerations to choose a particular pre-trained model, Federated Learning, Flexible Inferencing. | **5 hrs** |
| **3** | **Android Anatomy:** Android Architecture, Linux Kernel, Binder, HAL Native Libraries, Android Runtime, Dalvik Application framework, Applications, IPC. | **5 hrs** |

**Text Books**


1. Linux System Programming, by Robert Love, Copyright © 2007 O'Reilly Media.
2. Heterogeneous Computing with OpenCL, 2nd Edition by Dana Schaa, Perhaad Mistry, David R. Kaeli, Lee Howes, Benedict Gaster, Publisher: Morgan Kaufmann.
3. Deep Learning, MIT Press book, Goodfellow, Bengio, and Courville's.
4. TensorFlow for Deep Learning, by Bharath Ramsundar, Reza Bosagh Zadeh, O'Reilly Media, Inc.
5. Beginning Android, by Wei-Meng Lee, Publisher: Wrox , O'Reilly Media.


**Reference Books:**


1. Deep Learning with PyTorch, Eli Stevens, Luca Antiga, and Thomas Viehmann, Manning Publication.
2. Machine Learning with PyTorch and Scikit-Learn, Sebastian Raschka, Yuxi (Hayden) Liu , Vahid Mirjalili, Packt Publishing.


**Evaluation Scheme (ISA)**

| Section | Chapter Numbers | Conducted for marks | Weightage in Marks |
|---|---|---|---|
| ISA - I | 1, 2, 3 | 40 | 34 Marks |
| Lab Evaluation | 1, 2, 3 | 60 | 33 Marks |

**Evaluation Scheme (ESA)**

| Section | Chapter Numbers | Conducted for marks | Weightage in Marks |
|---|---|---|---|
| Lab Exam (ESA) | 1, 2, 3 | 40 | 33 Marks |

**List of experiments**

| Expt. No. | Brief description about the experiment | No. of Lab Slots |
|---|---|---|
| **1.** | Comparative analysis and execution of pre-trained neural networks using TensorFlow, PyTorch, and TensorFlow Lite for edge deployment. | **1** |
| **2.** | Design and deployment of lightweight convolutional neural networks for resource-constrained embedded environments. | **2** |
| **3.** | Implementation and performance evaluation of quantization techniques on DNN models for on-device execution. | **1** |
| **4.** | Implementation of structured model pruning with emphasis on parameter compression, retraining methodologies, and accuracy evaluation on embedded platforms. | **1** |
| **5.** | Implementation of knowledge distillation framework focusing on transferring representational capabilities from high-capacity teacher networks to lightweight student models. | **2** |
| **6.** | Development of native android applications for incorporating embedded machine learning models with focus on android runtime, inter-process communication, and user interface integration. | **1** |
| **7.** | Integration of cross-platform PyTorch models into android applications through TorchScript conversion and deployment using the PyTorch mobile framework. | **2** |
| **8.** | Design and development of computationally optimized and quantized deep neural network architectures on heterogeneous android platforms with real-time inference profiling, multi-hardware delegate analysis, and comprehensive evaluation of accuracy-latency-memory trade-offs. | **4** |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Robotic Process Automation Design & Development** | | **Course Code: 25ECSE301** |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 4hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical Hrs: 28** | **Exam Duration: 2 hrs** |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Programming Basics & Recap –** Programming Concepts Basics - Understanding the application - Basic Web Concepts - Protocols - Email Clients -. Data Structures - Data Tables - Algorithms - Software Processes - Software Design - Scripting - .Net Framework - .Net Fundamentals - XML - Control structures and functions - XML - HTML - CSS - Variables & Arguments. | **5 hrs** |
| **2** | **Rpa Concepts -** 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 Developemt methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Proccess Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem. | **5 hrs** |
| **3** | **Rpa Introduction & Basics -** Introduction to RPA Tool - 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 | **5 hrs** |
| | **Unit –II** | |
| **4** | **Advanced Automation Concepts And Techniques-1** – Recording and Advanced UI Interaction - Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Selectors - | **5 hrs** |

| | | |
|---|---|---|
| | Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix | |
| **5** | **Advanced Automation Concepts And Techniques-2** - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF. | **5 hrs** |
| **6** | **Email Automation & Exceptional Handling** – Email Automation - Email Automation - Incoming Email automation - Sending Email automation - Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors. | **5 hrs** |

**Text Books:**

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940

**Reference Books:**

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3. Srikanth Merianda,Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
4. https://www.uipath.com/rpa/robotic-process-automation

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| **Assessment** | **Conducted for marks** | **Weightage in Marks** |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| **Assessment** | **Conducted for marks** | **Weightage in Marks** |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

**List of experiments**

**Lab Experiments:**

| Expt./Job No. | Brief description about the experiment/job | No. of tutorial Slots per batch (estimate) | Marks |
|---|---|---|---|
| 1 | Demo on UiPath Studio | 02 | NA |
| 2 | UiPath Studio practice session | 02 | NA |
| 3 | Bot Building:<br>IMDB Movie Rating | 02 | 10 |
| 4 | Automating UI input and output actions | 02 | 10 |
| 5 | Bot Building:<br>Amazon Data Scraping | 02 | 10 |
| 6 | PDF Automation | 02 | 10 |
| 7 | E-mail Automation<br>Exception Handling | 02 | 10 |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Parallel Computing** | | | **Course Code: 17ECSE307** |
| **L-T-P: 3-0-0** | **Credits: 3** | | **Contact Hrs: 03 hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | | **Total Marks: 100** |
| **Teaching Hrs: 40** | | | **Exam Duration: 03 hrs** |
| **Unit –I** | | | |
| **1** | **Introduction to Parallel Computing & Parallel Programming Platforms:** Motivating Parallelism, Scope of Parallel Computing, Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines. | | **8 hrs** |
| **2** | **Principles of Parallel Algorithm Design:** Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models. | | **8 hrs** |
| **Unit –II** | | | |
| **3** | **Analytical Modeling of Parallel Programs:** Sources of Overhead in Parallel Programs, Performance metrics for parallel systems, The effect of Granularity on performance, Scalability of Parallel Systems, Minimum execution time and minimum cost optimal execution time, Asymptotic analysis of Parallel programs, Other Scalability Metrics. | | **8 hrs** |
| **4** | **Programming Using the Message Passing Paradigm:** Principles of Message – Passing Programming, The Building Blocks, and MPI: The Message passing Interface, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups & Communicators. | | **8 hrs** |
| **Unit –III** | | | |
| **5** | **Pthreads and Synchronization:** Thread Basics, POSIX Thread API, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs. | | **4 hrs** |
| **6** | **OpenMP:** Open MP programming model, Specifying tasks in openMP, Synchronization constructs in opn MP, Data handling in OpenMP, Open MP library functions, Environment variables in OpenMP, Explicit Thread versus OpenMP based programming. | | **4 hrs** |

| |
|---|
| **Text Books:**<br>1. Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, Introduction to Parallel Computing, Second Edition, Pearson India, 2013 |
| **Reference Books:**<br>1. Michael Quinn, Parallel Computing Theory and Practice, Tata McGraw Hill, 2003 |

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1, 2 | Solve Any **2** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 3,4 | Solve Any **2** |
| III | Q.No.-7 | 5 | Solve Any **1** |
| | Q.No.-8 | 5 | |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Quantum Computing Fundamentals** | | **Course Code: 17ECSE306** | |
| **L-T-P: 3-0-0** | **Credits: 3** | **Contact Hrs: 3hrs/week** | |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** | |
| **Teaching Hrs: 40** | | **Exam Duration: 3hrs** | |
| **Unit –I** | | | |
| **1** | **Introduction and Background:** Overview, Computers and the Strong Church–Turing Thesis, The Circuit Model of Computation, A Linear Algebra Formulation of the Circuit Model, Reversible Computation, A Preview of Quantum Physics, Quantum Physics and Computation | | **6 hrs** |
| **2** | **Linear Algebra and the Dirac Notation:** The Dirac Notation and Hilbert Spaces, Dual Vectors, Operators, The Spectral Theorem, Functions of Operators, Tensor Products, The Schmidt Decomposition Theorem, Some Comments on the Dirac Notation | | **6 hrs** |
| **3** | **Introduction to Quantum Toolbox in Python:** Installation, Basics and Quantum mechanics | | **4 hrs** |
| **Unit –II** | | | |
| **4** | **Qubits and the Framework of Quantum Mechanics:** The State of a Quantum System, Time-Evolution of a Closed System, Composite Systems, Measurement, Mixed States and General Quantum Operations, Mixed States, Partial Trace, General Quantum Operations | | **6 hrs** |
| **5** | **A Quantum Model of Computation:** The Quantum Circuit Model, Quantum Gates, 1-Qubit Gates, Controlled-U Gates, Universal Sets of Quantum Gates, Efficiency of Approximating Unitary Transformations, Implementing Measurements with Quantum Circuits | | **6 hrs** |
| **6** | **Problems and Project:** Exploring Python for Solving Problems / Projects using Quantum Computing. | | **4 hrs** |
| **Unit –III** | | | |
| **7** | **Introductory Quantum Algorithms:** Probabilistic Versus Quantum Algorithms, Phase Kick-back, The Deutsch Algorithm, The Deutsch–Jozsa Algorithm, Simon's Algorithm | | **4 hrs** |
| **8** | **Case Studies and Projects done during the course**: Image processing, Data Sciences, Machine Learning, Networking | | **4 hrs** |

**Text Books**

1. Phillip Kaye, Raymond Laflamme and Michele Mosca "An Introduction to Quantum Computing ", Oxford University, Press, 2007
2. User Guide - Quantum Toolbox in Python, Release 4.2.0 – Qutip.org

**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1, 2,3 | Solve Any **2** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 4,5,6 | Solve Any **2** |
| III | Q.No.-7 | 7 | Solve Any **1** |
| | Q.No.-8 | 8 | |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Applied Computational Medicine** | | **Course Code: 24ECSE320** |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 4 hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical: 28hrs** | **Exam Duration: 2 hrs** |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Advanced Systems Biology:** Integrative Omics Approaches, Advanced Network Analysis, Multi-Scale Modeling Applications in Precision Medicine | **05 hrs** |
| **2** | **Computational Genomics:** Genomic Data Analysis, Machine Learning in Genomics, Genome-Wide Association Studies (GWAS), Functional Genomics | **05 hrs** |
| **3** | **Computational Proteomics:** Protein Structure Prediction, Mass Spectrometry Data Analysis, Proteomics Data Integration, Applications in Drug Discovery | **05 hrs** |
| | **Unit –II** | |
| **4** | **Computational Metabolomics:** Metabolic Pathway Analysis, Metabolomics Data Interpretation, Metabolic Flux Analysis, Applications in Disease Modeling | **05 hrs** |
| **5** | **Computational Neuroscience:** Neural Network Modeling, Brain-Computer Interfaces, Neuroinformatics, Case Studies: Brain Disorders | **05 hrs** |
| **6** | **Advanced Computational Anatomy:** 3D Reconstruction Techniques, Imaging Data Analysis, Organ-Specific Computational Models, Case Studies: Organs Beyond Brain and Heart | **05 hrs** |

**Text Books:**

NA

**Reference Books:**

1. Lecture Notes and Handouts
2. Reference papers / Slides/ Videos

**Evaluation Scheme**

**ISA Scheme**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Laboratory Assessment | 60 | 34 |
| | **Total** | **67** |

**ESA Scheme**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ESA (Theory) | 60 | 33 |
| | **Total** | **33** |

**List of Exercises**

| Expt. No | Brief description about the experiments | No of lab slots |
|---|---|---|
| 1. | a. To integrate genomics, transcriptomic, proteomics, and metabolomics data to identify potential disease biomarkers.<br>or<br>b. To construct and analyze biological networks, such as gene regulatory networks (GRNs) or protein-protein interaction (PPI) networks. | 02 |
| 2. | a. To analyze genomic sequences, perform DNA sequence alignment, and detect genetic variations (mutations, SNPs).<br>Or<br>a. To develop a machine learning model that predicts drug response for personalized medicine based on patient omics data. | 02 |
| 3. | a. To analyze population-scale genomic data and identify genetic markers associated with specific diseases.<br>Or<br>b. To analyze RNA sequencing (RNA-Seq) data for gene expression profiling in normal vs. diseased tissues | 03 |
| 4. | a. To predict the 3D structure of a protein from its amino acid sequence using computational methods.<br>Or<br>b. To process and analyze mass spectrometry (MS) data to identify proteins in a biological sample. | 02 |
| 5. | a. To integrate proteomics datasets with other omics data (e.g., genomics, transcriptomics) to identify disease biomarkers.<br>Or<br>b. To use molecular docking techniques to predict drug binding interactions with a target protein. | 03 |
| 6. | a. To create a computational model of lung airflow and study respiratory function.<br>Or<br>b. To analyze organ structures, functions, and disease impact beyond the brain and heart. | 02 |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Quantum Algorithms and Cryptography** | | **Course Code: 25ECSE336** |
| **L-T-P: 2-0-1** | **Credits: 3** | **Contact Hrs: 4hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical: 28** | **Exam Duration: 2 hrs** |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Introduction to Quantum Computing:** Mathematical models for quantum mechanics, Single and multi-qubit quantum gates and circuits, Concepts of entanglement, no-cloning theorem, and quantum parallelism. | **06 hrs** |
| **2** | **Quantum Algorithms:** Deutsch-Jozsa, Simon's, Bernstein-Vazirani, Grover's, and Shor's algorithms. | **06 hrs** |
| **3** | **Post-Quantum Cryptography:** Introduction to lattices, codes, and isogenies, Useful lattice problems, Learning with Errors (LWE) and Short Integer Solution (SIS) problems, Connection to dihedral hidden subgroup problem, Basic primitives: post-quantum public key encryption and signatures, Quantum hardness of lattice problems. | **08 hrs** |
| | **Unit –II** | |
| **4** | **Public Key Encryption and Fully Homomorphic Encryption:** Design and analysis of public key encryption schemes. Concepts of fully homomorphic encryption. | **04hrs** |
| **5** | **Quantum Key Distribution:** Protocols for quantum key distribution, Quantum one-time pad and its security implications, Quantum public key encryption, Quantum fully homomorphic encryption. | **06hrs** |

**Text Book**

1. Hiu Yung Wong. Introduction to Quantum Computing: From a Layperson to a Programmer in 30 Steps. Springer, 2023.
2. Marc Joye, Mirela Iftene, and Pascal Paillier. Homomorphic Encryption for Data Science (HE4DS). Springer, 2023

**References:**

1. Zvika Brakerski, Paul Christiano, Urmila Mahadev, Umesh Vazirani, Thomas Vidick. Public-Key Encryption with Quantum Keys. Springer, 2023
2. Agrawal, S. (n.d.). *Quantum Algorithms and Cryptography*. NPTEL – Indian Institute of Technology Madras. Retrieved from https://onlinecourses.nptel.ac.in/noc23_cs04.

| **Lab Experiments** | |
|---|---|
| Lab 1: Quantum Gates and Circuits | Objective: Understand and implement single and multi-qubit quantum gates.<br>Activities:<br>• Implement basic gates like Pauli-X, Y, Z, Hadamard, and CNOT.<br>• Construct simple quantum circuits using these gates.<br>Tools: Qiskit (Python-based quantum computing SDK). |
| Lab 2: Entanglement and No-Cloning Theorem | Objective: Explore quantum entanglement and the implications of the no-cloning theorem.<br>Activities:<br>• Create Bell states to demonstrate entanglement.<br>• Attempt to clone a quantum state and observe the results, reinforcing the no-cloning theorem.<br>Tools: Qiskit, IBM Quantum Lab |
| Lab 3: Quantum Parallelism | Objective: Demonstrate the concept of quantum parallelism.<br>Activities:<br>• Implement superposition states and observe parallel computation outcomes.<br>Tools: Qiskit. |
| Lab 4: Quantum Algorithms | Objective: Implement and analyze fundamental quantum algorithms.<br>Activities:<br>• Deutsch-Jozsa Algorithm: Determine if a function is constant or balanced.<br>• Simon's Algorithm: Find the period of a function.<br>• Bernstein-Vazirani Algorithm: Determine a hidden string.<br>• Grover's Algorithm: Search for an element in an unsorted database.<br>• Shor's Algorithm: Factorize integers.<br>Tools: Qiskit. |
| Lab 5: Lattice-Based Cryptography | Objective: Understand the structure and applications of lattices in cryptography.<br>Activities:<br>• Explore lattice problems like Learning with Errors (LWE) and Short Integer Solution (SIS).<br>• Implement basic lattice-based encryption schemes.<br>Tools: Python |

| | |
|---|---|
| Lab 6: Quantum-Resistant Public Key Encryption and Signatures | Objective: Implement and analyze post-quantum public key encryption and digital signature schemes.<br>Activities:<br>• Implement schemes like CRYSTALS-Kyber (encryption) and CRYSTALS-Dilithium (signatures).<br>• Test the schemes against potential quantum attacks.<br>Tools: Python, available cryptographic libraries. |

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| **Assessment** | **Conducted for marks** | **Weightage in Marks** |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 34 |
| **Total** | | **67** |

**End-Semester Assessment Scheme**

| **Assessment** | **Conducted for marks** | **Weightage in Marks** |
|---|---|---|
| Theory | 60 | 33 |
| | **Total** | **33** |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: Algorithmic Problem Solving** | | **Course Code: 24ECSE309** |
| **L-T-P: 2-0-4** | **Credits: 6** | **Contact Hrs: 10 hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical Hrs: 112** | **Exam Duration: 2 hrs** |

| | | |
|---|---|---|
| | **Unit –I** | |
| **1** | **Design Philosophy and Reflections:** Algorithm Design Techniques and Principles, Case Studies and Reflections | **5 hrs** |
| **2** | **Competitive Programming and Problem Solving:** Why Competitive Programming, Handbook and Rules, Theoretical Implications, Global Level Standard Sets | **5 hrs** |
| **3** | **System Design:** Roadmap, System Design Components, Principles and Theorems, Backend and Front End Design, Communication and Interaction | **5 hrs** |
| | **Unit –II** | |
| **4** | **Dynamic Programming:** Common and Typical Problem Sets, Idea and Intuition, Design of DP Problems | **5 hrs** |
| **5** | **Search Space Analysis:** Search Space, Graph Algorithms, Heuristic Space Analysis | **5 hrs** |
| **6** | **Special Topics:** Special Topics and Case Studies – Contemporary Problems | **5 hrs** |

**Text Books**

1. Levitin A., “Introduction to the Design and Analysis of Algorithms”, Third Edition, Pearson Education, 2017.
2. Levitin A, Levitin M, “Algorithmic Puzzles”, First Edition, Oxford University Press, 2011.
3. Laaksonen A., “Competitive Programmer’s Handbook”, CSES Set, 2018.

**Reference Books:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, Third Edition, MIT Press, 2010.
2. Online Coding Platforms

**Evaluation Scheme**

**In-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| ISA-1 (Theory) | 30 | 17 |
| ISA-2 (Theory) | 30 | |
| Lab Activity | 50 | 33 |
| **Total** | | **50** |

**End-Semester Assessment Scheme**

| Assessment | Conducted for marks | Weightage in Marks |
|---|---|---|
| Theory | 60 | 50 |
| | **Total** | **50** |

**Lab Experiments**

| Experiment No. | Concept | Hours |
|---|---|---|
| 1 | Design Techniques and Reflections | 16 |
| 2 | Mathematics in Competitive Programming | 16 |
| 3 | Dynamic Programming | 16 |
| 4 | Array Query and Case Studies | 16 |
| 5 | Search Space Analysis | 16 |
| 6 | Problem Assortments | 16 |
| 7 | CSES Problem Set | 16 |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Semantic Web** | | | **Course Code: 19ECSE303** |
| **L-T-P: 3-0-0** | **Credits: 3** | | **Contact Hrs: 3hrs/week** |
| **ISA Marks: 50** | **ESA Marks: 50** | | **Total Marks: 100** |
| **Teaching Hrs: 40** | | | **Exam Duration: 03 hrs** |
| **Unit –I** | | | |
| **1** | **Introduction to Semantics:** History of the Web, Limitations, Vision of Semantic Web, Principles, Data Integration Across Web, Data Modeling Methods, Semantic Relationships, Metadata, Perpetual Data | | **4 hrs** |
| **2** | **Expressing Meaning:** Triple Store, Merging Graphs, Querying: Case Study | | **4 hrs** |
| **3** | **Using Semantic Data:** Query Language, Feed Forward Inference, Searching for Connections, Linked Data, Freebase | | **8 hrs** |
| **Unit –II** | | | |
| **4** | **Working with Semantics:** RDF—The Basis of the Semantic Web, OWL, Metadata with RDF, Metadata Taxonomies, Ontology | | **8 hrs** |
| **5** | **Reasoning and Social Web:** Reasoning types: Approximate Reasoning and Bounded Reasoning, Social Semantic Web, Semantic Crawlers | | **8 hrs** |
| **Unit –III** | | | |
| **6** | **Semantic Modeling**<br>Semantic Modeling, Semantic Web Applications, Logic for Semantic Web, Case Studies: Dr. Watson, Yahoo! SearchMonkey | | **8 hrs** |

**Text Books**

1. Grigoris Antoniou, Paul Groth, Frank van Harmelen and Rinke Hoekstra, A Semantic Web Primer, MIT Press; 3rd edition, 2012.
2. Toby Segaran, Colin Evans, and Jamie Taylor, Programming the Semantic Web: Build Flexible Applications with Graph Data, O'Reilly Media; 2 edition, July 2009.

**Reference Books:**

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, Foundations of Semantic Web Technologies, Chapman and Hall; 1st edition, 2009.
2. Dean Allemang, and James Hendler, Semantic Web for the Working Ontologist, Effective Modeling in RDFS and OWL, Morgan Kaufmann; 2nd edition, 2011.
3. John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez, and Mike Dean (Foreword), Semantic Web Programming, Wiley Publishers, 1 edition 2009.

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**Scheme for End Semester Assessment (ESA)**

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter Numbers | Instructions |
|---|---|---|---|
| I | Q.No.-1, Q.No.-2, Q.No.-3 | 1, 2,3 | Solve Any **2** |
| II | Q.No.-4, Q.No.-5, Q.No.-6 | 4,5 | Solve Any **2** |
| III | Q.No.-7 | 6 | Solve Any **1** |
| | Q.No.-8 | 6 | |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: DevOps** | | | **Course Code: 24ECSE310** |
| **L-T-P: 1-0-2** | **Credits: 3** | | **Contact Hrs: 5hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | | **Total Marks: 100** |
| **Teaching Hrs: 20** | **Practical: 56** | | **Exam Duration: 3 hrs** |
| **Unit –I** | | | |
| **1** | **Introduction to Devops and Linux for Automation:** Introducing DevOps, Software development life cycle, Agile practice applied to Devops, Infrastructure As Code, Continuous Integration and Development.<br>**Linux and Automation**: File System and Directory Management, Process Management, User and Group Management, Network Management, Package Management | | **3 hrs** |
| **2** | **Introduction to AWS and Version Control Systems: AWS Cloud**: Introduction to cloud computing & AWS, Regions & AZ's, EC2, EBS, EFS, Auto scaling, Load balancing & Route 53, VPC, Object storage(S3), AWS Lambda & CLI.<br>**Version Control with Git:** Source Code Management (SCM), Git branching and merging, Git Overview, creating pull request, Code Review, Merging changes, Create a repo and push code on GibHub / Bitbucket. | | **3 hrs** |
| **3** | **Containerization and Continuous Integration in AWS: Jenkins**- launching Jenkins through Terraform, configuration, integrating Git with Jenkins, integrating Maven with Jenkins, Building first Jenkins job.<br>**Docker:** Containers Concepts, Container Vs Virtual Machine, Docker installation, Managing Container with Docker Commands, Building your own docker images. | | **5 hrs** |
| **4** | **Configuration Management and Continuous Monitoring: Ansible:** Introduction, integrating Ansible with Jenkins, creating Docker image and pushing in ECR, creating CI playbook, Integrating CI playbook in CI job, creating CD playbook, Integrating CD playbook in CD job, Nagios. | | **4 hrs** |

**Text Books:**


1. Joakim Verona, "Practical DevOps." Packt Publishing Ltd, Feb. 2016, ISBN: 9781785882876
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans." Leanpub, 2015.
3. John Ferguson, "Jenkins: The Definitive Guide" Smart Publisher: O'Reilly Media, Release Date: June 2016.


**Reference Books:**


1. Jennifer Davis, Ryn Daniels, "Effective DevOps, Building a Culture of Collaboration, Affinity, and Tooling at Scale", Publisher: O'Reilly Media, Release Date: June 2016.

2. Gene Kim, Patrick Debois, John Willis, Jez Humble, "The DevOps Handbook: How to Create World-Class Speed, Reliability, and Security in Technology Organizations", IT Revolution Press, 2016.

**List of Experiments**

| Expt. No. | Experiments | No. of Slots |
|---|---|---|
| 1. | • Exploring AWS cloud services<br>• Exploring Linux commands for automation on AWS cloud server | 1 |
| 2. | • Exploring Git Commands through Collaborative coding.<br>• Implement GitHub Operations | 2 |
| 3. | • Applying CI/CD Principles to Web Development<br>• Using Jenkins, Git, and Local HTTP Server | 2 |
| 4. | • Exploring Containerization and Application<br>• Deployment with Docker<br>• Applying CI/CD Principles to Web Development<br>• Create the GitHub A/C to demonstrate CI/CD pipeline using Cloud Platform. | 3 |
| 5. | • Certification Courses: Infosys Springboard<br>➢ Linux for Cloud & DevOps Engineers (https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01415770309187993629 3/overview)<br>➢ Practical AWS for DevOps: Exploring AWS DevOps Services (https://infyspringboard.onwingspan.com/web/en/viewer/html/lex_auth_01381750634955571253 6)<br>➢ Jenkins (https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01309444052195737625 53_shared/overview)<br>➢ Ansible (https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01309441859173580820 36_shared/overview)<br>➢ Docker (https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01329507424063488045376_shared/overview) | 4 |
| 6. | • Course Project Review (3 Reviews) | 3 |

**Evaluation Scheme (ISA)**

| Assessment | Conducted for Marks | | Weightage in Marks |
|---|---|---|---|
| Theory | **ISA** | **40** | **34** |
| Lab | Evaluation 1 | 10 | |
| | Project review -Phase 1 | 10 | |
| | Project Review – Phase 2 | 10 | |
| | Project Review – Phase 3 | 10 | |
| | Infosys Springboard certification | 20 | |
| | **Lab Assessment Total** | **60** | **33** |
| | | **Total** | **67** |

**Evaluation Scheme (ESA)**

| Assessment | Conducted for Marks | Weightage in Marks |
|---|---|---|
| ESA Lab | 40 | 33 |
| | **Total** | **33** |

BACK

| Program: Bachelor of Engineering | | |
|---|---|---|
| **Course Title: MLOps** | | **Course Code: 25ECSE337** |
| **L-T-P: 1-0-2** | **Credits: 3** | **Contact Hrs: 5 hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | **Total Marks: 100** |
| **Teaching Hrs: 15** | **Practical Hrs: 56** | **Exam Duration: NA** |

| Unit - I | | |
|---|---|---|
| **1** | **Foundations of MLOps:** Introduction to machine learning operations MLOps: Lifecycle, MLOps vs DevOps, Tools overview, Docker: Containers vs VMs, Docker images, Docker Compose basics | **06 hrs** |
| **2** | **Version Control for Data & Models, CI/CD Automation:** Data Version Control (DVC): Versioning datasets/models, metrics tracking CI/CD Concepts: Overview, Jenkins basics, GitHub Actions or GitLab CI Automation: Triggering model training using CI tools | **09 hrs** |
| **3** | **Model Training Pipelines & Monitoring:** MLFlow: Experiment tracking, Projects, Model Registry<br>Kubernetes Basics: Pods, Deployments, and Services using Minikube<br>Monitoring Tools: Prometheus, Grafana basics. | **05 hrs** |
| **4** | **Cloud-based MLOps & Final Deployment Projects:** AWS MLOps Overview: S3, CodeBuild, SageMaker basics<br>Azure MLOps Overview: Azure ML Studio, YAML pipelines (optional)<br>Model Deployment: Dockerize, CI/CD integration, Monitoring | **04 hrs** |

**Reference Weblink:**

1. https://now.informatica.com/Customer-360-SaaS-for-Business-Users-Instructor-Led.html

**Evaluation Scheme (ISA)**

| Assessment | Conducted for Marks | Weightage in Marks |
|---|---|---|
| IS (Theory) | 40 | 33 |
| Lab | 60 | 34 |
| | **Total** | **67** |

**Evaluation Scheme (ESA)**

| Assessment | Conducted for Marks | Weightage in Marks |
|---|---|---|
| Lab | 40 | 33 |
| | **Total** | **33** |

**Laboratory Plan**

| Sl. No. | Experiments | Number of slots |
|---|---|---|
| 1. | Linux and Shell Scripting Basics,Git and GitHub Integration | 1 |
| 2. | DVC Setup for Data Versioning | 1 |
| 3. | Pipeline Creation and Experiment Management, | 2 |
| 4. | Dockerize a Flask ML Application | 2 |
| 5. | Kubernetes Deployment on Minikube and CI/CD Pipeline with Jenkins | 2 |
| 6. | Monitor Metrics with Prometheus and Grafana | 2 |
| 7 | Model Lifecycle Management with MLFlow | 2 |
| 8 | Deploy ML Model using SageMaker | 2 |

BACK

| Program: Bachelor of Engineering | | | |
|---|---|---|---|
| **Course Title: Theories of Intelligent Systems** | | | **Course Code: 25ECSE338** |
| **L-T-P: 2-0-1** | **Credits: 3** | | **Contact Hrs: 4hrs/week** |
| **ISA Marks: 67** | **ESA Marks: 33** | | **Total Marks: 100** |
| **Teaching Hrs: 30** | **Practical Hrs: 28** | | **Exam Duration: 2 hrs** |
| **Unit – I** | | | |
| **1** | **Turing Machines and Idea of Computation:** Idea of Computation, Turing Machines, Ideas from Leibniz, Babbage, Turing, Imitation Game, Chinese Room Experiment, Computing Machinery and Intelligence | | **5 hrs** |
| **2** | **Languages and Limits:** Grammar and Metaphor Cognition, Ambiguity and Recursion in Human Languages, Gödel's incompleteness, Wittgenstein on language limits, Programming Languages as Formal Systems, Functional Programming. | | **5 hr** |
| **3** | **Computational Complexity:** Real-world Problem-Solving Trade-offs, Optimization vs. Heuristic Problem-Solving, Visualization of Complexity, Verifiers vs. Solvers, Reductions (Intuitive Idea: Translating Puzzles), SAT and Why it Matters. | | **5 hrs** |
| **Unit – II** | | | |
| **4** | **Distributed Thinking:** Beyond TM: Interactive Computations, Logical Time: Lamport Timestamps, The Two Generals Problem, Byzantine Generals, CAP Theorem, Paxos / Raft. | | **5 hrs** |
| **5** | **Machines and Meaning:** Symbolic AI vs Connectionist Models, Generative AI: Creativity and Randomness, Ethical and Existential Implications, Embodied Cognition, Posthumanism, Human-in-the-loop systems, Technology as cognitive scaffolding | | **5 hrs** |
| **6** | **Computation and Consciousness:** Integrated Information Theory (IIT), Global Workspace Theory (GWT), Hard Problem of Consciousness (Chalmers), Philosophical zombies, qualia, and AI | | **5 hrs** |

**Text Books:**

1. George S. Boolos, John P. Burgess, Richard C. Jeffrey, Computability and Logic, 5th Edition, Cambridge University Press, 2007.
2. Michael Sipser, Introduction to the Theory of Computation, 3rd Edition, Cengage Learning, 2012.
3. Case Studies and Research Papers as per chapter topics

**Reference Books:**

1. Margaret A. Boden, Mind as Machine: A History of Cognitive Science, 1st Edition, Oxford University Press, 2006.
2. Andrew S. Tanenbaum, Maarten van Steen, Distributed Systems: Principles and Paradigms, 2nd Edition, Pearson Education, 2007.

**Evaluation Scheme**

**ISA Scheme**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ISA-1 (Theory) | 30 | 33 |
| ISA-2 (Theory) | 30 | |
| Laboratory Assessment | 60 | 34 |
| | **Total** | **67** |

**ESA Scheme**

| Assessment | Conducted for marks | Weightage in (%) |
|---|---|---|
| ESA (Theory) | 60 | 33 |
| | **Total** | **33** |

**List of Exercises**

| Expt./ No. | Brief description about the experiment/job | No. of Lab. Slots |
|---|---|---|
| 1. | Turing Machines | 2 |
| 2. | Functional Programing, Principles and Limitations | 2 |
| 3. | Computational Complexity | 2 |
| 4. | Distributed Thinking | 2 |
| 5. | Machines and Meaning | 2 |
| 6. | Case Studies: Turing Test, Halting Problem | 2 |

BACK