# R.M.D. ENGINEERING COLLEGE

**(An Autonomous Institution)**

**REGULATIONS–2024**
**CHOICE BASED CREDIT SYSTEM**
**B.E. COMPUTER SCIENCE AND ENGINEERING**
(For the students admitted in the Academic year 2025-2026)

## PROGRAM EDUCATIONAL OBJECTIVES

**PEO 1**

To enable graduates to pursue higher education and research, or have a successful career in industries associated with Computer Science and Engineering, or as entrepreneurs.

**PEO 2**

To ensure that graduates will have the ability and attitude to adapt to emerging technological changes.

**PEO 3**

To enable graduates to value social responsibility and possess strong leadership and interpersonal abilities.

## PROGRAMME OUTCOMES (POs)

**On successful completion of the programme, Engineering Graduates will be able to:**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needswith appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context oftechnological change.

**PROGRAMME SPECIFIC OUTCOMES (PSOs)**

**After the successful completion of the program, the graduates will be able to: PSO 1**

To analyze, design and develop computing solutions by applying foundational concepts of Computer Science and Engineering.

**PSO 2**

To apply software engineering principles and practices for developing quality software for scientific and business applications.

**PSO 3**

To adapt to emerging Information and Communication Technologies (ICT) to innovate ideas and solutions to existing/novel problems.

## Mapping of POs/PSOs to PEOs

Contribution 1: Reasonable 2: Significant 3: Strong

### PEOs & POs

The B.E. Computer Science and Engineering program outcomes leading to the achievement of theobjectives are summarized in the following table.

| PROGRAM EDUCATIONAL OBJECTIVES | PROGRAM OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 |
| I | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 1 |
| II | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| III | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 1 | 1 | 1 |

| PROGRAM EDUCATIONAL OBJECTIVES | PROGRAM SPECIFIC OUTCOMES | | |
|---|---|---|---|
| | PSO 1 | PSO 2 | PSO 3 |
| I | 3 | 3 | 3 |
| II | 3 | 3 | 3 |
| III | 1 | 1 | 1 |

## MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Course Outcomes and Programme Outcomes is given in the following table.

Contribution 1: Reasonable 2: Significant 3: Strong

**R.M.D. ENGINEERING COLLEGE**
**B.E. COMPUTER SCIENCE AND ENGINEERING**
**REGULATION – 2024**
**CURRICULUM SEMESTER I to VIII**
**&**
**SYLLABUS SEMESTER I to IV**
**CHOICE BASED CREDIT SYSTEM**
(For the Students admitted in the Academic Year 2025-26)
**SEMESTER - I**

| Sl. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY COURSES** | | | | | | | | |
| 1. | 24MA101 | Matrices and Calculus | BSC | 4 | 3 | 1 | 0 | 4 |
| 2. | 24GE101 | Heritage of Tamils | HSMC | 1 | 1 | 0 | 0 | 1 |
| 3. | 24HS111 | Interpersonal skills, PsychometricAnalysis and Career Development | EEC | 1 | 1 | 0 | 0 | 1 |
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 4. | 24CS101 | Programming in C++ | ESC | 6 | 3 | 0 | 3 | 4.5 |
| 5. | 24CS102 | Software Development Practices | ESC | 6 | 3 | 0 | 3 | 4.5 |
| 6. | 24CH101 | Engineering Chemistry | BSC | 5 | 3 | 0 | 2 | 4 |
| 7. | 24EC101 | Digital Principles and System Design | ESC | 5 | 3 | 0 | 2 | 4 |
| **LABORATORY COURSES** | | | | | | | | |
| 8. | 24GE111 | Idea Lab I (Non Credit) | EEC | 1 | 0 | 0 | 1 | 1 |
| **MANDATORY COURSES** | | | | | | | | |
| 9. | 24MC101 | Students Induction Program (Non Credit) | MC | 3 Weeks | | | | |
| 10. | 24MC102 | Programming in C (Non Credit) | MC | 40 Periods | | | | |
| 11. | | Physical Education – I (Non Credit) | AC | 1 | 0 | 0 | 1 | 0 |
| 12. | | NSS/YRC/UBA(Non Credit) | AC | 1 Week | | | | |
| | | | **TOTAL** | **30** | **17** | **1** | **12** | **24** |

## SEMESTER -II

| Sl. No. | COURSE CODE | COURSE TITLE | CATE GORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY COURSES** | | | | | | | | |
| **1.** | 24GE201 | Tamils and Technology | HSMC | 1 | 1 | 0 | 0 | 1 |
| **2.** | 24HS211 | Innovation and CreativitySkills Development | EEC | 1 | 1 | 0 | 0 | 1 |
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| **3.** | 24MA201 | Linear Algebra and Applications | BSC | 5 | 3 | 0 | 2 | 4 |
| **4.** | 24CS201 | Data Structures | ESC | 6 | 3 | 0 | 3 | 4.5 |
| **5.** | 24CS202 | Java Programming | ESC | 6 | 3 | 0 | 3 | 4.5 |
| **6.** | 24PH201 | Physics for InformationScience | BSC | 5 | 3 | 0 | 2 | 4 |
| **7.** | 24AM201 | Introduction to Artificial Intelligence | ESC | 4 | 2 | 0 | 2 | 3 |
| **LABORATORY COURSES** | | | | | | | | |
| **8.** | 24GE211 | Idea Lab II | EEC | 4 | 0 | 0 | 4 | 2 |
| **MANDATORY COURSES** | | | | | | | | |
| **9.** | 24CH102 | Environmental Science & Sustainability (Non Credit) | MC | 2 | 2 | 0 | 0 | 0 |
| **10.** | 24MC201 | Yoga for Stress Management(Non Credit) | AC | 1 | 0 | 0 | 1 | 0 |
| **11.** | | Physical Education – II (Non Credit) | AC | 1 | 0 | 0 | 1 | 0 |
| **12.** | | Foreign Language (Japanese/German/Korean) | AC | | Basic (Level 1) Certification | | | |
| | | | **TOTAL** | **36** | **18** | **0** | **18** | **24** |

## SEMESTER-III

| Sl. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY COURSES** | | | | | | | | |
| 1. | 24MA301 | Discrete Mathematics | BSC | 4 | 3 | 1 | 0 | 4 |
| 2. | 24GE301 | Universal Human Values II: Understanding Harmony | HSMC | 3 | 2 | 1 | 0 | 3 |
| 3. | 24CS301 | Computer Organization and Architecture | ESC | 3 | 3 | 0 | 0 | 3 |
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 4. | 24CS302 | Advanced Java Programming | PCC | 6 | 3 | 0 | 3 | 4.5 |
| 5. | 24CS303 | Database Management Systems | PCC | 6 | 3 | 0 | 3 | 4.5 |
| 6. | 24CS304 | Operating Systems | PCC | 4 | 2 | 0 | 2 | 3 |
| **LABORATORY COURSES** | | | | | | | | |
| 7. | 24GE311 | Product Development Lab - 1 | EEC | 2 | 0 | 0 | 2 | 1 |
| 8. | 24CS311 | Aptitude and Coding Skills I | EEC | 4 | 0 | 0 | 4 | 2 |
| 9. | 24CS312 | Internship/Seminar (1 Week) | EEC | 1 | 0 | 0 | 1 | 0.5 |
| **MANDATORY COURSES** | | | | | | | | |
| 10. | 24MC301 | Indian Constitution(Non Credit) | MC | 1 | 1 | 0 | 0 | 0 |
| | | | **TOTAL** | **34** | **17** | **2** | **15** | **25.5** |

## SEMESTER-IV

| Sl. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 1. | 24MA401 | Probability and Statistics | BSC | 5 | 3 | 0 | 2 | 4 |
| 2. | 24CS401 | Computer Networks | PCC | 5 | 3 | 0 | 2 | 4 |
| 3. | 24CS402 | Design and Analysis of Algorithms | PCC | 5 | 3 | 0 | 2 | 4 |
| 4. | 24IT402 | Web Development Frameworks | PCC | 6 | 3 | 0 | 3 | 4.5 |
| 5. | | Professional Elective I | PEC | 4 | 2 | 0 | 2 | 3 |
| **LABORATORY COURSES** | | | | | | | | |
| 6. | 24GE411 | Product Development Lab - 2 | EEC | 4 | 0 | 0 | 4 | 2 |
| 7. | 24CS411 | Aptitude and Coding Skills II | EEC | 4 | 0 | 0 | 4 | 2 |
| **AUDIT COURSES** | | | | | | | | |
| 8. | 24AC401 | Value Education (Non Credit) | AC | 1 | 1 | 0 | 0 | 0 |
| | | | **TOTAL** | **34** | **15** | **0** | **19** | **23.5** |

## SEMESTER-V

| Sl. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY COURSES** | | | | | | | | |
| 1. | 24CS501 | Theory of Computation | PCC | 3 | 3 | 0 | 0 | 3 |
| 2. | | Professional Elective III | PEC | 3 | 3 | 0 | 0 | 3 |
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 3. | 24CS502 | Distributed and Cloud Computing | PCC | 4 | 2 | 0 | 2 | 3 |
| 4. | | Machine Learning | PCC | 5 | 3 | 0 | 2 | 4 |
| 5. | | Professional Elective II | PEC | 4 | 2 | 0 | 2 | 3 |
| **LABORATORY COURSES** | | | | | | | | |
| 6. | | Professional Communication – I (TOEFL) | HSMC | 4 | 0 | 0 | 4 | 2 |
| 7. | | Industry Oriented Course- I | EEC | 2 | 0 | 0 | 2 | 1 |
| 8. | 24CS511 | Advanced Aptitude and Coding Skills I | EEC | 4 | 0 | 0 | 4 | 2 |
| 9. | 24CS512 | Internship/Seminar (2 Weeks) | EEC | 2 | 0 | 0 | 2 | 1 |
| **AUDIT COURSES** | | | | | | | | |
| 10. | 24MC501 | Essence of Indian Traditional Knowledge (Non Credit) | MC | 1 | 1 | 0 | 0 | 0 |
| | | | **TOTAL** | **32** | **14** | **0** | **18** | **22** |

**SEMESTER-VI**

| Sl. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY COURSES** | | | | | | | | |
| 1. | | Professional Elective IV | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | | Open Elective I | OEC | 3 | 3 | 0 | 0 | 3 |
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 3. | 24CS601 | Compiler Design | PCC | 5 | 3 | 0 | 2 | 4 |
| 4. | 24CS602 | Cryptography and Cyber Security | PCC | 5 | 3 | 0 | 2 | 4 |
| 5. | 24CS603 | Object Oriented Software Engineering | PCC | 4 | 2 | 0 | 2 | 3 |
| 6. | | Design Thinking | HSMC | 3 | 1 | 0 | 2 | 2 |
| **LABORATORY COURSES** | | | | | | | | |
| 7. | | Professional Communication – II (TOEFL) | HSMC | 2 | 0 | 0 | 2 | 1 |
| 8. | | Industry Oriented Course- II/ Self Learning Course | EEC | 0 | 0 | 0 | 0 | 3 |
| 9. | 22CS611 | Advanced Aptitude and Coding Skills II | EEC | 4 | 0 | 0 | 4 | 2 |
| **AUDIT COURSES** | | | | | | | | |
| 10. | 24AC601 | Personality Development (Non Credit) | AC | 2 | 2 | 0 | 0 | 0 |
| | | | **TOTAL** | **31** | **17** | **0** | **14** | **25** |

**SEMESTER-VII**

| Sl. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 1. | 24CS701 | Data Analytics | PCC | 5 | 3 | 0 | 2 | 4 |
| 2. | 24CS702 | Mobile Computing | PCC | 4 | 2 | 0 | 2 | 3 |
| 3. | | Professional Elective V | PEC | 4 | 2 | 0 | 2 | 3 |
| **LABORATORY COURSES** | | | | | | | | |
| 4. | | Internship/Seminar (4 weeks) | EEC | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **17** | **7** | **0** | **10** | **12** |

**SEMESTER-VIII**

| Sl. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 1. | 24CS811 | Project | EEC | 16 | 0 | 0 | 16 | 8 |
| | | | **TOTAL** | **16** | **0** | **0** | **16** | **8** |

**TOTAL CREDITS: 164**

## Summary

| S. No. | Subject Area | CREDITS AS PER SEMESTER | | | | | | | | Total Credits | Percentage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | | |
| 1. | HSMC | 1 | 1 | 3 | | 2 | 3 | | | 10 | 6.10% |
| 2. | BSC | 8 | 8 | 4 | 4 | | | | | 24 | 14.63% |
| 3. | ESC | 13 | 12 | 3 | | | | | | 28 | 17.07% |
| 4. | PCC | | | 12 | 12.5 | 10 | 11 | 7 | | 52.5 | 32.01% |
| 5. | PEC | | | | 3 | 6 | 3 | 3 | | 15 | 9.14% |
| 6. | OEC | | | | | | 3 | | | 3 | 1.82% |
| 7. | EEC | 2 | 3 | 3.5 | 4 | 4 | 5 | 2 | 8 | 31.5 | 19.20% |
| 8. | MC | | | | | | | | | | |
| TOTAL | | 23 | 23 | 25 | 22 | 21.5 | 22.5 | 18 | 8 | 164 | |

**HSMC - Humanities and Social Sciences including Management Course; BSC – Basic Science Course; ESC – Engineering Science Course; PCC – Professional Core Course; PEC – Professional Elective Course; OEC – Open Elective Course; EEC – Employability Enhancement Course; MC – Mandatory Course; AC – Audit Course.**

## PROFESSIONAL ELECTIVE COURSES: VERTICALS

| Cyber Security | Cloud Computing | Full Stack Technology | Emerging Technologies |
|---|---|---|---|
| Ethical Hacking (Lab Integrated) | Cloud Foundations (Lab Integrated) | UI/UX Design (Lab Integrated) | Multimedia Computing |
| Social Network Security (Lab Integrated) | Rest Application Development Using Spring Boot and JPA (Lab Integrated) | Rest Application Development Using Spring Boot and JPA (Lab Integrated) | GPU Computing |
| Rest Application Development Using Spring Boot and JPA (Lab Integrated) | Virtualization | Software Testing and Automation | Introduction to Augmented and Virtual Reality |
| Blockchain Technology | Data Engineering in Cloud | Blockchain Technology | Digital Marketing |
| Cloud and Data Security | Devops (Lab Integrated) | Usability Design of Software Application | Quantum Computing |
| Enterprise Cyber Security | Machine Learning for NLP in Cloud | Devops (Lab Integrated) | Intelligent Robots |
| Digital and Mobile Forensics | Microservice Architecture | Microservice Architecture | Next Gen Computing |
| | | | Principles of 3D Printing and Design |
| | | | High Performance Computing |

## HONOUR DOMAIN SUBJECTS

| Cyber Security | Cloud Computing | Full Stack Technology | Data Science | Artificial Intelligence |
|---|---|---|---|---|
| Vulnerability Analysis and Penetration Testing | Software Defined Networks | MERN Stack Development (Lab Integrated) | Foundations of Data Science | Soft Computing |
| Engineering Secure Software Systems | Storage Technologies | Web Application Security | Data Exploration and Visualization | Knowledge Engineering |
| Network Design and Programming | Cloud Security Foundations | Generative AI Fundamentals | Healthcare Analytics | Reinforcement Learning |
| Fault Tolerant Computing | Cloud Services Management | Mobile Architecture and Application Development (Lab Integrated) | Generative AI Fundamentals | Recommender Systems |
| Capstone Project | Capstone Project | Capstone Project | Text and Speech Analytics | Natural Language Processing |
| Rest Application Development using Spring Boot and JPA | Rest Application Development using Spring Boot and JPA | Rest Application Development using Spring Boot and JPA | Image and Video Analytics | Applied AI and ML |
| | | | Cognitive Science and Analytics | Generative AI Fundamentals |
| | | | Capstone Project | Capstone Project |

## ELECTIVE VERTICALS

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **CYBER SECURITY** | | | | | | | | |
| 1 | 24CS901 | Ethical Hacking (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| 2 | 24CS902 | Social Network Security (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| 3 | 24CS903 | Blockchain Technology (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| 4 | 24CS904 | Cloud and Data Security | PEC | 3 | 3 | 0 | 0 | 3 |
| 5 | 24CS905 | Enterprise Cyber Security | PEC | 3 | 3 | 0 | 0 | 3 |
| 6 | 24CS906 | Digital and Mobile Forensics | PEC | 3 | 3 | 0 | 0 | 3 |
| 7 | 24IT903 | Rest Application Development using Spring Boot and JPA | PEC | 4 | 2 | 0 | 2 | 3 |
| **CLOUD COMPUTING** | | | | | | | | |
| 1 | 24CS911 | Cloud Foundations (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| 2 | 24CS912 | Virtualization | PEC | 3 | 3 | 0 | 0 | 3 |
| 3 | 24CS913 | Data Engineering in Cloud | PEC | 3 | 3 | 0 | 0 | 3 |
| 4 | 24CS914 | Devops (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| 5 | 24CS915 | Machine Learning for NLP in Cloud | PEC | 3 | 3 | 0 | 0 | 3 |
| 6 | 24CS916 | Microservice Architecture | PEC | 3 | 3 | 0 | 0 | 3 |
| 7 | 24IT903 | Rest Application Development using Spring Boot and JPA | PEC | 4 | 2 | 0 | 2 | 3 |
| **FULL STACK TECHNOLOGY** | | | | | | | | |
| 1 | 24CS921 | UI/UX Design (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| 2 | 24CS922 | Software Testing and Automation | PEC | 4 | 2 | 0 | 2 | 3 |
| 3 | 24CS903 | Blockchain Technology (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| 4 | 24CS923 | Usability Design of Software Application | PEC | 3 | 3 | 0 | 0 | 3 |
| 5 | 24CS914 | Devops (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| 6 | 24CS916 | Microservice Architecture | PEC | 3 | 3 | 0 | 0 | 3 |
| 7 | 24IT903 | Rest Application Development using Spring Boot and JPA | PEC | 4 | 2 | 0 | 2 | 3 |
| **EMERGING TECHNOLOGIES** | | | | | | | | |
| 1 | | Multimedia Computing | PEC | 3 | 3 | 0 | 0 | 3 |
| 2 | 24CS930 | GPU Computing | PEC | 3 | 3 | 0 | 0 | 3 |
| 3 | 24CS931 | Introduction to Augmented and Virtual Reality | PEC | 3 | 3 | 0 | 0 | 3 |
| 4 | 24CS932 | Digital Marketing | PEC | 3 | 3 | 0 | 0 | 3 |
| 5 | 24CS933 | Quantum Computing | PEC | 3 | 3 | 0 | 0 | 3 |
| 6 | 24CS934 | Intelligent Robots | PEC | 3 | 3 | 0 | 0 | 3 |
| 7 | 24CS935 | Next Gen Computing | PEC | 3 | 3 | 0 | 0 | 3 |
| 8 | 24CS936 | Principles of 3D Printing and Design | PEC | 3 | 3 | 0 | 0 | 3 |
| 9 | 24CS937 | High Performance Computing | PEC | 3 | 3 | 0 | 0 | 3 |

## HONOUR DOMAIN SUBJECTS

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **CYBER SECURITY** | | | | | | | | |
| 1 | 24CS907 | Vulnerability Analysis and Penetration Testing | | 3 | 3 | 0 | 0 | 3 |
| 2 | 24CS908 | Engineering Secure software systems | | 3 | 3 | 0 | 0 | 3 |
| 3 | 24CS909 | Network Design and Programming | | 3 | 3 | 0 | 0 | 3 |
| 4 | 24CS910 | Fault Tolerant Computing | | 3 | 3 | 0 | 0 | 3 |
| 5 | 24CS928 | Capstone Project | | 12 | 0 | 0 | 12 | 6 |
| **CLOUD COMPUTING** | | | | | | | | |
| 1 | 24CS917 | Software Defined Networks | | 3 | 3 | 0 | 0 | 3 |
| 2 | 24CS918 | Storage Technologies | | 3 | 3 | 0 | 0 | 3 |
| 3 | 24CS919 | Cloud Security Foundations | | 3 | 3 | 0 | 0 | 3 |
| 4 | 24CS920 | Cloud Services Management | | 3 | 3 | 0 | 0 | 3 |
| 5 | 24CS928 | Capstone Project | | 12 | 0 | 0 | 12 | 6 |
| **FULL STACK TECHNOLOGY** | | | | | | | | |
| 1 | 24CS924 | MERN Stack Development (Lab Integrated) | | 4 | 2 | 0 | 2 | 3 |
| 2 | 24CS925 | Web Application Security | | 3 | 3 | 0 | 0 | 3 |
| 3 | 24CS926 | Generative AI Fundamentals | | 3 | 3 | 0 | 0 | 3 |
| 4 | 24CS927 | Mobile Architecture and Application Development (Lab Integrated) | | 4 | 2 | 0 | 2 | 3 |
| 5 | 24CS928 | Capstone Project* | | 12 | 0 | 0 | 12 | 6 |
| **DATA SCIENCE** | | | | | | | | |
| 1 | 24AM901 | Foundations of Data Science | | 4 | 2 | 0 | 2 | 3 |
| 2 | 24AM502 | Data Exploration and Visualization | | 4 | 2 | 0 | 2 | 3 |
| 3 | | Healthcare Analytics | | 3 | 3 | 0 | 0 | 3 |
| 4 | 24CS926 | Generative AI Fundamentals | | 3 | 3 | 0 | 0 | 3 |
| 5 | 24AM902 | Text and Speech Analytics | | 3 | 3 | 0 | 0 | 3 |
| 6 | 24AM908 | Image and Video Analytics | | 3 | 3 | 0 | 0 | 3 |
| 7 | 24CS928 | Capstone Project | | 12 | 0 | 0 | 12 | 6 |
| **ARTIFICIAL INTELLIGENCE** | | | | | | | | |
| 1 | 24CS929 | Soft Computing | | 4 | 2 | 0 | 2 | 3 |
| 2 | 24AM933 | Knowledge Engineering | | 3 | 3 | 0 | 0 | 3 |
| 3 | | Reinforcement Learning | | 3 | 3 | 0 | 0 | 3 |
| 4 | 24AM932 | Recommender Systems | | 3 | 3 | 0 | 0 | 3 |
| 5 | | Natural Language Processing | | 3 | 3 | 0 | 0 | 3 |
| 6 | | Applied AI and ML | | | | | | |
| 7 | 24CS926 | Generative AI Fundamentals | | 3 | 3 | 0 | 0 | 3 |
| 8 | 24CS928 | Capstone Project | | 12 | 0 | 0 | 12 | 6 |

## SEMESTER – I

| 24MA101 | MATRICES AND CALCULUS (Common to B.E./B.Tech., all branches except CSBS) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Explain the concepts of matrix algebra techniques.
- Understand various techniques to solve second and higher order differential equations.
- Demonstrate simple applications of functions of several variables and vector calculus.
- Comprehend the basic concepts of multiple integrals.
- Illustrate elementary ideas of vector calculus.

| UNIT I | MATRICES | 12 |
|---|---|---|

Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices by orthogonal transformation (excluding similarity transformation) – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

| UNIT II | DIFFERENTIAL EQUATIONS | 12 |
|---|---|---|

Second and Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

| UNIT III | FUNCTIONS OF SEVERAL VARIABLES | 12 |
|---|---|---|

Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's seriesfor functions of two variables – Maxima and minima of functions of two variables– Lagrange's method of undetermined multipliers.

| UNIT IV | MULTIPLE INTEGRALS | 12 |
|---|---|---|

Double integrals – Change of order of integration – Area enclosed by Cartesian Coordinates (excluding polar coordinates) – Triple integrals (excluding spherical and cylindrical coordinates) – Volume of solids (Cartesian Coordinates only).

| UNIT V | VECTOR CALCULUS | 12 |
|---|---|---|

Gradient, divergence and curl (excluding vector identities) – Directional derivative – Irrotational and Solenoidal vector fields – Green's theorem in a plane, Stoke's theorem and Gauss divergencetheorem (Statement only) - Simple applications involving cubes and rectangular parallelopipeds.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1**: Compute the matrix inverse and their higher powers.

**CO2:** Solve second and higher order differential equations.

**CO3:** Determine the maxima and minima of functions of two variables.

**CO4:** Determine the volume and surface area using multiple integrals.

**CO5:** Evaluate integrals using the concept of vector calculus.

**CO6:** Apply matrix algebra techniques to diagonalize the matrix.

**TEXT BOOKS:**

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2014.

**REFERENCES:**

1. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi,2015.
2. M. K. Venkataraman, "Engineering Mathematics", Volume I, 4th Edition, The NationalPublication Company, Chennai, 2003.
3. Sivaramakrishna Dass, C. Vijayakumari, "Engineering Mathematics", Pearson Education India, 4th Edition 2019.
4. H. K. Dass, and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand PrivateLimited, 3rd Edition 2014.
5. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company,6th Edition, New Delhi, 2008.
6. NPTEL course on "Engineering Mathematics - I", by Prof. Jitendra Kumar, IIT Kharagpur:https://onlinecourses.nptel.ac.in/noc21_ma58/preview

| 24CS101 | PROGRAMMING IN C++ (Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 3 | 4.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To learn problem solving and programming fundamentals.
- To gain knowledge on pointers and functions.
- To apply the principles of object orientated programming.
- To understand operator overloading, inheritance and polymorphism.
- To use the functionalities of I/O operations, files build C++ programs using exceptions.

| UNIT I | PROGRAMMING FUNDAMENTALS | 9+9 |
|---|---|---|

Procedural Languages vs Object Oriented Languages - Types of computer programming languages - Genesis of C++ - Program Life Cycle -Structure of C++ program - Identifiers - Variables - Keywords - Number System -Binary Number System -Octal Number System- Decimal Number System -Hexadecimal Number System - Data types - Constants - Errors – Operators- Expressions - Type Conversions - Control-Flow Statements - Conditional Statements - Iterative Statements - Unconditional Control Statements - Arrays - One-

Dimensional Arrays - Two-Dimensional Arrays - Multi -Dimensional Arrays - Strings - String Manipulation Functions - Array of Strings.

**List of Exercise/Experiments:**

1. Write C++ programs for the following:
    a. Find the sum of individual digits of a positive integer.
    b. Compute the GCD of two numbers.
    c. Find the roots of a number (Newton ‘s method)
2. Write C++ programs using arrays:
    a. Find the maximum of an array of numbers.
    b. Remove duplicates from an array of numbers.
    c. Print the numbers in an array after removing even numbers.
3. Write C++ programs using strings:
    a. Checking for palindrome.
    b. Count the occurrences of each character in a given word.

| **UNIT II** | **POINTERS AND FUNCTIONS** | **9+9** |
|---|---|---|

Pointers - Pointer Variables - Pointer Operators & Expressions -Pointers with Arrays - Functions - Scope Rules -Function Arguments -return Statement - Function Variables - Storage Classes - Types of storage classes - Create Header Files - User-Defined Functions - Inline Functions - Function Overloading -Recursion - Namespaces.

**List of Exercise/Experiments:**

1. Generate salary slip of employees using structures and pointers. Create a structure Employee with the following members: EID, Ename, Designation, DOB, DOJ, Basic pay
   Note that DOB and DOJ should be implemented using structure within structure.
2. Compute internal marks of students for five different subjects using structures and functions.

| **UNIT III** | **CLASSES AND OBJECTS** | **9+9** |
|---|---|---|

Concepts of Object Oriented Programming – Benefits of OOP – Simple C++ program - Classes and Objects - Member functions - Nesting of member functions - Private member functions - Memory Allocation for Objects - Static Data Members - Static Member functions - Array of Objects - Objects as function arguments - Returning objects - friend functions – Const Member functions - Constructors – Destructors.

**List of Exercise/Experiments:**

1. Write a program Illustrating Class Declarations, Definition, and Accessing Class Members.
2. Program to illustrate default constructor, parameterized constructor and copy constructors.

**Practice Questions & Scenario Based Questions:**

1. Imagine you are working as a software engineer at a tech company. Your team is developing a mathematical software library that will be used in various applications across the company. One of the features that your team lead has asked you to implement is a function that calculates the number of trailing zeros in the factorial of a number.
   The team lead has emphasized the importance of encapsulation in your implementation.
2. Create a C++ class Calculator representing a simple calculator. The class should have the following attributes and methods:

   Attributes: Two operands and an operation (+, -, *, /)
   Methods: Perform the operation and return the result

Implement constructors to initialize the calculator with default values (0,0) and with specified values. Also, implement a destructor to perform any necessary cleanup.

| UNIT IV | OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM | 9+9 |
|---|---|---|

Operator Overloading - Overloading Using Friend functions – Inheritance – Types of inheritance – Virtual Base Class - Abstract Class – Constructors in Derived Classes - member class: nesting of classes.

Pointer to objects – this pointer- Pointer to derived Class - Virtual functions – Pure Virtual Functions – Polymorphism.

**List of Exercise/Experiments:**

1. Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.
2. Write a Program to Demonstrate Friend Function and Friend Class.
3. Program to demonstrate inline functions.
4. Program for Overriding of member functions.
5. Write C++ programs that illustrate how the following forms of inheritance are supported:
   a) Single inheritance b) Multiple inheritance c) Multi level inheritance d) Hierarchical inheritance.

**Practice Questions & Scenario Based Questions:**

1. Joy is a software developer at a 3D modeling company. The company is developing a new software tool that will be used by architects and engineers to design and analyze 3D models of various structures. One of the features that her project manager has asked is to implement a function that calculates the volume of basic 3D shapes like cylinders and cuboids. The project manager has emphasized the importance of using function overloading in her implementation.
2. Imagine you are a software developer tasked with creating a utility program for a school that handles student scores. The school wants a simple program where teachers can enter the scores of students for a particular test, and the program will then provide the highest and lowest scores among them. This will help the teachers quickly identify the top performer and the student who might need extra help.
   Your task is to write program that satisfies the above scenario using **inline function**
3. Develop a software system to manage part-time worker students at a university. These students have unique attributes such as their name, student ID, hourly wage, and hours worked per week. Your goal is to create a C++ program that models this system.

Ramu is a software developer at a company specializing in developing software solutions for geometric shapes. Recently, a client approached with a request to create a program to calculate the areas of rectangles and triangles.

| UNIT V | I/O, FILES AND EXCEPTIONS | 9+9 |
|---|---|---|

C++ Streams – Unformatted I/O - Formatted Console I/O – Opening and Closing File – File modes - File pointers and their manipulations – Templates – Class Templates – Function Templates - Exception handling.

**List of Exercise/Experiments:**

1. Program to demonstrate pure virtual function implementation.
2. Count the number of account holders whose balance is less than the minimum balance using sequential access file.
3. Write a Program to Demonstrate the Catching of all Exceptions.

**Practice Questions & Scenario Based Questions:**

1. Develop a simple library management system. Create a base class Book representing

a book in the library. The class should have attributes such as title, author, and ISBN (International Standard Book Number). Implement a virtual function displayDetails() to display information about the book.

2. A software developer working on a banking application. One of the requirements is to analyze account holders' balances based on a minimum balance threshold. The application should read account information from a sequential access file, where each line represents an account record in the format: account_holder_name, balance.
3. The financial company is developing a new software tool that will be used by financial analysts to perform various calculations. One of the features of that project is to implement is a function that performs division of two numbers.
   Write a program that takes two integer inputs, numerator and denominator, from the user. Implement error handling to check if the denominator is zero. If the denominator is zero, display the message "Division by zero is not allowed!" using an exception. If the denominator is not zero, calculate the result of the division and display it.
4. Mini project.

**TOTAL: 45 (L) + 45 (P) = 90 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Solve problems using basic constructs in C++.
**CO2:** Implement C++ programs using pointers and functions.
**CO3:** Apply object-oriented concepts and solve real world problems.
**CO4:** Develop C++ programs using operator overloading and polymorphism.
**CO5:** Implement C++ programs using Files and exceptions.
**CO6:** Develop applications using C++ concepts

**TEXT BOOKS:**


1. Herbert Schildt, “The Complete Reference C++”, 4th edition, MH, 2015.
2. E Balagurusamy,” Object Oriented Programming with C++”, 4th Edition, Tata McGraw-Hill Education, 2008.


**REFERENCES:**


1. Karl Beecher,” Computational Thinking: A beginner's guide to problem-solving and programming”, BCS Learning & Development Ltd, 2017. (Unit 1)
2. Nell Dale, Chip Weems, “Programming and Problem Solving with C++”, 5th Edition, Jones and Barklett Publishers, 2010.
3. John Hubbard, “Schaum's Outline of Programming with C++”, MH, 2016.
4. Yashavant P. Kanetkar, “Let us C++”, BPB Publications, 2020
5. ISRD Group, “Introduction to Object-oriented Programming and C++”, Tata McGraw-Hill Publishing Company Ltd., 2007.
6. D. S. Malik, “C++ Programming: From Problem Analysis to Program Design”, Third Edition, Thomson Course Technology, 2007.
7. Paul Deitel, Harvey Deitel, “C++ How to Program”, 10th Edition, Pearson Education Inc. 2017.
8. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01297200240671948837_shared/overview


**LIST OF EQUIPMENTS:**

1. Standalone desktops with C/C++ compiler (or) Server with C/C++ compiler.

| 24CS102 | SOFTWARE DEVELOPMENT PRACTICES (Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 3 | 4.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To discuss the essence of agile development methods.
- To set up and create a GitHub repository.
- To create interactive websites using HTML
- To design interactive websites using CSS.
- To develop dynamic web page using Java script.

| UNIT I | AGILE SOFTWARE DEVELOPMENT AND Git and GitHub | 9+9 |
|---|---|---|

Software Engineering Practices – Waterfall Model - Agility – Agile Process – Extreme Programming - Agile Process Models – Adaptive Software Development – Scrum – Dynamic Systems Development Method – Crystal – Feature Driven Development – Lean Software Development – Agile Modeling – Agile Unified Process – Tool set for Agile Process.

Introduction to Git –Setting up a Git Repository - Recording Changes to the Repository - Viewing the Commit History - Undoing Things - Working with Remotes -Tagging - Git Aliases - Git Branching - Branches in a Nutshell - Basic Branching and Merging - Branch Management - Branching Workflows - Remote Branches - Rebasing.

Introduction to GitHub – Set up and Configuration - Contribution to Projects, Maintaining a Project – Scripting GitHub.

**List of Exercise/Experiments:**

1. Form a Team, Decide on a project:
    a) Create a repository in GitHub for the team.
    b) Choose and follow a Git workflow
        - Each team member can create a StudentName.txt file with contents about themselves and the team project
        - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
        - Team members can now create a Pull request to merge the branch to master branch or main development branch.
        - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updating.
        - Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.
2. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.

| UNIT II | HTML | 9+9 |
|---|---|---|

Introduction – Web Basics – Multitier Application Architecture – Cline-Side Scripting versus Server-side Scripting – HTML5 – Headings – Linking – Images – Special Characters and Horizontal Rules – Lists – Tables – Forms – Internal Linking – meta Elements – Form input Types – input and datalist Elements – Page-Structure Elements.

**List of Exercise/Experiments:**

1. Create web pages using the following:
    - Tables and Lists
    - Image map

- Forms and Form elements
- Frames

| UNIT III | CSS | 15 |
|---|---|---|

Inline Styles – Embedded Style Sheets – Conflicting Styles – Linking External Style Sheets – Positioning Elements – Backgrounds – Element Dimensions – Box Model and Text Flow – Media Types and Media Queries – Drop-Down Menus – Text Shadows – Rounded Corners – Colour – Box Shadows – Linear Gradients – Radial Gradients – Multiple Background Images – Image Borders – Animations – Transitions and Transformations – Flexible Box Layout Module – Multicolumn Layout.

**List of Exercise/Experiments:**

1. Apply Cascading style sheets for the web pages created.

| UNIT IV | JAVASCRIPT BASICS | 9+9 |
|---|---|---|

Introduction to Scripting – Obtaining user input – Memory Concepts – Arithmetic – Decision Making: Equality and Relational Operators – JavaScript Control Statements – Functions – Program Modules – Programmer-defined functions – Scope rules – functions – Recursion – Arrays – Declaring and Allocating Arrays – References and Reference Parameters – Passing Arrays to Functions – Multidimensional arrays.

**List of Exercise/Experiments:**

1. Form Validation (Date, Email, User name, Password and Number validation) using JavaScript.

| UNIT V | JAVASCRIPT OBJECTS | 9+9 |
|---|---|---|

Objects – Math, String, and Date, Boolean and Number, document Object – Using JSON to Represent objects – DOM: Objects and Collections – Event Handling.

**List of Exercise/Experiments:**

Implement Event Handling in the web pages.

Mini Projects-Develop any one of the following web applications (not limited to one) using above technologies.

a. Online assessment system
b. Ticket reservation system
c. Online shopping
d. Student management system
e. Student result management system
f. Library management
g. Hospital management
h. Attendance management system
i. Examination automation system
j. Web based chat application

**TOTAL: 45 (L) + 45 (P) = 90 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Understand basic software engineering practices effectively.

**CO2:** Apply version control using Git and GitHub, and manage code repositories proficiently.

**CO3:** Design web applications using HTML, CSS, and JavaScript.

**CO4:** Analyze problems and create solutions using CSS for better web page presentation

and usability.

**CO5:** Develop interactive web pages using JavaScript with an event-handling mechanism.

**CO6:** Apply the technological changes and improve skills continuously.

**TEXT BOOKS:**


1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill International Edition, Nineth Edition, 2020.
2. Scott Chacon, Ben Straub, "Pro GIT", Apress Publisher, 3rd Edition, 2014.
3. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Pearson, 5th Edition, 2018.


**REFERENCES:**


1. Roman Pichler, "Agile Product Management with Scrum Creating Products that Customers Love", Pearson Education, 1 st Edition, 2010.
2. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
3. Stephen Wynkoop and John Burke, "Running a Perfect Website", QUE, 2nd Edition, 1999.
4. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
5. Gopalan N.P. and Akilandeswari J., "Web Technology", Second Edition, Prentice Hall of India, 2014.
6. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094421427470336209 9_shared/overview


**LIST OF EQUIPMENTS:**

1. Systems with either Netbeans or Eclipse
2. Java/JSP/ISP Webserver/Apache
3. Tomcat / MySQL / Dreamweaver or
4. Equivalent/ Eclipse, WAMP/XAMP

| 24CH101 | ENGINEERING CHEMISTRY (Common for CSE and IT) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Gain a comprehensive knowledge on polymers utilized in various industrial sectors.
- Knowledge on the fundamental principles of energy storage devices.
- Gain insights into the basic concepts and applications of chemical sensors and cheminformatics.
- Identify the different types of smart materials and explore their applications in Engineering and Technology.
- Assimilate the preparation, properties and applications of nanomaterials in various fields.

| UNIT I | INDUSTRIAL POLYMERS | 15 |
|---|---|---|

Polymers: Terminology – functionality, degree of polymerization, properties – glass transition temperature and molecular weight (weight average method).

Engineering plastics: preparation, properties and application of Polyethylene, Teflon, Polyethylene terephthalate and Epoxy resin- industrial applications of Polyethylene and Polyethylene terephthalate in packaging.

Special polymers: preparation, properties and applications of piezoelectric polymer - Polyvinylidene fluoride, electroactive polymer-Polyacetylene and biodegradable polymer - Polylactic acid.

(Theory-9)

1. Determination of the molecular weight of polymer using viscometer.
2. Determination of degradation of biodegradable polymer using photoreactor.
3. Demonstrate the applications of biodegradable plastic using 3D printing.

(Laboratory-6)

| UNIT II | ENERGY STORAGE DEVICES AND GREEN FUEL | 15 |
|---|---|---|

Introduction to Electrochemical cell and its terminology - electrochemical series and its applications.

Batteries: classification - construction and working principle -primary alkaline battery – secondary battery - Pb-acid battery.

Green fuel – Hydrogen - production (Photo electrocatalytic and photo catalytic water splitting), construction, working principle and applications in H2 -O2 fuel cells.

Batteries used in E- vehicle: Ni-metal hydride battery, Li-ion Battery - recycling of Li-ion batteries by direct cycling method; environmental effects of different energy storage devices.

(Theory-9)

1. Construction of electrochemical cell.
2. Determination of discharging state of Pb-acid battery by estimating the strength of the acid correlates with specific gravity.
3. Study of performance of a battery using battery analyzing module.

(Laboratory-6)

| UNIT III | CHEMICAL SENSORS AND CHEMINFORMATICS | 15 |
|---|---|---|

Introduction: classification of chemical sensors -principle, construction and working of chemical sensors; pH sensor – Glass electrode; Breath analyzer; Industrial sensor – CO2 sensors- Sensor for health care – Glucose sensor.

Cheminformatics: definition, scope, and significance; applications in the environmental sector – carbon footprint measurements, data analysis and interpretation.

(Theory-9)

1. Determination of the amount of given hydrochloric acid using a pH meter.
2. Calculate the carbon footprint from the provided dataset, analyze the results and draw conclusions.

(Laboratory-6)

| UNIT IV | SMART MATERIALS | 15 |
|---|---|---|

Shape Memory Alloys: introduction - shape memory effect – functional properties of SMAs – types of SMA - Nitinol (Ni-Ti) alloys and its applications.

Chromogenic materials: introduction – types, applications in chemical and biological detection, display technologies, smart windows and light- modulating devices, biomedical and healthcare.

Smart Hydrogels: Introduction - Super Absorbent Polymers (SAP) - preparation, properties and applications of polyacrylic acid and sodium polyacrylate

(Theory-9)

1. Demonstrate the shape memory effect using Nitinol wire.
2. Determination of pH sensitivity of bromothymol blue.
3. Determination of absorption efficiency of hydrogel by using kinetic study.

(Laboratory-6)

| UNIT V | NANO CHEMISTRY | 15 |
|---|---|---|

Introduction – synthesis – top-down process (laser ablation, chemical vapor deposition), bottom-up process (precipitation, electrochemical deposition) - properties of nanomaterials – types – nanotubes -carbon nanotubes, applications of CNT - nanocomposites – general applications of nanomaterials in electronics, information technology, medical and healthcare, energy, environmental remediation, construction and transportation industries.

(Theory-9)

1. Preparation of nano $BaSO_4$ by precipitation method.
2. Demonstrate the efficiency of nano adsorbents in polluted water.

(Laboratory-6)

**TOTAL: 75 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** To examine the role of polymers in different industrial sectors.
**CO2:** To identify the suitability of batteries for various fields.
**CO3:** To apply the fundamental principles of chemical sensors, cheminformatics and their applications across various industries.
**CO4:** To analyze the types of smart materials used in various engineering fields.
**CO5:** To explore the applications of nanomaterials in various fields, considering their Advantages and limitations.
**CO6:** To integrate the concepts of chemistry for various engineering applications**.**

**TEXT BOOKS:**


1. P. C. Jain and Monika Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 19th Edition, 2024.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd reprint, 2012.


**REFERENCES:**


1. S.S. Dara and S.S. Umare, “A Textbook of Engineering Chemistry,S. Chand &company, New Delhi, 12th Edition, 2022.
2. V.R. Gowarikar, Polymer Science, New Age International Publishers, 4th edition,2021.
3. J. C. Kuriacose and J. Rajaram, “Chemistry in Engineering and Technology”, Volume

-1 & Volume -2, Tata McGraw-Hill Education Pvt. Ltd., 2010.
4. Barry A. Bunin, Brian Siesel, and J. Bajorath, “Chemoinformatics: Theory, Practice, & Products”, Springer, First Edition, 2007.
5. Geoffrey A. Ozin, Andre C. Arsenault and Ludovico Cademartiri, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC publishers, 2nd Edition, 2015.
6. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas and B. Sivasankar, “Vogel’s Quantitative Chemical Analysis”, Pearson Education Pvt. Ltd., 6th edition, 2019.
7. NPTEL course on “Polymers: concepts, properties, uses and sustainability” Prof. Abhijit P Deshpande, IIT-Madras, https://onlinecourses.nptel.ac.in/noc20_ch41/preview
8. NPTEL course on “Electrochemical Energy Storage” Prof. Subhasish Basu Majumder, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc21_mm34/preview
9. NPTEL course on “Nanotechnology, Science and Applications”, Prof. Prathap Haridoss, IIT-Madras, https://onlinecourses.nptel.ac.in/noc22_mm33/preview

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS**

| S. No. | Description of Equipment | Quantity |
|---|---|---|
| 1 | Conductivity meter | 12 Nos. |
| 2 | pH meter | 12 Nos. |
| 3 | UV-Visible Spectrophotometer | 2 Nos. |
| 4 | Potentiometer | 12 Nos. |
| 5 | CAN Enabled BMS unit | 4 Nos. |
| 6 | Photoreactor | 2 Nos. |

| 24EC101 | DIGITAL PRINCIPLES AND SYSTEMS DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Acquire the knowledge in Digital fundamentals and its simplification methods.
- Familiarize the design of various combinational digital circuits using logic gates.
- Realize various sequential circuits using flip flops.
- Elucidate various semiconductor memories and related technology.
- Build various logic functions using Programmable Logic Devices.

| UNIT I | BOOLEAN ALGEBRA AND LOGIC GATES | 15 |
|---|---|---|

Review of number systems-representation-conversions, Review of Boolean algebra theorems, sum of product and product of sum simplification, canonical forms, min term and max term, Simplification of Boolean expressions-Karnaugh map, Implementation of Boolean expressions using logic gates and universal gates.

**List of Exercise/Experiments:**

- 1. Implementation of Boolean expression using logic gates.

| UNIT II | COMBINATIONAL LOGIC CIRCUITS | 15 |
|---|---|---|

Design of combinational circuits - Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/De-mux, Parity Generator/Checker

**List of Exercise/Experiments:**

2. Design of adders

3. Design of subtractors.
4. Design of binary adder using IC7483
5. Design of Multiplexers &Demultiplexers.
6. Design of Encoders and Decoders.
7. Implementation of a boolean function using a multiplexer

| UNIT III | SEQUENTIAL CIRCUITS | 15 |
|---|---|---|

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Asynchronous and Synchronous Counters Design - Shift registers, Universal Shift Register.

**List of Exercise/Experiments:**

8. Design and implementation of 3 bit ripple counters.
9. Design and implementation of 3 bit synchronous counter
10. Design and implementation of shift registers

| UNIT IV | SYNCHRONOUS SEQUENTIAL CIRCUITS DESIGN | 15 |
|---|---|---|

Design of clocked sequential circuits - Moore/Mealy models, state minimization, state assignment, circuit implementation.

| UNIT V | MEMORY AND PROGRAMMABLE LOGIC DEVICES | 15 |
|---|---|---|

Basic memory structure ROM: PROM – EPROM – EEPROM –RAM – Static and dynamic RAM – Programmable Logic Devices: Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL.

**TOTAL: 45 PERIODS (THEORY) + 30 PERIODS (LAB) = 75 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Apply Boolean algebra to simplify and implement digital circuits.

**CO2:** Design combinational circuits to meet specific functional requirements using logic gates.

**CO3:** Demonstrate the operation of counters and shift registers using flip-flops in sequential circuits.

**CO4:** Analyze synchronous sequential circuits to determine their behavior and performance characteristics.

**CO5:** Evaluate various types of memory devices, discussing their roles and functionalities in digital systems.

**CO6:** Construct combinational circuits using Programmable Logic Devices (PLDs) to solve complex digital design problems.

**TEXTBOOKS:**


1. M. Morris Mano and Michael D. Ciletti, Digital Design, With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th Edition, Pearson, 2018.
2. S.Salivahanan and S.Arivazhagan,Digital Circuits and Design, 5th Edition, Oxford University Press, 2018.


**REFERENCES:**

1. A.Anandkumar, Fundamental of digital circuits, 4th Edition, PHI Publication,2016.
2. WilliamKleitz, Digital Electronics-A Practical approach to VHDL, Prentice Hall International Inc, 2012.
3. CharlesH.Roth, Jr. andLarry L. Kinney, Fundamentals of Logic Design, 7th Edition, Thomson Learning, 2014.
4. Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson Education Inc, 2017.
5. John.M Yarbrough, Digital Logic: Applications and Design, 1st Edition, Cengage India, 2006.

**NPTEL Link:**
https://nptel.ac.in/courses/108105132

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**
IC Trainer Kit -15 Nos
ICs each - 30 Nos
7400/ 7404 / 7486 / 7408 / 7432 / 7483 / 7473 / 7411/7474

| 24GE101 | HERITAGE OF TAMILS (Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**OBJECTIVES:**
**The Course will enable learners to:**
- Recognize Tamil literature and its significance in Tamil culture.
- Introduce the Tamils' rich artistic and cultural legacy.
- Familiarize the different types of folk and martial arts that are unique to Tamil Nadu.
- Acquaint the concept of Thinai in Tamil literature and culture.
- Comprehend the significance of Tamil in developing Indian culture.

| UNIT I | LANGUAGE AND LITERATURE | 3 |
|---|---|---|

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry – Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

| UNIT II | HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE | 3 |
|---|---|---|

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making -- Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

| UNIT III | FOLK AND MARTIAL ARTS | 3 |
|---|---|---|

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

| UNIT IV | THINAI CONCEPT OF TAMILS | 3 |
|---|---|---|

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

| UNIT V | CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE | 3 |
|---|---|---|

Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil

| |
|---|
| Books. |
| **TOTAL: 15 PERIODS** |
| **OUTCOMES:**<br>**Upon completion of the course, the students will be able to:**<br>**CO1:** State the role of Tamil literature in shaping Tamil Cultural roots.<br>**CO2:** Express the cultural and religious significance of Tamil art and sculptures.<br>**CO3:** Identify and describe the techniques of folk and martial arts.<br>**CO4:** Classify the role of Thinai concept in Tamil culture and literature.<br>**CO5:** Compare the idea of cultural and intellectual contributions of Tamils. |
| **TEXT BOOKS & REFERENCES:** |
| 1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்). |
| 2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்). |
| 3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு) |
| 4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு) |
| 5. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print) |
| 6. Social Life of the Tamils - The Classical Period (Dr.S .Singaravelu) (Published by: International Institute of Tamil Studies. |
| 7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu ) (Published by: International Institute of Tamil Studies). |
| 8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.) |
| 9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) |
| 10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author) |
| 11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) |
| 12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book |

| **24MC101** | **STUDENT INDUCTION PROGRAM (SIP)**<br>**(Common to all branches of First Year B.E./ B.Tech)** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | | | | **3 Weeks** |

**OBJECTIVES:**

**The Course will enable learners to:**

- Facilitate the adjustment of new students to the new environment, ensuring they feel comfortable and supported.
- Inculcate the institution's ethos and culture in new students, helping them internalize these values.
- Encourage the building of bonds among students and between students and faculty
- members.
- Expose students to a sense of larger purpose and guide them in their journey of self- exploration.

The various modules or core areas recommended for the 3-week SIP are

| | | |
|---|---|---|
| **Module 1** | **Universal Human Values I** | **18** |

| | | |
|---|---|---|
| Welcome and Introductions - Aspirations and Concerns - Self- Management - Health - Relationships - Society - Natural Environment - Sum Up - Self-evaluation and Closure. | | |
| **Module 2** | **Physical Health and Related Activities** | **6** |
| Special Lecturers: Happy and Healthy lifestyle - Physical Health -Mental Health - Health and Fitness. | | |
| **Module 3** | **Familiarization of Department/ Branch and Innovation** | **8** |
| Principal Address - Address by Head of Science and Humanities - Addresses by Respective Department HoDs – Campus Tour – CoE introduction – Introduction of Student Activity Cell (SAC). | | |
| **Module 4** | **Visit to a Local Area** | **4** |
| Virtual tour: Government Museum - Theosophical Society - Fort St. George - Ripon Building - Kalakshetra Foundation - Anna Centenary Library - Marina Beach - St. Thomas Mount - Vivekananda House. | | |
| **Module 5** | **Lectures by Eminent People** | **10** |
| Special Lecturers: Academics – industry – Careers – Art - Self-management. | | |
| **Module 6** | **Proficiency Modules** | **30** |
| Basic Competencies: C Programming, Foundation in Mathematics, Interpersonal Communication. | | |
| **Module 7** | **Literature / Literary Activities** | **7** |
| Literary Debate - Creative Writing Workshop - Literature Circle Discussions - Author Study and Presentation. | | |
| **Module 8** | **Creative Practices** | **10** |
| Activity: Handicrafts (Painting / Drawing / Pottery / Knitting / Jewellery making, etc.) | | |
| **Module 9** | **Extra-Curricular Activities** | **10** |
| Students Activity Cell: Activities from Coding Club – Math Club -- Language Club – Astronomy Club - ECO Club - Photography Club - Tedx Club -Yoga Club. | | |
| **Valedictory and Closing Ceremony** | | **2** |
| | | **TOTAL: 105 PERIODS** |

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Achieve a smooth transition where students feel comfortable and confident in their new environment.

**CO2:** Demonstrate a strong understanding and practice of the institution's ethos and culture within the campus community.

**CO3:** Build meaningful and supportive relationships with peers and faculty members.

**CO4:** Develop a clear sense of purpose and engage in self-exploration, leading to a deeper understanding of personal goals and aspirations.

**REFERENCES:**

https://www.aicte-india.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf

| 24MC102 | C PROGRAMMING<br>(Common to All Branches) | |
|---|---|---|

**OBJECTIVES:**

**The Course will enable learners to:**

- To learn problem solving and programming fundamentals in C.
- To gain knowledge on Arrays and Functions.
- To understand Pointers, Structures and File handling concepts.

| UNIT I | INTRODUCTION TO C PROGRAMMING | 10 |
|---|---|---|

Introduction to C, Comments, Tokens, Character set, Identifiers- Variables, Keywords, Bits and Bytes representations- Data Types, Type Qualifiers- Symbolic Constants, One's and Two's Complement Forms, Expressions and Statements- Operators- Operator Precedence and Associativity- Pre-Processor Directives- I/O Functions- Control Structures: Decision Making Statements For Loop-While and do-while Loops

| UNIT II | ARRAYS AND FUNCTIONS | 15 |
|---|---|---|

Array Operations-One dimensional array-Multi Dimensional Array - Practice Programs-Searching-Sorting-String Handling Functions- Function: Declaration, Definition, Function Call and Return Statements-Passing Parameters to Functions-Types of Functions-Calling Functions from Another Function and Recursive Functions. Variable Scope, Lifetime and Storage Classes-Storage Classes-Problem Solving using Recursion- Towers of Hanoi Problem, Advantages and Disadvantages of Recursion.

| UNIT III | POINTERS, STRUCTURES AND FILE HANDLING CONEPTS | 15 |
|---|---|---|

Introduction to Pointers-Dynamic Memory Allocation-Pointers of Arrays and Strings-Pointer Arithmetic - Pointers to Functions-Introduction to User Defined Data Types-Structures, Functions and Nested Structures-Bit Fields in Structure and Union Enumerated Data Types- Introduction to File Handling-Advanced File Operations-Command Line Arguments & Error Handling.

**TOTAL HOURS: 40**

**OUTCOMES:**

**Upon completion of the course, the students will be able to**

- Develop a C program, control the sequence of the program and give logical outputs, implement strings in C program, store different data types in the memory, write functions in C and also handle files

**REFERENCES:**


1. Programming in C. E. Balagurusamy. 9th Edition, Tata McGraw-Hill Publishing, 2020. ISBN
2. The C programming language. BW Kemighan, DM Ritchie. Prentice Hall, Englewood Cliffs 2015

| 24HS111 | INTERPERSONAL SKILLS, PSYCHOMETRIC ANALYSIS AND CAREER DEVELOPMENT (Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Evaluate and enhance language proficiency by using SMART Vox to assess communication skills and linguistic abilities.
- Explore future technologies, solve real-time problems, and prepare students for campus recruitment.
- Assess and develop work style, cognitive abilities, emotional intelligence, and work competencies
- Explore placements, internships, higher education options, GATE and CAT exams, and career development.
- Understand career milestones, assess personal skills and personality, and develop effective goal-setting strategies for successful career planning

| UNIT I | LANGUAGE PROFICIENCY EVALUATION | 3 |
|---|---|---|

Identification of Strengths and Weaknesses - Assessing Language Skills (Diagnostic tests and interactive exercises) - Measuring Language Competence (Proficiency Levels) - Identifying Support Needs - Developing Individual Learning Plans - Enhancing Student Experience (Building Confidence) – Evaluation using SMART Vox

| UNIT II | CAREER GUIDANCE | 3 |
|---|---|---|

Future of Engineering- Various aspects of Technology and its Applications - Future of Technologies – Branch Specific emerging technologies - Problems solving through open source - Campus recruitment process.

| UNIT III | PSYCHOMETRIC EVALUATION | 15 |
|---|---|---|

Understanding Behavioural work style (Personality)- Testing of numerical, logical, and verbal reasoning skills (Cognitive Abilities / Aptitude) – Measure of emotional intelligence and interpersonal skills – Determination of Culture Preferences in various workplace scenarios – Evaluation of Work Competencies through targeted games and simulations.

| UNIT IV | CAREER PREPARATION | 15 |
|---|---|---|

Present Scenario of Engineering - Placement Opportunities - Internship Opportunities - Types of Internships- Higher Education opportunities in India and Abroad - Understanding GATE and CAT Exams - Other Opportunities - Career path development plans.

| UNIT V | PROFILE BUILDING AND CODING MASTERY | 15 |
|---|---|---|

Resume Building – Career Building for Engineering Students – Coding Orientation – Algorithmic Thinking and Advanced Problem Solving – Building Your Own App with Just Logic.

**TOTAL 15 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Assess and improve their English language proficiency using SMART Vox, gaining insights into their communication skills and linguistic competence

**CO2:** Understand future engineering trends, emerging technologies, importance of solving real-time problems, and the process of campus recruitment.

**CO3:** Evaluate their behavioral work style, cognitive abilities, emotional intelligence, cultural preferences, and work competencies.

**CO4:** Understand the current engineering landscape, placement opportunities, and higher education prospects to develop effective career path plans

**CO5:** Develop a clear and actionable vision for their future career path.

| 24GE111 | IDEA LAB - I (Common to all Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 1 | 0 |

The students may be grouped into 3 to 4. The device/Machine/system/component are studied by the students and a final presentation to be done by the students about the study of various devices or machinery at the end of the semester.

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the functionalities and limitation of various machines/equipment
- Demonstrate various operations that can be performed using various Machines

**LIST OF EXPERIMENTS**

1. Study of fundamental operations of 3D Printer and Scanner with Software.
2. Study of Laser cutting machine.
3. Study of CNC Router machine.
4. Study of Fundamentals of basic circuit design, Soldering and Desoldering.
5. Study of PCB Milling Machine.

**TOTAL: 15 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

**CO1:** Describe the working of the 3D Printer.0

**CO2:** Explain the operation of the CNC router and laser cutting machines.

**CO3:** Explain the basic parts and PCB fabrication process.

**CO4:** Develop the ability to handle delicate electronic components carefully, minimizing damage during the soldering process.

**CO5:** Describe the process for converting ideas into prototypes.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

| S.No. | Description of Equipment | Quantity |
|---|---|---|
| 1 | CNC Router | 1 No |
| 2 | 3D Printer | 1 No |
| 3 | 3D Scanner | 1 No |
| 4 | Laser cutting Machine | 1 No |
| 5 | Multimeter | 5 Nos. |
| 6 | Solder Stations | 5 Sets |
| 7 | Desoldering Machine | 1 No |
| 8 | PCB Milling Machine | 1 No |
| 9 | Variable Power Supply | 1 No |
| 10 | Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc. | 5 Sets |

## SEMESTER II

| 24MA201 | LINEAR ALGEBRA AND APPLICATIONS (Common to CSE, IT,AIML) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Comprehend the fundamental concepts of matrices.
- Illustrate the basic notions associated with vector spaces and its properties.
- utilize the Gram-Schmidt ortho normalization process.
- Understand the components and implications for vector spaces by rank-nullity dimension theorem.
- Calculate the eigenvalues and eigenvectors of linear transformations.

| UNIT I | MATRICES AND SYSTEM OF LINEAR EQUATIONS | 15 |
|---|---|---|

Matrices – Row echelon form – Rank of a matrix – System of linear equations – Consistency – Gauss elimination method – Gauss Jordan method.

**Experiments using C language:**

1. Solve the system of equations using Gauss Elimination method.
2. Solve the system of equations using Gauss Jordan method.

| UNIT II | VECTOR SPACES | 15 |
|---|---|---|

Real and Complex fields – Vector spaces over Real and Complex fields – Subspace – Linear space – Linear independence and dependence (Statement only) – Bases and dimensions.

**Experiments using C language:**

1. Check whether the given vectors are linearly independent or not.
2. Find the basis and dimension for given vectors.

| UNIT III | INNER PRODUCT SPACES | 15 |
|---|---|---|

Inner product space and norms – Properties – Orthogonal, Orthonormal vectors – Gram-Schmidt ortho normalization process – Least squares approximation.

**Experiments using C language:**

1. Find the orthogonal vectors using inner product.
2. Find the orthonormal vectors using inner product.

| UNIT IV | LINEAR TRANSFORMATION | 15 |
|---|---|---|

Linear transformation – Range and null space – Rank and nullity – Rank nullity Dimension theorem – Matrix representation of linear transformation – Eigenvalues and eigenvectors of linear transformation.

**Experiments using C language:**

1. Find the Rank and Nullity of a matrix.
2. Find the eigenvalues and eigenvectors of a matrix.

| UNIT V | EIGENVALUE PROBLEMS AND MATRIX DECOMPOSITION | 15 |
|---|---|---|

Eigenvalue problems – Power method – Jacobi method – Singular value decomposition – QR decomposition.

**Experiments using C language:**

1. Solve the system of equations using Jacobi method.
2. Find QR decomposition of a matrix.

**TOTAL: 75 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Solve the system of linear equations using Gauss elimination and Gauss Jordan method.

**CO2:** Analyze vector spaces to determine their bases and dimensions.
**CO3:** Apply Gram-Schmidt process to ortho normalize sets of vectors.
**CO4:** Apply rank nullity theorem to analyse linear transformations.
**CO5:** Compute the eigenvalues and eigenvectors using singular value decomposition.
**CO6:** Understand the ideas of least squares approximations and its applications.

**TEXTBOOKS:**


1. 1. A.H. Friedberg, A. J. Insel, and L. Spence, “Linear Algebra”, Prentice Hall of India, 5th Edition, New Delhi, 2008.
2. Steven J. Leon, “Linear Algebra with Applications”, Pearson Educational International”, 9th Edition, United States of America, 2015.


**REFERENCES:**


1. 1. G. Strang, “Linear Algebra and its applications”, Thomson (Brooks / Cole), 4th Edition, New Delhi, 2005.
2. 2. C.F. Gerald and P.O. Wheatley, “Applied Numerical Analysis”, 7th Edition, Pearson Education, New Delhi, 2004.
3. Richard Branson, “Matrix Operations”, Schaum's outline series, 1989.
4. Bernard Kolman, R. David R. Hill, “Introductory Linear Algebra”, Pearson Educations, New Delhi, First Reprint, 2009.
5. 5. S. Kumaresan, “Linear Algebra - A geometric approach”, Prentice Hall of India, New Delhi, Reprint, 2010.
6. NPTEL course on "Linear Algebra", by Prof. K. C. Sivakumar, IIT Madras: https://archive.nptel.ac.in/courses/111/106/111106051/##


| 24CS201 | DATA STRUCTURES (Common to CSE, IT, CSBS and AIML) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 3 | 4.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To understand the concepts of List ADT.
- To learn linear data structures – stacks and queues ADTs.
- To understand and apply Tree data structures.
- To understand and apply Graph structures.
- To analyze sorting, searching and hashing algorithms.

| UNIT I | LINEAR DATA STRUCTURES – LIST | 9+9 |
|---|---|---|

Algorithm analysis - running time calculations - Abstract Data Types (ADTs) – List ADT – array- based implementation – linked list implementation – singly linked lists - circularly linked lists - doubly-linked lists – applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

**List of Exercise/Experiments:**

- Array implementation of List ADTs.
- Linked list implementation of List ADTs.

| UNIT II | LINEAR DATA STRUCTURES – STACKS, QUEUES | 9+9 |
|---|---|---|

Stack ADT – Stack Model - Implementations: Array and Linked list - Applications - Balancing symbols - Evaluating arithmetic expressions - Conversion of Infix to postfix expression - Queue ADT – Queue Model - Implementations: Array and Linked list - applications of queues - Priority Queues – Binary Heap – Applications of Priority Queues.

**List of Exercise/Experiments:**

- Array implementation of Stack and Queue ADTs.

- Linked list implementation of Stack and Queue ADTs.
- Applications of List – Polynomial manipulations
- Applications of Stack – Infix to postfix conversion and expression evaluation.

| UNIT III | NON LINEAR DATA STRUCTURES – TREES | 9+9 |
|---|---|---|

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT– AVL Tree.

**List of Exercise/Experiments:**

- Implementation of Binary Trees and operations of Binary Trees.
- Implementation of Binary Search Trees.
- Implementation of Heaps using Priority Queues.

| UNIT IV | NON LINEAR DATA STRUCTURES - GRAPHS | 9+9 |
|---|---|---|

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Applications of graphs – BiConnectivity – Euler circuits.

**List of Exercise/Experiments:**

- Graph representation and Traversal algorithms.

| UNIT V | SEARCHING, SORTING AND HASHING TECHNIQUES | 9+9 |
|---|---|---|

Searching- Linear Search - Binary Search - Sorting - Bubble sort - Selection sort - Insertion sort – Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

**List of Exercise/Experiments:**

- Implement searching and sorting algorithms.

**TOTAL: 45(L) + 45(P) = 90 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Analyze algorithms and abstract data types (ADTs).

**CO2:** Evaluate fundamental data structures.

**CO3:** Implement linked data structures and its application.

**CO4:** Apply advanced tree data structures.

**CO5:** Understand basic graph theory concepts.

**CO6:** Evaluate various searching and sorting algorithms.

**TEXTBOOKS:**


1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, 4th Edition, Pearson Education, 2014.
2. Sartaj Sahni, “Data Structures, Algorithms and Applications in C++”, Silicon paper publications, 2004.


**REFERENCES:**

1. Rajesh K. Shukla, “Data Structures using C and C++”, Wiley India Publications, 2009.
2. Narasimha Karumanchi, “Data Structure and Algorithmic Thinking with Python: Data Structure and Algorithmic Puzzles”, CareerMonk Publications, 2020.
3. Jean-Paul Tremblay and Paul Sorenson, “An Introduction to Data Structures with Application”, McGraw-Hill, 2017.
4. Mark Allen Weiss, “Data Structures and Algorithm Analysis in Java”, Third Edition, Pearson Education, 2012.
5. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008.
6. Ellis Horowitz, Sartaj Sahni, Dinesh P Mehta, “Fundamentals of Data Structures in C++”, Second Edition, Silicon Press, 2007.
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013501578165051392105 84/overview

**LIST OF EQUIPMENTS:**

1. Systems with Linux/Ubuntu Operating System with gnu C++ compiler

| 24CS202 | JAVA PROGRAMMING (Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 3 | 4.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To explain object oriented programming concepts and fundamentals of Java
- To apply the principles of packages, interfaces and exceptions
- To develop a Java application with I/O streams, threads and generic programming
- To build applications using strings and collections.
- To apply the JDBC concepts

| UNIT I | JAVA FUNDAMENTALS | 9+9 |
|---|---|---|

An Overview of Java - Data Types, Variables, and Arrays – Operators - Control Statements – Class Fundamentals – Declaring objects – Methods – Constructors – this keyword – Overloading methods - Overloading constructors - Access Control – Static – Final

**List of Exercise/Experiments:**

1. Develop a Java application to generate Electricity bill. You must use one super class called EB Bill and must have two sub classes namely Domestic Bill and Commercial Bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff

If the type of the EB connection is domestic, calculate the amount to be paid as follows: First 100 units - Rs. 1 per unit

101-200 units - Rs. 2.50 per unit 201 -500 units - Rs. 4 per unit

> 501 units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows: First 100 units - Rs. 2 per unit

101-200 units - Rs. 4.50 per unit 201 -500 units - Rs. 6 per unit

> 501 units - Rs. 7 per unit

2. Arrays Manipulations: (Use Methods for implementing these in a Class)

a. Find kth smallest element in an unsorted array

b. Find the sub array with given sum

c. Matrix manipulations – Addition, Subtraction, Multiplication

d. Remove duplicate elements in an Array

e. Accept an integer value N and print the Nth digit in the integer sequence 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and so on till infinity.

Example: The 11th digit in the sequence 12345678910111213…. is 0.

| UNIT II | INHERITANCE, INTERFACES AND EXCEPTION HANDLING | 9+9 |
|---|---|---|

Inheritance: Inheritance basics, Using super, Method Overriding, Using Abstract Classes, Using final with Inheritance - Package and Interfaces: Packages, Packages and member access, Importing Packages, Interfaces, Static Methods in an Interface – Exception Handling: Exception- Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions.

**List of Exercise/Experiments:**

1. Develop a Java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.
2. Develop a Java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
3. Design a Java interface for ADT Stack. Implement this interface using array and built-in classes. Provide necessary exception handling in both the implementations.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains the methods print Area () that prints the area of the given shape and Numberofsides() that prints the number of sides of the given shape.
5. Write a Java program to apply built-in and user defined exceptions.

| UNIT III | MULTITHREADING, I/O AND GENERIC PROGRAMMING | 9+9 |
|---|---|---|

Multithreaded Programming: Creating a Thread, Thread Priorities, Synchronization, Interthread Communication – I/O: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files – Generics: Introduction, Generic class, Bounded Types, Generic Methods, Generic Interfaces, Generic Restrictions.

**List of Exercise/Experiments:**

1. Write a Java program to read and copy the content of one file to other by handling all file related exceptions.

| UNIT IV | STRING HANDLING AND COLLECTIONS | 9+9 |
|---|---|---|

Lambda Expressions - String Handling – Collections: The Collection Interfaces, The Collection Classes – Iterator – Map - Regular Expression Processing.

**List of Exercise/Experiments:**

1. String Manipulation:

a. Reversing a set of words and count the frequency of each letter in the string.

b. Pattern Recognition - Find the number of patterns of form 1[0]1 where [0] represents

any number of zeroes (minimum requirement is one 0) there should not be any other character except 0 in the [0] sequence in a given binary string.

c. Remove all the occurrences of string S2 in string S1 and print the remaining.

d. Find the longest repeating sequence in a string

e. Print the number of unique string values that can be formed by rearranging the letters in the string S.

2. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.

3. Collections:

a. Write a program to perform string operations using ArrayList. Write functions for the following

i. Append - add at end

ii. Insert – add at particular index

iii. Search

iv. List all string starts with given letter

b. Find the frequency of words in a given text.

| UNIT V | JDBC CONNECTIVITY | 9+9 |
|---|---|---|

JDBC – DataSource, Configurations, Connection, Connection Pools, Driver Types, ResultSet, Prepared Statement, Named Parameter, Embedded SQL (Insert, Update, Delete, Join, union etc), ResultSet Navigation, Connection Close and Clean up.

**List of Exercise/Experiments:**

- Mini Project (using JDBC)

**TOTAL: 45(L) + 45(P) = 90 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Solve core Java programming concepts.

**CO2:** Utilize object-oriented programming (OOP) principles.

**CO3:** Demonstrate competency in handling exceptions and implementing multithreading.

**CO4:** Develop expertise in input/output (I/O) operations and file handling.

**CO5:** Apply advanced Java programming concepts with generics and lambda expressions.

**CO6:** Implement database connectivity using JDBC.

**TEXTBOOKS:**

1. Herbert Schildt, “Java: The Complete Reference”, 11th Edition, McGraw Hill Education, 2019.

**REFERENCES:**

1. Cay S. Horstmann, Gary Cornell, “Core Java Volume – I Fundamentals”, 11th Edition, Prentice Hall, 2019.
2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
3. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
4. Timothy Budd, Understanding Object-oriented programming with Java, Third Edition, Pearson Education, 2008.
5. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_29959473947367270000_shared/overview

**LIST OF EQUIPMENTS:**

1. Java and Eclipse / NetBeans IDE or Equivalent

| 24PH201 | PHYSICS FOR INFORMATION SCIENCE (Common to CSE, IT and AIML) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the classical free electron theory and Fermi distribution function
- Relate the theory of laser with its applications in optical fibers
- Solve the Schrodinger's wave equation in one dimensional and three dimensional box
- Gain the basic knowledge in quantum operators and quantum gates
- Comprehend the behavior of semiconductor diodes in various electron devices and nano electronic devices

| UNIT I | ELECTRICAL PROPERTIES OF MATERIALS | 15 |
|---|---|---|

Classical free electron theory - Expression for electrical conductivity and thermal conductivity - thermal conductivity of a bad conductor- Lee's disc method -Effect of temperature on Fermi function - Density of energy states and average energy of an electron at 0 K- Effective mass of electron - Concept of hole.

Semiconductors - Direct and Indirect bandgap semiconductors - Intrinsic Carrier Concentration - Bandgap Determination.

(Theory -9)

1. Determination of Thermal conductivity of a bad conductor - Lee's Disc Method
2. Bandgap determination of intrinsic semiconductor

(Laboratory- 6)

| UNIT II | LASER | 18 |
|---|---|---|

Characteristics of Laser, Spatial and Temporal Coherence - Population inversion – Relation between Einstein's A and B coefficients - Components of Laser - Optical amplification (qualitative) - Semiconductor lasers: Homojunction and Heterojunction- Application: Engineering applications of lasers in data storage (qualitative), Principle of Fiber optics- Fiber optic communication system - Fiber optic sensors (pressure and displacement).

(Theory 9)

1. Determination of divergence of the laser beam
2. Determination of acceptance angle and numerical aperture of an optical fiber
3. Determination of wavelength of semiconductor laser

(Laboratory 9)

| UNIT III | QUANTUM THEORY | 15 |
|---|---|---|

Introduction- Blackbody Radiation - Newton's law of cooling - Planck's quantum theory- matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, Time independent and Time- dependent Schrödinger's wave equations, Physical significance of wave function, Particle in a one-dimensional potential box - Particle in a three-dimensional box (qualitative) - degenerate and non-degenerate energy levels- Quantum tunneling - Scanning Tunneling Microscope (STM).

(Theory -9)

1. Determination of emissivity (Newton's law of cooling)
2. Determination of Planck's constant

(Laboratory- 6)

| UNIT IV | BASICS OF QUANTUM COMPUTING | 12 |
|---|---|---|

Quantum Operators: Linear vector spaces - inner product space - Hilbert space - examples Vectors and Tensors: Scalars and vectors, Dirac notations of Bra-Ket notation-

Matrix representation of observables and states.
Quantum Computing: Quantum states - classical bits - quantum bits or qubits – Entanglement and superposition - multiple qubits - Bloch sphere - quantum gates - CNOT gate - Advantages of quantum computing over classical computing.

(Theory -9)

1. Truth table verification of CNOT gate through Virtual Laboratory

(Laboratory-3)

| UNIT V | NANOELECTRONIC DEVICES | 15 |
|---|---|---|

Introduction to Nano materials – synthesis by sol gel method, properties - Quantum confinement - Quantum structures: Density of energy states of quantum wells, quantum wires and quantum dots- band gap of nanomaterials - Quantum dot laser- Single electron phenomena -single electron transistor - Quantum system for information processing.

(Theory -12)

1. Synthesis of Nano-powders by sol-gel method

(Laboratory- 3)

**TOTAL: 75 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Derive electrical and thermal conductivities using classical free electron theory

**CO2:** Calculate the electrical conductivity and bandgap in Intrinsic semiconductors

**CO3:** Associate the basic principles of working of laser and their applications in fiber optics

**CO4:** Calculate the energy eigen value and eigen function for a particle in a one-dimensional and three dimensional box using Schrodinger wave equations

**CO5:** Use quantum operators to frame equations for logic gates in Quantum computing

**CO6:** Relate the quantum properties of nanoscale materials with their applications

**TEXTBOOKS:**


1. Neil W Ashcroft and N David Mermin, Solid State Physics, Harcourt College Publishers,1976
2. M.N. Avadhanulu and P.G. Kshirsagar, A textbook of Engineering Physics, S. Chand and Company, New Delhi, 2014.
3. David J. Griffiths, Introduction to Quantum Mechanics, 2nd Edition, Pearson Prentice-Hall (2004).
4. Thomas G. Wong, Introduction to Classical and Quantum Computing, Rooted Grove (2022).


**REFERENCES:**


1. R. A. Serway and J.W. Jewett, Physics for Scientists and Engineers, Ninth Edition, Cengage Learning, 2014.
2. Marikani, Materials Science, PHI Learning Private Limited, Eastern Economy Edition, 2017.
3. R. Wolfson, Essential University Physics, Volume 1 and 2 with Mastering Physics, Global Edition,3rd Edition, Pearson 2017.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning India, 2012.
5. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press (2014).
6. Mermin, N. David, Making better sense of quantum mechanics. Reports on Progress in Physics 82.1 (2018): 012002.
7. Michael Nielsen, L. Isaac Chuang, Quantum Computation and Quantum Information, Cambridge University Press (2010).

8. NPTEL course on “Introduction to LASER” by Prof. M. R. Shenoy, IIT Delhi : https://onlinecourses.nptel.ac.in/noc24_ph45/preview
9. NPTEL course on “Introduction to Quantum Computing: Quantum Algorithms and Qiskit” by Prof. Prabha Mandayam, Prof. Anupama Ray, Prof. Sheshashayee

| 24AM201 | INTRODUCTION TO ARTIFICIAL INTELLIGENCE (Common to all Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the basics and applications of Artificial Intelligence.
- Apply the basics of Python programming.
- Use python libraries to solve simple problems.
- Understand the different types of Machine Learning algorithms.
- Solve real world problems using AI/ML.
- Explore the various applications in the field of Artificial Intelligence and Machine Learning.

**UNIT I ARTIFICIAL INTELLIGENCE** **6+6**

Introduction – Types of AI – ANI, AGI, ASI – Narrow, General, Super AI, Examples - AI problems – Production Systems – State space Representation – Applications of AI in various industries.

**List of Exercise:**

1. Build a simple AI model using python.

**UNIT II BASICS OF PYTHON** **6+6**

Introduction to Python programming – Arithmetic Operators - values and types - variables, expressions, statements – Functions – Conditionals and Recursion –Iteration. Lists: Sequence, Mutable, Traversing, Operations, list slices, list methods - Tuples: Immutable, Tuple Assignment, Tuple as Return Values, Comparing and Sorting.

**List of Exercises:**

1. Compute the GCD of two numbers.
2. Operations on Tuples: a) finding repeated elements, b) slice a tuple c) reverse a tuple d) replace last value of a tuple.

**UNIT III PYTHON LIBRARIES** **6+6**

Introduction to Numpy - Multidimensional Ndarrays – Indexing – Properties – Constants – Data Visualization: Ndarray Creation – Matplotlib - Introduction to Pandas – Series – Dataframes – Visualizing the Data in Dataframes - Pandas Objects – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – Joins- Pivot Tables - String operations – Working with time series – High performance Pandas.

**List of Exercises:**

1. Download, install and explore the features of R/Python for data analytics
    - Installing Anaconda
    - Basic Operations in Jupyter Notebook
    - Basic Data Handling
2. Working with Numpy arrays - Creation of numpy array using the tuple, Determine the size, shape and dimension of the array, Manipulation with array Attributes, Creation of Sub array, Perform the reshaping of the array along the row vector and column vector, Create two arrays and perform the concatenation among the arrays.
3. Working with Pandas data frames - Series, DataFrame , and Index, Implement the Data Selection Operations, Data indexing operations like: loc, iloc, and ix,

operations of handling the missing data like None, Nan, Manipulate on the operation of Null Vaues (is null(), not null(), dropna(), fillna()).

4. Perform the Statistics operation for the data (the sum, product, median, minimum and maximum, quantiles, arg min, arg max etc.).
5. Use any data set compute the mean ,standard deviation, Percentile.

| UNIT IV | MACHINE LEARNING | 6+6 |
|---|---|---|

Introduction – ML Algorithms Overview – Types – Supervised – Unsupervised – Reinforcement Learning – Introduction to Neural Networks – Working of Deep Learning – Applications of DL – Ethical consideration in AI and ML.

**List of Exercise:**

1. Apply any Machine Learning model to predict the sales in a store.

| UNIT V | CASE STUDIES | 6+6 |
|---|---|---|

Disease Prediction – Share Price Forecasting – Weather Prediction – Domain Specific Case Studies.

List of Domain Specific Case Studies:

- For CSE & allied: Sentiment analysis of product reviews using machine learning.
- For ECE & allied: Smart homes using AI.
- For EEE: Forecasting of Renewable energy availability during a specified period using AI.
- Civil: Application of ML for crack detection on concrete structures.
- Mech: Predictive Maintenance for CNC Machines Using AI and Machine Learning.

**List of Exercise:**

1. Build a machine learning model to solve any real-world problem from your domain.

**TOTAL: 30(L) + 30(P) = 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Elaborate the basics and applications of Artificial Intelligence.
**CO2:** Apply the basics of Python programming to solve problems.
**CO3**: Use python libraries to solve simple ML problems.
**CO4:** Outline the different types of Machine Learning algorithms.
**CO5:** Use Machine Learning Algorithms to solve real world problems.
**CO6:** Outline the recent developments in the field of Artificial Intelligence.

**TEXT BOOKS:**


1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016.
2. Jake VanderPlas, “Python Data Science Handbook – Essential tools for working with data”, O’Reilly, 2017.
3. Steve Abrams, “Artificial Intelligence and Machine Learning for Beginners: A simple guide to understanding and Applying AI and ML”, Independently published, May 14, 2024.


**REFERENCES:**


1. Vinod Chandra S S, Anand Hareendran S, Artificial Intelligence and Machine Learning, PHI Learning, 2014.
2. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice Hall, 2010.
3. Ethem Alpaydın, Introduction to Machine Learning, Second Edition, the MIT Press, Cambridge, Massachusetts, London, England.
4. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2nd Edition, 2015, by Taylor & Francis Group, 2015.
5. Tom M. Mitchell, Machine Learning, McGraw-Hill Science, ISBN: 0070428077
6. Mayuri Mehta, Vasile Palade, Indranath Chatterjee, Explainable AI: Foundations, Methodologies and Applications, Springer, 2023.

7. Siddhartha Bhattacharyya, Indrajit Pan, Ashish Mani, Sourav De, Elizabeth Behrman, Susanta Chakraborti, "Quantum Machine Learning", De Gruyter Frontiers in Computational Intelligence, 2020.

**LIST OF EQUIPMENTS:**

1. Systems with Anaconda, Jupyter Notebook, Python.

| 24GE201 | TAMILS AND TECHNOLOGY (Common to all branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Recognize the historical significance of weaving and pottery technologies in ancient Tamil civilization.
- Highlight the concepts of design and construction technology during the Sangam age.
- Provide an overview of manufacturing technology and its role in Tamil society.
- Illustrate the agricultural and irrigation techniques employed in ancient Tamil society.
- Promote scientific Tamil and Tamil computing.

| UNIT I | WEAVING AND CERAMIC TECHNOLOGY | 3 |
|---|---|---|

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

| UNIT II | DESIGN AND CONSTRUCTION TECHNOLOGY | 3 |
|---|---|---|

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)-Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

| UNIT III | MANUFACTURING TECHNOLOGY | 3 |
|---|---|---|

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

| UNIT IV | AGRICULTURE AND IRRIGATION TECHNOLOGY | 3 |
|---|---|---|

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea – Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

| UNIT V | SCIENTIFIC TAMIL & TAMIL COMPUTING | 3 |
|---|---|---|

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**TOTAL: 15 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Identify the role of weaving and ceramic technology in ancient Tamil Culture.

**CO2:** Assess the design and construction technology ideas in the current Tamil society.

**CO3:** Identify the different types of manufacturing technology used in Tamil society and

their significance.

**CO4:** Classify agricultural and irrigation technologies in ancient Tamil society and its current relevance.

**CO5:** Discuss the fundamentals of scientific Tamil and Tamil computing.

**REFERENCES:**


1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S .Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu ) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by:International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL).


| 24GE211 | IDEA LAB - II (Common to all Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Develop hands-on experience and practical application of theoretical knowledge.
- Develop their ability to explain the process involved.

**LIST OF EXPERIMENTS**

1. Printing of a 3D part.
2. Scanning of a 3D part.
3. Design and fabrication of press fit object using laser cutting machine.
4. Design and fabrication of 3D part using CNC Router.
5. Design and fabrication of simple PCB.
6. Soldering and desoldering of given electronic circuit.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

**CO1:** Analyze the latest manufacturing methods in advancements and technologies related to their field.

**CO2:** Understand the operations of a laser cutting machine and CNC Router.

**CO3:** Analyze the process of design and fabrication of PCB and Soldering operations

**CO4:** Develop technical proficiency and problem-solving abilities, making more

competent and confident in their field.

**CO5:** Develop themselves with the skills needed to address industry-specific problems

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

| S.No. | Description of Equipment | Quantity |
|---|---|---|
| 1 | CNC Router | 1 No |
| 2 | 3D Printer | 1 No |
| 3 | 3D Scanner | 1 No |
| 4 | Laser cutting Machine | 1 No |
| 5 | Multimeter | 5 Nos. |
| 6 | Solder Stations | 5 Sets |
| 7 | Desoldering Machine | 1 No |
| 8 | PCB Milling Machine | 1 No |
| 9 | Variable Power Supply | 1 No |
| 10 | Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc. | 5 Sets |

| 24HS211 | INNOVATION AND CREATIVITY SKILLS AND DEVELOPMENT (Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand study plans, co-curricular activities, programming skills, recruitment test patterns, and hiring strategies through national qualifiers and hackathons.
- Equip students with strategies for higher education, resume enhancement, project management, and securing internships
- understand entrepreneurship fundamentals, including key differences, global hubs, business ideas, and scalability.
- develop essential entrepreneurial skills such as opportunity recognition, patience, risk management, communication, persistence, and leadership
- Understand life, success, self-confidence, health, scientific heritage, personal counseling, and cybercrime awareness

| UNIT I | STEPPING STONE – ENGINEERING CAREERS AND SKILL DEVELOPMENT | 3 |
|---|---|---|

Study Plans and Resources - Identification of key resources and job opportunities - career prospects and academic growth through co-curricular activities - importance of programming/coding skills - Overview of test patterns and essential skills for popular campus recruiters - Comparison of IT Services, Dream, and Super Dream offers and their recruitment processes - National Qualifier Tests and their impact on hiring processes – Overview of Corporate contests and hackathons (e.g., TCS Codevita, HackerRank)

| UNIT II | STEPPING STONE – HIGHER EDUCATION AND CAREER DEVELOPMENT | 3 |
|---|---|---|

Overview of higher education opportunities: GATE, GRE, GMAT, XAT, CAT, MAT - Exam formats, preparation strategies, and timelines - Resume Enhancement Strategies - Project Management - Steps to develop projects from proposal to prototype - Internship Pathways -

| | | |
|---|---|---|
| Strategies for maximizing internship experiences for career advancement | | |
| **UNIT III** | **FUNDAMENTALS OF ENTREPRENEURSHIP: FROM IDEAS TO VENTURES** | **3** |
| Introduction to Entrepreneurship – Intrapreneur vs. entrepreneur - Roles and Contributions - Global Entrepreneurship Hubs - Overview of Key Global Locations - Idea vs. Commercial Value - Transforming Ideas into Viable Business Models - Characteristics of Successful Business Ideas - Understanding Market Competition - Basics of Copyrights and Intellectual Property - Scalability in Business Ventures - Strategies for Scaling a Business | | |
| **UNIT IV** | **HUMAN SKILLS FOR ENTREPRENEURSHIP** | **3** |
| Identifying and capitalizing on business opportunities - Case studies and anecdotes - Patience and Risk Management - The role of patience in entrepreneurial success and decision-making - Effective Communication - Techniques for clear and persuasive communication - Importance of communication in building and leading teams - Leadership qualities and their impact on entrepreneurial ventures - Analyzing success and failure stories | | |
| **UNIT V** | **FOUNDATIONS OF PERSONAL DEVELOPMENT AND WELL-BEING** | **3** |
| Understanding Life and Success - Self-Confidence and Fear - Practical strategies for enhancing self-esteem - Adolescent Issues - Health Management - Basics of a balanced diet - Benefits of physical activity - Scientific Heritage of India - Overview of India's scientific achievements and contributions - Cyber Crime Awareness - Types and prevention strategies | | |
| | **TOTAL 15 PERIODS** | |

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Create study plans, value co-curricular activities, develop programming skills, and navigate for career advancement

**CO2:** Understand about higher education options, resume enhancement, project management, and securing internships

**CO3:** Learn entrepreneurship skills and strategies to develop successful business ideas..

**CO4:** Develop key entrepreneurial skills like opportunity recognition, risk management, and leadership through real-world examples

**CO5:** Explore personal development, health management, scientific heritage, and cybercrime awareness

| **24MC201** | **Yoga for Stress Management (Common to all branches)** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **0** | **0** | **1** | **0** |

**OBJECTIVES:**

**The Course will enable learners to:**

- Understanding the different types of stress and managing stress.
- Develop an understanding of practicing yoga
- Learning to do asanas, including sitting, standing and lying postures

| | | |
|---|---|---|
| **UNIT I** | **Stress Management** | **3** |
| Definition of Stress - Stress in Daily Life - Impact of Stress on Life - Identifying the Causes of Stress - Symptoms of Stress - Managing Stress (Habits, Tools, Training, Professional Help) - Complications of Stress Mismanagement - The Importance of Sleep for Mental Wellness - | | |

| | | |
|---|---|---|
| Connection Between Sleep and Digestion. | | |
| **UNIT II** | **Introduction to Yoga** | **3** |
| Meaning and Definition of Yoga - Aims and Objectives of Yoga - Guidelines for Practicing Asanas - Benefits of Yoga | | |
| **UNIT III** | **Different Asanas** | **3** |
| Methods of Performing Asanas - Pranayama - Suryanamaskar Asanas - Sitting Postures: Uttanpadasana, Paschimottanasana ,Janu Sirsasana , Baddha Konasana - Shishupal Asana - Vajrasana | | |
| **UNIT IV** | **Standing Postures** | **3** |
| Uttanasana -Trikonasana -Vrikshasana -Tadasana - Superbrain asana | | |
| **UNIT V** | **Lying Postures** | **3** |
| Pavana Muktasana - Pada Sanchalanasana – Jhulana Lurhakanasana -Dhanurasana – Marjaryasana. BitilasanaDictionaries – Sorkuvai Project. | | |
| | **TOTAL: 15 PERIODS** | |

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Relieve stress and achieve mental wellness.

**CO2:** Experience the benefits of yoga

**CO3:** Keep self and body healthy

**REFERENCES:**


1. Iyengar, Bellur Krishnamukar Sundara. "Light on yoga." (1965).
2. Desikachar, Tirumalai Krishnamacharya Venkata. The heart of yoga: Developing a personal practice. Simon and Schuster, 1999.
3. Davis, Martha, Elizabeth Robbins Eshelman, and Matthew McKay. The relaxation and stress reduction workbook. New Harbinger Publications, 2008.
4. Krishnamacharya, Tirumalai, et al. "Yoga makaranda: The nectar of yoga." Swathi Soft (2013).


| 24CH102 | ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to all Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To gain knowledge of the environment and various natural resources.
- To identify the Scientific and Technological solutions to pollution issues and Waste management.
- To understand the significance of the conservation of biodiversity.
- To recognize the needs and benefits of sustainability and its management.
- To comprehend the effects of human population on the environment.

| | | |
|---|---|---|
| **UNIT I** | **NATURAL RESOURCES** | **7** |
| Definition, scope and importance of environment – need for public awareness. Introduction to natural resources - types - forest resources: use and over-exploitation, deforestation and its impacts, food resources: effects of modern agriculture, organic farming, renewable energy sources - solar, wind, geothermal, tidal, OTE and biomass. field activity -tree plantation | | |
| **UNIT II** | **POLLUTION AND WASTE MANAGEMENT** | **7** |
| Pollution - definition –causes, effects and control measures of (a) air pollution (b) water pollution(c) soil pollution (d) noise pollution (e) nuclear hazards - nuclear accidents and holocaust - role of an individual in prevention of pollution –case studies.<br><br>Waste management- municipal solid wastes, E- waste, plastic waste. | | |

Field study – Solid waste management of the institution

| UNIT III | BIODIVERSITY AND ITS CONSERVATION | 6 |
|---|---|---|

Biodiversity: types – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species, extinct, rare, vulnerable species of India – conservation of biodiversity: in-situ and ex-situ method.

Field study – Biodiversity of the institution

| UNIT IV | SUSTAINABILITY AND MANAGEMENT | 5 |
|---|---|---|

Sustainability-concept, needs and challenges- circular economy - sustainable development goals- concept of carbon footprint, environmental impact assessment, clean development mechanism, solutions.

Field study – Alternate energy sources and its impacts

| UNIT V | HUMAN POPULATION | 5 |
|---|---|---|

Introduction - population growth, variation among nations, population explosion, environment and human health – endemic/epidemic/pandemic – role of information technology in environment and human health.

Case Study – Pandemics of 21st century

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** To investigate and use conservational practices to protect natural resources.

**CO2:** To identify the causes of pollutants and illustrate suitable methods for pollution abatement.

**CO3:** To analyze the values of biodiversity and its conservational methods.

CO4: To classify suitable sustainable development practices and apply it in day-to-day life.

**CO5:** To assess the impacts of human population and suggest suitable solutions.

**CO6:** To develop innovative solutions and strategies to address sustainability challenges.

**TEXTBOOKS:**


1. Anubha Kaushik and C.P. Kaushik, “Perspectives in environmental studies”, New Age International Publishers, 8th edition, 2024.
2. Benny Joseph, Environmental Science and Engineering, McGraw-Hill, 1st edition, 2017.
3. Gilbert M. Masters, Introduction to Environmental Engineering and Science, Pearson Education, 3rd edition, 2014.
4. Erach Bharuch, Textbook of Environmental Studies for Undergraduate Courses, Universities Press(I) Pvt. Ltd., 3rd edition, 2021.


**REFERENCES:**


1. 1. William P. Cunningham and Mary Ann Cunningham Environmental Science: A Global Concern, McGraw Hill, 14th edition, 2017.
2. Rajagopalan, R, Environmental Studies-From Crisis to Cure, Oxford University Press, 2015.
3. G. Tyler Miller and Scott E. Spoolman, —Environmental Science, Cengage Learning India Pvt, Ltd., Delhi, 2014.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall, 2012.
5. Bradley. A.S; Adebayo, A.O. and Maria, P. Engineering applications in sustainable design and development, Cengage learning, 2015.
6. 6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006 and subsequent amendments, 2022

**SEMESTER III**

| 24MA301 | DISCRETE MATHEMATICS<br>(Common to CSE, IT) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**OBJECTIVES:**

**The Course will enable the learners to:**

- Describe the arguments using connectives and rules of inference.
- Introduce the basic concept of counting and generating functions.
- Construct recurrence relations for mathematical models.
- Define the graphs and its models.
- Understand the concept of group theory, Lattices and Boolean algebra.

| UNIT I | LOGIC AND PROOFS | 12 |
|---|---|---|

Propositional logic - Propositional equivalences - Predicates and quantifiers - Nested quantifiers - Rules of inference - Introduction to proofs - Proof methods and strategy.

| UNIT II | COMBINATORICS | 12 |
|---|---|---|

Mathematical induction - Strong induction and well ordering - The basics of counting - The pigeonhole principle - Permutations and combinations - Recurrence relations - Solving linear recurrence relations - Generating functions - Inclusion and exclusion principle and its applications.

| UNIT III | GRAPHS | 12 |
|---|---|---|

Graphs and graph models - Graph terminology and special types of graphs - Matrix representation of graphs and graph isomorphism - Connectivity - Euler and Hamilton paths.

| UNIT IV | ALGEBRAIC STRUCTURES | 12 |
|---|---|---|

Algebraic systems - Semi groups and monoids - Groups - Subgroups - Homomorphism‘s - Normal subgroup and cosets - Lagrange‘s theorem - Definitions and examples of Rings and Fields.

| UNIT V | LATTICES AND BOOLEAN ALGEBRA | 12 |
|---|---|---|

Partial ordering -Posets- Lattices as posets- Properties of lattices - Lattices as algebraic systems - Sub lattices - Direct product and homomorphism - Some special lattices - Boolean algebra.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1**: Examine the validity of the arguments.

**CO2:** Apply various proof techniques and principles using analytic and combinatorial methods.

**CO3:** Develop the recurrence relation for the sequence.

**CO4:** Implement graph theory techniques to solve real time problems

**CO5:** Apply the concepts of groups, rings, and fields in solving algebraic problems.

**CO6:** Solve problems in Lattices and Boolean algebra.

**TEXT BOOK:**

1.K. H. Rosen, "Discrete Mathematics and its Applications", 8th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2021.

2.J. P. Tremblay, and R. Manohar. " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2017.

**REFERENCES:**

1.R.P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, New Delhi, Reprint 2019.

2.S. Lipschutz, and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 4th Edition, 2021.

3.T. Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 1st Edition, 2014.

| 24GE301 | UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 1 | 0 | 3 |

**OBJECTIVES:**

**The Course is designed to:**

- Development of a holistic perspective based on self-exploration about themselves (human beings), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act

| UNIT I | NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION | 12 |
|---|---|---|

Purpose and motivation for the course - recapitulation from Universal Human Values-I - SelfExploration–what is it? – It's content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration - Continuous Happiness and Prosperity- A Look at Basic Human Aspirations - Right understanding, Relationship and Physical Facility- the basic requirements for the fulfilment of aspirations of every human being with their correct priority - Understanding Happiness and Prosperity Correctly- A critical appraisal of the current scenario - Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Practice sessions: To discuss natural acceptance in human beings as the innate acceptance of living with responsibility (living in relationship, harmony, and co-existence) rather than as arbitrariness in choice based on liking-disliking.

| UNIT II | UNDERSTANDING HARMONY IN THE HUMAN BEING – HARMONY IN MYSELF! | 12 |
|---|---|---|

Understanding human beings as a co-existence of the sentient 'I' and the material 'Body' - Understanding the needs of Self ('I') and 'Body' - happiness and physical facility -Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) - Understanding the characteristics and activities of 'I' and harmony in 'I' - 'Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, the meaning of Prosperity in

detail - Programs to ensure Sanyam and Health. Practice sessions: To discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss programs for ensuring health vs dealing with the disease.

| UNIT III | UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY HARMONY IN HUMAN-HUMAN RELATIONSHIP | 12 |
|---|---|---|

Understanding values in a human-human relationship - the meaning of Justice (nine universal values in relationships) and the program for its fulfillment to ensure mutual happiness -Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in a relationship - Understanding the harmony in the society (society being an extension of the family) - Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Practice sessions: To reflect on relationships in family, hostel and institute as extended family, real-life examples, teacher-student relationship, the goal of education etc. Gratitude as a universal value in relationships. Discuss scenarios. Elicit examples from students' lives.

| UNIT IV | UNDERSTANDING HARMONY IN NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE | 12 |
|---|---|---|

Understanding the harmony in Nature - Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature - Understanding Existence as the Coexistence of mutually interacting units in all-pervasive Space - Holistic perception of harmony at all levels of existence. Practice sessions: To discuss human beings as the cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc

| UNIT V | IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY IN PROFESSIONAL ETHICS | 12 |
|---|---|---|

Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order - Competence in professional ethics: a. Ability to utilize professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems - Case studies of typical holistic technologies, management models and production systems - Strategy for the transition from the present state to Universal Human Order: a. At the level of the individual: as socially and ecologically responsible engineers, technologists, and managers b. At the level of society: as mutually enriching institutions and organizations - Sum up. Practice Exercises and Case Studies e.g. To discuss the conduct as an engineer or scientist etc.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1**: Develop self-awareness and a deeper understanding of their surroundings, including family, society, and nature

**CO2:** Identify and resolve inner conflicts based on natural acceptance.

**CO3:** Become more responsible towards life, and handle problems with sustainable solutions by considering human relationships and natural harmony.

**CO4:** Enhance their critical thinking and analyzing skills.

**CO5:** Develop a stronger commitment towards human values, relationships, and societal well-being.

**CO6: A**pply what they have learnt in different day-to-day settings in real life, and take the initial steps towards integrating these values into daily life.

**TEXT BOOK:**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, First edition: New Delhi, 2010, ISBN: 978-81-7446-781-2 Reprint: 2010, 2011, 2013, 2016, 2018, 2019 (Second edition: New Delhi, 2019, ISBN: 978-93-87034-47-1)
2. A foundation course in Human Values and Professional Ethics RR Gaur, R Asthana, GP Bagaria, Third revised edition: New Delhi, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), ISBN: 978-81-957703-6-6 (e-book), UHV Publications

**REFERENCES:**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful-E. F Schumacher.
6. Slow is Beautiful-Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India – by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

| 24CS301 | COMPUTER ORGANIZATION AND ARCHITECTURE (Common to CSE, IT and AIML) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Describe the basic principles and operations of digital computers.
- Design arithmetic and logic unit for various fixed and floating point operations
- Construct pipeline architectures for RISC processors.
- Explain various memory systems & I/O interfacings
- Discuss parallel processor and multi-processor architectures

| UNIT I | COMPUTER FUNDAMENTALS | 9 |
|---|---|---|

Computer Types - Functional Units — Basic Operational Concepts - Number Representation and Arithmetic Operations - Performance Measurement - Instruction Set Architecture - Memory Locations and Addresses - Instructions and Instruction Sequencing - Addressing Modes.

| UNIT II | COMPUTER ARITHMETIC | 9 |
|---|---|---|

Addition and Subtraction of Signed Numbers - Design of Fast Adders - Multiplication of Unsigned Numbers - Multiplication of Signed Numbers - Fast Multiplication - Integer Division - Floating-Point Numbers – Representation and Operations.

| | | |
|---|---|---|
| **Study Experiments: Ripple Carry Adder, Carry Look-a-head Adder, Booth's Multiplier** | | |
| **UNIT III** | **BASIC PROCESSING UNIT AND PIPELINING** | **9** |
| Basic Processing Unit: Concepts - Instruction Execution - Hardware Components - Instruction Fetch and Execution Steps -Control Signals - Hardwired Control.<br>Pipelining: Basic Concept - Pipeline Organization- Pipelining Issues - Data Dependencies - Memory Delays - Branch Delays - Resource Limitations - Performance Evaluation -Superscalar Operation.<br>**Study Experiments: Arithmetic Logic Unit, CPU Design** | | |
| **UNIT IV** | **I/O AND MEMORY** | **9** |
| Input/Output Organization: Bus Structure - Bus Operation - Arbitration - The Memory System: Basic Concepts - Semiconductor RAM Memories - Read-only Memories - Direct Memory Access - Memory Hierarchy - Cache Memories - Performance Considerations - Virtual Memory - Memory Management Requirements - Secondary Storage.<br>**Study Experiments: Memory Design, Associative Cache Design, Direct Mapped Cache Design.** | | |
| **UNIT V** | **PARALLEL PROCESSING AND MULTICORE COMPUTERS** | **9** |
| Parallel Processing: Use of Multiple Processors - Symmetric Multiprocessors - Multithreading and Chip Multiprocessors - Clusters - Nonuniform Memory Access Computers - Vector Computation - Multicore Organization. | | |
| **TOTAL: 45 PERIODS** | | |

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Infer the basic principles and operations of digital computers.

**CO2:** Analyze the performance of computers by identifying factors that contribute to performance.

**CO3:** Apply arithmetic algorithms for various operations.

**CO4:** Design hardware to solve computationally intensive problems.

**CO5:** Compare various I/O methods and analyze memory management techniques.

**CO6:** Demonstrate the concept of parallelism in hardware and software

**TEXT BOOKS:**


1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer organization, Tata McGraw Hill, Sixth edition, 2012.
2. David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface, 5th edition, Morgan Kaufmann, 2013.


**REFERENCES:**


1. John P.Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
2. David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface, 6th edition, Morgan Kaufmann, 2021.
3. John L. Hennessy and David A. Patterson, Computer Architecture – A Quantitate Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition,2012.


| | | L | T | P | C |
|---|---|---|---|---|---|
| **24CS302** | **ADVANCED JAVA PROGRAMMING (Lab Integrated) (Common to All Branches)** | **3** | **0** | **3** | **4.5** |

**OBJECTIVES:**

**The Course will enable learners to:**

- Gain a comprehensive understanding of the Java Collections Framework and its various interfaces and implementations.
- Learn the details of Java I/O streams and utility classes for managing dates, numbers, and currencies.

- Develop a thorough understanding of the Stream API introduced in Java 8 and its various operations.
- Explore advanced object serialization and string tokenizing techniques, including pattern matching with regular expressions.
- Understand advanced Stream API features and gain proficiency in using regular expressions for text processing.

| UNIT I | COLLECTIONS FRAMEWORK AND UTILITY CLASSES | 9+9 |
|---|---|---|

Introduction to Collections Framework - Collection Interface- Methods in Collection Interface - Iterable and Iterator Interfaces - List Interface- ArrayList - LinkedList - Set Interface - HashSet- LinkedHashSet - TreeSet - Map Interface - HashMap -LinkedHashMap- TreeMap - Queue Interface -PriorityQueue - Deque Interface - Utility Classes.

**List of Experiments**

1. Write a program that measures the time taken for insertion, deletion, and search operations on ArrayList, LinkedList, HashSet, and TreeSet for varying sizes of input data.
2. Implement a custom data structure that combines features of a list and a set.
3. Write a Java program to create a HashMap where the keys are strings, and the values are integers Add five key-value pairs to the map. Print all the keys and values in the map. Remove an entry by key. Update the value associated with a specific key. Check if the map contains a specific key and a specific value.

| UNIT II | DATE HANDLING AND SERIALIZATION | 9+9 |
|---|---|---|

Date – Calendar – Comparable interface – Observer Interface –– Serialization – Dates - Numbers, and Currency - Working with Dates - Numbers and Currencies - Object Serialization - Serializable Interface - Writing and Reading Serializable Objects -Transient Keyword- SerialVersionUID.

**List of Experiments**

1. Create a class representing a complex object with nested data structures. Serialize the object to a file, then deserialize it back and verify that the object remains intact.
2. Write a program that formats dates and currencies according to different locales.
3. Create a class hierarchy representing different types of objects (e.g., Person, Employee). Serialize instances of these classes to a file using object serialization.

| UNIT III | STREAM API AND FUNCTIONAL PROGRAMMING PARADIGMS | 9+9 |
|---|---|---|

Overview of Stream API - Importance of Stream API in Java 8 and Beyond – Functional Programming Concepts - Creating Streams - Stream Interface Methods - Stream Operations - Intermediate Filtering (filter)-Mapping (map, flatMap)-Sorting (sorted)-Distinct (distinct) - Limit and Skip (limit, skip) - Terminal Operations -Collecting Results (collect) - Reducing and Summarizing (reduce, summaryStatistics)-Iterating (forEach) - Matching and Finding (anyMatch, allMatch, noneMatch, findFirst, findAny) -Counting (count).

**List of Experiments**

1. Write a program that performs stream operations like filtering, mapping, and reducing.
2. Create an infinite stream generator that generates prime numbers. Implement methods to check for primality and generate the next prime number.
3. Write a program that reads a text file containing sentences. Tokenize each sentence into words, filter out stopwords, and print the remaining words.

| UNIT IV | ADVANCED STRING PROCESSING AND I/O TECHNIQUES | 9+9 |
|---|---|---|

String Tokenizer – Parsing - Tokenizing and Formatting - Locating Data via Pattern Matching, Tokenizing - Streams - Types of Streams - The Byte-stream I/O hierarchy - Character Stream Hierarchy – Random Access File class – the java.io. Console Class - Advanced I/O - Piped Streams (PipedInputStream and PipedOutputStream) – SequenceInputStream - PushbackInputStream and PushbackReader.

**List of Experiments**

1. Write a program that reads a text file and tokenizes it into sentences using the StringTokenizer class.
2. Implement a java program that allows users to open a text file, navigate through it using random access, insert, delete, and modify text at specific positions within the file.
3. Implement a program that uses advanced I/O techniques like PipedInputStream, PipedOutputStream, SequenceInputStream, and PushbackInputStream.

| UNIT V | ADVANCED STREAM FEATURES AND REGULAR EXPRESSIONS | 9+9 |
|---|---|---|

Importance and Use Cases of Advanced Stream Features - Creating Custom Streams -Stream Generators (Stream.generate, Stream.iterate) - Infinite Streams - Using Spliterators – Advanced Stream Operations - FlatMapping - Chaining Stream Operations - Stream Peeking (peek) - Advanced Filtering Techniques - Introduction to Regular Expressions - Character Classes - Quantifiers - Pattern Matching - Groups and Capturing - Regex in Java - java.util.regex Package Pattern Class - Matcher Class - String Manipulation with Regex - Splitting Strings - Replacing Text (replaceAll, replaceFirst) - Replacing with Backreferences.

**List of Experiments**

1. Implement custom stream generators using Stream.generate and Stream.iterate methods.
2. Write a program that demonstrates advanced stream operations like flatMapping, chaining stream operations, and peeking.
3. Develop a program that utilizes regular expressions to perform string manipulation tasks such as splitting strings, replacing text, and extracting specific patterns.

**TOTAL: 45+45 = 90 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1**: Implement various data structures by utilizing core Java features and libraries

**CO2:** Demonstrate proficiency in handling Java I/O operations, including file manipulation for efficient data storage and retrieval.

**CO3:** Apply and Analyze the Stream API for functional programming and data processing.

**CO4:** Implement advanced object serialization for complex data structures.

**CO5:** Utilize regular expressions for text parsing and string manipulation.

**CO6:** Build applications using advanced Java programming techniques.

**TEXT BOOK:**


3. Cay S. Horstmann, "Core Java Volume I--Fundamentals," 12th Edition, 2019.
4. Joshua Bloch, "Effective Java," 3rd Edition, 2018.
5. Raoul-Gabriel Urma, "Java 8 in Action: Lambdas, Streams, and Functional-Style Programming," 1st Edition, 2014.
6. Herbert Schildt, "Java: The Complete Reference," 11th Edition, 2018.

7. Alan Mycroft and Martin Odersky, "Programming in Scala," 4th Edition, 2020.

**REFERENCES:**

11. Bruce Eckel, "Thinking in Java," 4th Edition, 2006.
12. Herbert Schildt, "Java: A Beginner's Guide," 8th Edition, 2019.
13. Richard Warburton, "Java 8 Lambdas: Pragmatic Functional Programming," 1st Edition, 2014.

LIST OF EQUIPMENTS:

JDK/Eclipse

| 24CS303 | DATABASE MANAGEMENT SYSTEMS (Lab Integrated) (Common to CSE, IT, CSBS and AIML) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 3 | 4.5 |

**COURSE OBJECTIVES:**

**The Course will enable the learners to:**

- Understand the basic concepts of Data Modeling and Database Systems.
- Understand SQL and effective relational database design concepts.
- Learn relational algebra, calculus and normalization.
- Know the fundamental concepts of transaction processing, concurrency control techniques, recovery procedure and data storage techniques.
- Understand query processing, efficient data querying and advanced databases.

| UNIT I | DATABASE CONCEPTS | 9+9 |
|---|---|---|

Concept of Database and Overview of DBMS - Characteristics of databases -Data Models, Schemas and Instances - Three-Schema Architecture - Database Languages and Interfaces- Introductions to data models types- ER Model- ER Diagrams - Enhanced ER Model - reducing ER to table Applications: ER model of University Database Application – Relational Database Design by ER- and EER-to-Relational Mapping.

**List of Exercise/Experiments**

Case Study using real life database applications anyone from the following list

a) Inventory Management for a EMart Grocery Shop
b) Society Financial Management
c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance

- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.

| UNIT II | STRUCTURED QUERY LANGUAGE | 9+9 |
|---|---|---|

SQL Data Definition and Data Types – Constraints – Queries – INSERT, UPDATE, and DELETE in SQL - Views - Integrity Procedures, Functions, Cursor and Triggers - Embedded SQL - Dynamic SQL.

**List of Exercise/Experiments**

Case Study using real life database applications anyone from the following list and do the following exercises.

a) Inventory Management for a EMart Grocery Shop
b) Society Financial Management
c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
3. Views, Sequences, Synonyms
4. Database Programming: Implicit and Explicit Cursors
5. Procedures and Functions
6. Triggers
7. Exception Handling

| **UNIT III** | **RELATIONAL ALGEBRA, CALCULUS AND NORMALIZATION** | **9+9** |
|---|---|---|

Relational Algebra – Operations - Domain Relational Calculus- Tuple Relational Calculus - Fundamental operations.

Relational Database Design - Functional Dependency – Normalization (1NF, 2NF 3NF and BCNF) –Multivalued Dependency and 4NF –Joint Dependencies and 5NF - De-normalization.

**List of Exercise/Experiments**

1. Case Study using real life database applications anyone from the following list
   a) Inventory Management for a EMart Grocery Shop
   b) Society Financial Management
   c) Cop Friendly App – Eseva
   d) Property Management – eMall
   e) Star Small and Medium Banking and Finance.

Apply Normalization rules in designing the tables in scope.

| **UNIT IV** | **TRANSACTIONS, CONCURRENCY CONTROL AND DATA STORAGE** | **9+9** |
|---|---|---|

Transaction Concepts – ACID Properties – Schedules based on Recoverability, Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Transaction Recovery –Concepts – Deferred Update – Immediate Update.

Organization of Records in Files – Unordered, Ordered – Hashing Techniques – RAID – Ordered Indexes – Multilevel Indexes - B+ tree Index Files – B tree Index Files.

**List of Exercise/Experiments**

Case Study using real life database applications anyone from the following list

a) Inventory Management for a EMart Grocery Shop
b) Society Financial Management
c) Cop Friendly App – Eseva

d) Property Management – eMall
e) Star Small and Medium Banking and Finance

Ability to showcase ACID Properties with sample queries with appropriate settings for the above scenario.

| **UNIT V** | **QUERY OPTIMIZATION AND ADVANCED DATABASES** | **9+9** |
|---|---|---|

Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics.

Distributed Database Concepts – Design –Concurrency Control and Recovery – NOSQL Systems – Document-Based NOSQL Systems and MongoDB.

Explain Plan Statement – Parsing Output – Join Orders and Methods – Indexes - Standard Issues – Query Tuning - Explain Plan vs Explain Analyses.

**List of Exercise/Experiments**

Case Study using real life database applications anyone from the following list

a) Inventory Management for a EMart Grocery Shop
b) Society Financial Management
c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance

Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.

**TOTAL: 45 + 45 = 90 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Map ER model to Relational model to perform database design effectively.
**CO2:** Implement SQL and effective relational database design concepts.
**CO3:** Apply relational algebra, calculus and normalization techniques in database design.
**CO4:** Understand the concepts of transaction processing, concurrency control, recovery procedure and data storage techniques.
**CO5:** Evaluate and implement transaction processing, concurrency control mechanisms, and recovery procedures to maintain data integrity.
**CO6:** Analyze and optimize database queries and understand the features and applications of advanced and distributed database systems, including NoSQL.

**TEXTBOOKS:**


1. Elmasri R. and S. Navathe, “Fundamentals of Database Systems”, Pearson Education, 7th Edition, 2016.
2. Abraham Silberschatz, Henry F.Korth, “Database System Concepts”, Tata McGraw Hill , 7th Edition, 2021.


**REFERENCES:**


1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.Raghu Ramakrishnan, Gehrke “Database Management Systems”, MCGraw Hill, 3rd Edition 2014.
2. Plunkett T., B. Macdonald, “Oracle Big Data Hand Book” , McGraw Hill, First Edition, 2013

3. Gupta G K , “Database Management Systems” , Tata McGraw Hill Education Private Limited, New Delhi, 2011
4. C. J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2015.
5. Maqsood Alam, Aalok Muley, Chaitanya Kadaru, Ashok Joshi, Oracle NoSQL Database: Real-Time Big Data Management for the Enterprise, McGraw Hill Professional, 2013.
6. Thomas Connolly, Carolyn Begg, “Database Systems: A Practical Approach to Design, Implementation and Management”, Pearson, 6th Edition, 2015.
7. Database Management System Part – 1

   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066728202245 6_shared/overview
8. Database Management System Part – 2

   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012767300562919424 1_shared/overview
9. Online Resources:
10. https://infyspringboard.onwingspan.com/web/en/page/home

**LIST OF EQUIPMENTS**

Systems with MySQL, Eclipse or NetBeans

| 24CS304 | **OPERATING SYSTEMS** (Lab Integrated) **(Common to CSE and IT)** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**OBJECTIVES:**

**The Course will enable learners to:**

- Explain the basic concepts of operating systems and process.
- Discuss threads and analyse various CPU scheduling algorithms.
- Describe the concept of process synchronization and deadlocks.
- Analyse various memory management schemes.
- Describe I/O management and file systems.

| **UNIT I** | **INTRODUCTION TO OPERATING SYSTEMS AND PROCESSES** | **6+6** |
|---|---|---|

Introduction: Computer system organization - architecture – Resource management - Protection and Security – Virtualization - Operating System Structures: Services - User and Operating-System Interface - System Calls - System Services - Design and Implementation - Building and Booting an Operating System – Processes: Process Concept - Process Scheduling - Operations on Processes – Inter process Communication - IPC in Shared-Memory Systems - IPC in Message-Passing Systems

**List of Exercise/Experiments:**

1. Basic Unix file system commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc..
2. Programs using Shell Programming.
3. Implementation of Unix System Calls.
4. Implementation of IPC using message queue
   a. Get the input data (integer value) from a process called sender
   b. Use Message Queue to transfer this data from sender to receiver process
   c. The receiver does the prime number checking on the received data

d. Communicate the verified/status result from receiver to sender process, this status should be displayed in the Sender process.

Note: Simultaneously execute two or more processes. Don't do it as a single process

| UNIT II | THREADS AND CPU SCHEDULING | 6+6 |
|---|---|---|

Threads & Concurrency: Overview - Multicore Programming - Multithreading Models - Thread Libraries - Implicit Threading - Threading Issues - CPU Scheduling: Basic Concepts – Scheduling Criteria - Scheduling Algorithms - Thread Scheduling - Multi-Processor Scheduling - Real-Time CPU Scheduling

**List of Exercise/Experiments:**

1. Write a program to implement the following actions using pthreads
   a. Create a thread in a program and called Parent thread, this parent thread creates another thread (Child thread) to print out the numbers from 1 to 20. The Parent thread waits till the child thread finishes
   b. Create a thread in the main program, this program passes the 'count' as arguments to that thread function and this created thread function has to print your name 'count' times.
2. Write C programs to implement the various CPU Scheduling Algorithms.

| UNIT III | PROCESS SYNCHRONISATION AND DEADLOCKS | 6+6 |
|---|---|---|

Process Synchronization: The critical-section problem – Peterson's Solution, Synchronization hardware, Mutex locks, Semaphores, monitors - Classic problems of synchronization: Bounded Buffer Problem - Reader's & Writer Problem, Dinning Philosopher Problem. Deadlock: System model - Deadlock characterization, Methods for handling deadlocks - Deadlock prevention - Deadlock avoidance - Deadlock detection - Recovery from deadlock.

**List of Exercise/Experiments:**

1. Process Synchronization using Semaphores. A shared data has to be accessed by two categories of processes namely A and B. Satisfy the following constraints to access the data without any data loss.
   a. When a process A1 is accessing the database another process of the same category is permitted.
   b. When a process B1 is accessing the database neither process A1 nor another 74 process B2 is permitted.
   c. When a process A1 is accessing the database process B1 should not be allowed to access the database. Write appropriate code for both A and B satisfying all the above constraints using semaphores.

   Note: The time-stamp for accessing is approximately 10 sec.
2. Bankers Algorithm for Deadlock Avoidance

| UNIT IV | MEMORY MANAGEMENT | 6+6 |
|---|---|---|

Memory Management: Contiguous Memory Allocation - Paging - Structure of the Page Table – Swapping - Virtual Memory: Demand Paging – Copy-on write – Page Replacement – Allocation of frames – Thrashing – Memory Compression

**List of Exercise/Experiments:**

1. Analysis and Simulation of Memory Allocation and Management Techniques
   i. First Fit ii. Best Fit iii. Worst Fit
2. Implementation of Page Replacement Techniques
   i. FIFO ii. LRU iii. Optimal page replacement

| UNIT V | STORAGE MANAGEMENT | 6+6 |
|---|---|---|

Mass Storage Structure: Overview of Mass Storage Structure- HDD scheduling – Swap Space Management, I/O systems: I/O Hardware, Application I/O interface, Kernel I/O Subsystem, File System Interface: File Concept – Access Methods – Directory Structure – Protection, File-System Implementation: File-System Structure- File-System Operations - Directory Implementation - Allocation Methods - Free-Space Management, - Case Study-Linux

**List of Exercise/Experiments:**

1. Simulation of File Allocation Techniques
   i. Sequential ii. Linked list iii. indexed
2. Implementation of File Organization Strategies
   Single level directory ii. Two level directory iii. Hierarchical level directory

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Demonstrate the basic concepts of operating systems and process.

**CO2:** Implement process management techniques using inter-process communication.

**CO3:** Implement the concepts of process synchronization and deadlocks.

**CO4:** Apply various memory management schemes for the suitable scenario.

**CO5:** Describe various I/O and file management techniques.

**CO6:** Develop practical skills in developing system-level programming.

**TEXTBOOKS:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts” II, 10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

**REFERENCES:**

1. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
2. Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.

**LIST OF EQUIPMENTS:**

1. Standalone desktops with C/C++/Java/Equivalent compiler

| 24GE311 | **PRODUCT DEVELOPMENT LAB - 1**<br>(Design Thinking)<br>(Common to All Branches) | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **0** | **0** | **2** | **1** |

**OBJECTIVES:**

**The Course will enable learners to:**

- Identify any gaps in the literature, such as open questions or conflicts in previous studies.
- Identify the need for additional research and areas of prior research to prevent duplication of effort.
- encourage the rapid and creative generation of diverse ideas within a limited timeframe, promoting innovation, critical thinking, and problem-solving in relation to a defined problem or research area.

**DESCRIPTION**

The students may be grouped into a batch of strength 3 or 4 to work under a project supervisor. The students learn to observe, empathize and ideate innovative solutions to real-world challenges. The student batches should identify a proposed work and will do literature review to develop prototype idea. Further at the end of the semester they will make a final presentation to exhibit the Identified literature gap.

**LIST OF ACTIVITIES:**

1. Conduct a literature review on the identified research area.

2. Identify the research gap from the literature review conducted.
3. Brain storming to be done to generate a large number of ideas within a specific timeframe.
4. Present the literature review conducted and identified research gap in relation to the research problem being investigated.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Identify, collect, and interpret relevant scholarly literature in the chosen research area.

**CO2:** Evaluate existing research to identify gaps and formulate precise research questions.

**CO3:** Apply brainstorming techniques to generate innovative and diverse research ideas.

**CO4:** Analyze reviewed literature and research gap to effectively present a research problem with clarity and rationale.

**CO5:** Develop skills in using evidence to create and present an engaging and critical argument.

| 24CS311 | APTITUDE AND CODING SKILLS – I (Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Develop vocabulary for effective communication and reading skills.
- Build the logical reasoning and quantitative skills.
- Develop error correction and debugging skills in programming.

**List of Exercises:**

1. **English – Phase I**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. **Logical Reasoning – Phase I**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. **Quantitative Ability - Phase I**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. **Automata Fix – Phase I**

Logical, Compilation and Code reuse

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Develop vocabulary for effective communication skills.

**CO2:** Build the logical reasoning enhance critical thinking.
**CO3:** Develop error correction and debugging skills in programming.
**CO4:** Apply programming skills to develop programs efficiently
**CO5:** Solve problems using quantitative skills
**CO6:** Develop effective reading and listening skills.

| 24MC301 | INDIAN CONSTITUTION | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 0 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To have some knowledge about Indian Constitution.
- To understand the concept of fundamental rights
- To learn about Lok Sabha and Rajya Sabha
- To have some knowledge about Legislative Assembly and Legislative Council
- To learn about Local Self Government

| UNIT I | INTRODUCTION |
|---|---|

Meaning and Importance of Constitution, Preamble and Salient Features of the Constitution

| UNIT II | FUNDAMENTAL RIGHTS |
|---|---|

Fundamental Rights, Right to Equality, Right to Freedom, Right against exploitation, Right to freedom of religion, Cultural and Educational Rights, Right to Constitutional Remedies and Duties, Directive Principlesof State Policy.

| UNIT III | LOK SABHA AND RAJYA SABHA |
|---|---|

Union Government – Lok Sabha and Rajya Sabha Composition, Powers, and functions: The President, ThePrime Minister, and Supreme Court: Role Position and Powers/ functions.

| UNIT IV | LEGISLATIVE ASSEMBLY AND LEGISLATIVE COUNCIL |
|---|---|

State Government - Legislative Assembly and Legislative Council: Composition, Powers and functions: TheGovernor, Chief Minister and High Court: Role, Position and Powers/ functions

| UNIT V | LOCAL SELF GOVERNMENT |
|---|---|

Local self-Government, Panchayat Raj System in India; Election Commission; Public Service Commissions,Role, powers, and function

**OUTCOMES:**

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

CO1: Interpret the knowledge on Indian Constitution.

CO2: Demonstrate the knowledge gained through fundamental rights concept.CO3: Relate the concept of Lok Sabha and Rajya Sabha.
CO4: Illustrate the concept of Legislative Assembly and Legislative Council.CO5: Analyze the concept of Local Self Government.

**TEXT BOOK:**

1. M V Pylee, An Introduction to The Constitution of India, Vikas Publishing House Pvt. Ltd., 5thEdition, 2007.

**REFERENCES:**

1. Durga Das Basu, Introduction to the Constitution of India, 19th Edition Reprint 2009.
2. Sharma, Brij Kishore, “Introduction to the Constitution of India”, Prentice Hall of India, 7th Edition, 2015.

## SEMESTER IV

| 24MA401 | PROBABILITY AND STATISTICS<br>(Common to CSE, IT) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Provide the necessary basic concepts of random variables and introduce some standard distributions.
- Comprehend the concepts of joint distributions, marginal and conditional distributions.
- Test the hypothesis for small and large samples.
- Introduce the concepts of analysis of variances.
- Understand the concept of statistical quality control.

**UNIT I** | **ONE-DIMENSIONAL RANDOM VARIABLES** | **9+6**

Basic probability, Independent events, Conditional probability (definition) - Random variable - Discrete and continuous random variables - Moments - Moment generating functions - Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

**List of Exercises/Experiments using R Programming:**

1. Finding conditional probability.
2. Finding mean, variance and standard deviation.

**UNIT II** | **TWO-DIMENSIONAL RANDOM VARIABLES** | **9+6**

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and linear regression - Transformation of random variables.

**List of Exercises/Experiments using R Programming:**

1. Finding marginal density functions for discrete random variables.
2. Calculating correlation and regression.

**UNIT III** | **TESTING OF HYPOTHESIS** | **9+6**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t and F distributions for mean and variance - Chi-square test- Contingency table (test for independent) - Goodness of fit.

**List of Exercises/Experiments using R Programming:**

1. Testing of hypothesis for given data using z - test.
2. Testing of hypothesis for given data using t - test.

**UNIT IV** | **DESIGN OF EXPERIMENTS** | **9+6**

One way and Two-way classifications - Completely randomized design - Randomized block design - Latin square design.

**List of Exercises/Experiments using R Programming:**

1. Perform one-way ANOVA test for the given data.
2. Perform two-way ANOVA test for the given data.

**UNIT V** | **STATISTICAL QUALITY CONTROL** | **9+6**

Control charts for measurements ($\bar{X}$ and R charts) - Control charts for attributes (p, c and np charts) - Tolerance limits.

**List of Exercises/Experiments using R Programming:**

1. Interpret the results for $\bar{X}$- Chart for variable data.
2. Interpret the results for R-Chart for variable data.

**TOTAL: 45+30=75 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Compute the statistical measures of standard distributions.

**CO2:** Apply joint, marginal and conditional distributions to solve practical problems

**CO3:** Determine the correlation and regression for two dimensional random variables

**CO4:** Employ the concept of testing of hypothesis to solve real life problems.

**CO5:** Apply the concept of analysis of variance for various experimental designs.

**CO6:** Prepare the control charts for variables and attributes for analyzing the data.

**TEXT BOOKS:**


1. R.A. Johnson, I. Miller and J. Freund, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2023.
2. J.S. Milton and J.C. Arnold, "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2019.


**REFERENCES:**


1. J. L. Devore, "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 9th Edition, Reprint 2020.
2. S. M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 6th Edition, Elsevier, 2020.
3. M. R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, 4th Edition, 2013.
4. R. E. Walpole, R. H. Myers, S.L. Myers and K. Ye, "Probability and Statistics for Engineers and Scientists". Pearson Education, Asia, 9th Edition, Reprint 2021.


**LIST OF EQUIPMENTS:**

1.

| 24CS401 | COMPUTER NETWORKS (Lab Integrated) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Study the fundamental concepts of computer networks and physical layer.
- Apply the knowledge of various protocols and techniques used in the data link layer.
- Implement the services of network layer and network layer protocols.
- Illustrate different protocols used in the transport layer.
- Build applications using the application layer protocols.

| UNIT I | INTRODUCTION AND PHYSICAL LAYER | 9+6 |
|---|---|---|

Data Communications – Network Types – Protocol Layering – Network Models (OSI, TCP/IP) Networking Devices: Hubs, Bridges, Switches – Performance Metrics – Transmission media - Guided media -Unguided media- Switching-Circuit Switching - Packet Switching.

**List of Exercise/Experiments:**

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute.
2. Capture ping and trace route PDUs using a network protocol analyzer and examine.

| UNIT II | DATA LINK LAYER | 9+6 |
|---|---|---|

Introduction – Link-Layer Addressing- Error Detection and Correction - Wired LANs: Ethernet - Wireless LANs – Introduction – IEEE 802.11, Bluetooth

**List of Exercise/Experiments:**

1. Simulation of an error correction code (like CRC).
2. Simulation of Flow control mechanisms.

| **UNIT III** | **NETWORK LAYER** | **9+6** |
|---|---|---|

Network Layer Services – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

**List of Exercise/Experiments:**

1. Simulation of DNS using UDP sockets.
2. Implementation of HTTP, Web Caching, FTP using socket programming.

| **UNIT IV** | **TRANSPORT LAYER** | **9+6** |
|---|---|---|

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol –Transmission Control Protocol – SCTP.

**List of Exercise/Experiments:**

1. Develop a DNS client server to resolve the given host name or IP address.
2. Simulation of unicast routing protocols.

| **UNIT V** | **APPLICATION LAYER** | **9+6** |
|---|---|---|

Application layer-WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP

**List of Exercise/Experiments:**

1. Observing Packets across the network and Performance Analysis of various Routing protocols.
2. Simulation of Transport layer Protocols and analysis of congestion control techniques in the network.

**TOTAL: 45 +30 = 75 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Understand the fundamental concepts of computer networks.
**CO2:** Apply the various routing protocols to solve real-world problems.
**CO3:** Build simple applications to solve societal problems.
**CO4:** Apply the simulation tools to implement various protocols used in the various layers.
**CO5:** Analyze the various application layer protocols.
**CO6:** Apply the mathematical knowledge to do performance analysis of various routing protocols.

**TEXT BOOK:**

1. Data Communications and Networking, Behrouz A. Forouzan, McGraw Hill Education, 5th Ed., 2017.

**REFERENCES:**

1. Computer Networking- A Top Down Approach, James F. Kurose, University of Massachusetts and Amherst Keith Ross, 8th Edition, 2021.
2. Computer Networks, Andrew S. Tanenbaum, Sixth Edition, Pearson, 2021.
3. Data Communications and Computer Networks, P.C. Gupta, Prentice-Hall of India, 2006.
4. Computer Networks: A Systems Approach, L. L. Peterson and B. S. Davie, Morgan Kaufmann, 3rd ed., 2003.

**LIST OF EQUIPMENTS:**
C/Java, Ubuntu OS, NS2 simulation tool

| 24CS402 | DESIGN AND ANALYSIS OF ALGORITHMS (Common to CSE, IT, CSBS and AIML) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**
**The Course will enable learners to:**

- Critically analyse the efficiency of alternative algorithmic solutions for the same problem
- Illustrate brute force and divide and conquer design techniques.
- Explain dynamic programming for solving various problems.
- Apply greedy technique and iterative improvement technique to solve optimization problems
- Examine the limitations of algorithmic power and handling it in different problems.

| UNIT I | INTRODUCTION | 9+6 |
|---|---|---|

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving –Fundamentals of the Analysis of Algorithmic Efficiency – Asymptotic Notations and their properties. Analysis Framework – Mathematical analysis for Recursive and Non-recursive algorithms

**List of Exercise/Experiments:**

1. Perform the recursive algorithm analysis.
2. Perform the non-recursive algorithm analysis.

| UNIT II | BRUTE FORCE AND DIVIDE AND CONQUER | 9+6 |
|---|---|---|

Brute Force - String Matching - Exhaustive Search - Knapsack Problem - Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort - Multiplication of Large Integers – Closest-Pair and Convex Hull Problems - Transform and Conquer Method: Heap Sort

**List of Exercise/Experiments:**

1. Write a program to search an element using binary search
2. Write a program to sort the elements using merge sort and find time complexity.

| UNIT III | DYNAMIC PROGRAMMING | 9+6 |
|---|---|---|

Dynamic programming – Principle of optimality – Floyd‘s algorithm – Multi stage graph - Optimal Binary Search Trees - Longest common subsequence - Matrix-chain multiplication – Travelling Salesperson Problem – Knapsack Problem and Memory functions.

**List of Exercise/Experiments:**

1. Solve Floyd’s algorithm
2. Write a program to find the longest common subsequence

| UNIT IV | GREEDY TECHNIQUE AND ITERATIVE IMPROVEMENT | 9+6 |
|---|---|---|

Greedy Technique – Prim‘s algorithm and Kruskal’s Algorithm – Huffman Trees. The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs - The Stable marriage Problem

**List of Exercise/Experiments:**

1. Write a program to find minimum spanning tree using Prim’s algorithm
2. Implement Kruskal’s algorithm to find minimum spanning tree

| UNIT V | BACKTRACKING AND BRANCH AND BOUND | 9+6 |
|---|---|---|

P, NP NP- Complete and NP Hard Problems. Backtracking – N-Queen problem - Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem

**List of Exercise/Experiments:**

3. Write a program to implement sum of subset problem.
4. Solve knapsack problem using branch and bound technique

**TOTAL: 45+30=75 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Understand the different algorithm design paradigms.

**CO2:** Design algorithms for real world problems using algorithmic design techniques.

**CO3:** Analyse the efficiency of simple recursive and non-recursive algorithms.

**CO4:** Analyse the algorithm's worst, best and average case behaviour in terms of time and space.

**CO5:** Understand the approximation algorithms for solving NP Hard problems

**CO6:** Solve the problems by selecting suitable algorithmic design techniques.

**TEXT BOOKS:**

3. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.
4. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.

**REFERENCES:**

5. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
6. S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.
7. http://nptel.ac.in/

**LIST OF EQUIPMENTS:**

2. Standalone PC with C/C++/Java

| 24IT402 | WEB DEVELOPMENT FRAMEWORKS (Lab Integrated) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 3 | 4.5 |

**COURSE OBJECTIVES:**

**The Course will enable the learners:**

- To understand web semantics and related tools and framework
- To get hands on latest JS based web frameworks
- To develop a scalable and responsive web application
- To develop an industry ready application web enterprise feature

| UNIT I | ADVANCED TYPESCRIPT | 9+9 |
|---|---|---|

Introduction to HTML5 and CSS3, Media Queries, JS, DOM, BootStrap, Variables, Loops, Operators, Scope, Hoisting, Arrays, Spread, REST, DeStructuring

Introduction, Advantage of Using TS over JS, and where to Use and not to use TS - Understanding the Compiler (Transpiler), and its options, Scope of TS - Variable Scopes, Static Data Types - String, Number, Interface, Date - Union, Tuple, Undefined Data Types, Unknown vs any vs Never - Object Oriented , Arrow Funcions - Types, KeyOf, TypeOf, InstanceOf ,Narrowing, Conditional Types - Generics, Enum ,Required / Partial / Optional - Arrays, Modules ,Async Processing w Call backs ,Type Inference, Type Compatibility, Utility Type -

Unit Testing, TSLint

**List of Exercise/Experiments**

1) Create a TS Object for Bank Account (with attributes like à customer name, account type, balance, data of creation, bank name, branch name, pan card number). Using JS Object keyword, try to perform following activities
   - List down all the entries of the bank object
   - Check the existence of a key
   - If key found, get the value for the key
2) Spread Operator
   - Merge Customer and Account Arrays
   - Update the Customer Object with the new values
   - Develop a function that takes an Spread Argument and calculates total balance.

| **UNIT II** | **INTRODUCTION TO REACTJS** | **9+9** |
|---|---|---|

Introduction to React - ES6 Features, What is React?, React Features - Setting up React Development Environment:- Node.js and npm installation, Create React App, Project structure - JSX (JavaScript XML):- What is JSX?,JSX Syntax and Rules,JSX Expressions - Components in React:- Functional Components, Class Components, Props and PropTypes - State and Lifecycle :- State and setState, Lifecycle Methods, Mounting, Updating, and Unmounting, Handling Events in React - Event Handling in React :- Synthetic Events, Event Binding, - Conditional Rendering:-If-else Statements, Ternary Operator, Logical && Operator
Lists and Keys:- Rendering Lists, Keys and Reconciliation, Extracting Components.

**List of Exercise/Experiments**

1) A leading bank from APAC wants to modernize their banking services and decided to build a online multi channel mobile ecommerce platform. As part of the drive, starting building following feature set in a staggered model emplying ReactJS as front end library and associated libs from React eco system. Feature to be implemented are
   a. User Login Page
   b. Account Summary
   c. Funds Transfer (within bank and outside bank)
   d. Recurring and Fixed deposits
   e. Letter of Credit
   f. Salary or 3rd Party Payment
2) Unit 2 Scope – Project Setup, Web App Layout Completion using BootStrap or Tailwind, Login Page Implementation, Landing Page Implementation, Authentication and Authorization Implementation.

| **UNIT III** | **REACTJS COMPONENTS** | **9+9** |
|---|---|---|

Forms and Controlled Components :- Form Handling in React, Controlled Components, Uncontrolled Components - Basic Hooks :- useState, useRef, useEffect, - Routing in React:- Introduction to React Router, Route, Link, and Switch Components, Route Parameters, useNavigate, useParams, - REST API – Axios GET/PUT/Delete/Remove, Interceptor, Headers, Authorization Token, Promise and Observables (via rxjs)

**List of Exercise/Experiments**

1) Extend the Project developed in previous section with newly learnt concepts

a. Unit 3 Scope – Forms and Validation (React Form Validation), Integration of Back End Apis via Axios, API Security Implementation, Routes and Navigation with Private Routes, Usage of useEffect, UseContext hooks

| UNIT IV | REACT PRO TOOLKIT: ERROR MANAGEMENT, ABSTRACTIONS & DATA HANDLING | 9+9 |
|---|---|---|

Error Handling :- Error Boundaries, componentDidCatch, Error Handling Strategies
Higher-Order Components (HOCs) :- What are HOCs?, Creating and Using HOCs, HOCs vs Render Props, Code Splitting and Lazy Loading, Server-Side Rendering - Data Fetching with React Query :- React Query, Introduction to React Query, Query Keys and Query Functions, Query Invalidation and Refetching.

**List of Exercise/Experiments**

1) Extend the Project developed in previous section with newly learnt concepts
    a. Unit 4 Scope – Completion of Remaining Modules, Error Handling, HOC and AUX implementation, Lazy loaded components for improved performance

Extend the Project developed in previous section with newly learnt concepts

| UNIT V | REACT UNDER THE HOOD: TESTING, CONTEXT API, AND REDUX | 9+9 |
|---|---|---|

Testing React Components :- Introduction to Testing, Jest Framework, React Testing Library
Context API :- Creating Context, Providing and Consuming Context, useContext Hook
Redux Overview :- What is Redux?, Redux Principles, Single Source of Truth - Redux Actions and Reducers :- Redux Actions, Redux Reducers, Combining Reducers.

**List of Exercise/Experiments**

1) Extend the Project developed in previous section with newly learnt concepts
    a. Unit 5 Scope – Unit Testing using JEST, Redux implementation for state management.

**Business Use Case Implementations**

1) Student Management System
2) Retail Bank System
3) eCommerce System
4) Student LMS Management System

**TOTAL: 45+45=90 PERIODS**

**COURSE OUTCOMES:**

After completing the course, students will have the ability to

**CO1.** Understand and apply modern web technologies including HTML5, CSS3, JavaScript, and advanced TypeScript concepts to build dynamic web components.

**CO2.** Develop responsive and modular front-end applications using ReactJS, including component creation, state management, and routing.

**CO3.** Implement advanced React features like hooks (useState, useEffect, useRef), React Router, and REST API integration using Axios for dynamic content handling.

**CO4.** Utilize higher-order components (HOCs), lazy loading, and server-side rendering to optimize and abstract React applications.

**CO5.** Perform unit testing using Jest and RTL, and manage global application state efficiently using Context API and Redux.

**CO6.** Design and deliver scalable and real-world enterprise web applications with complete user interface flow, security, and error handling.

**TEXTBOOKS:**


1) David Flanagan**,** Javascript The Definitive Guide, Paperback, 7th Edition, 2020.
2) David Choi ,Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL Paperback – Import, 18 December 2020.
3) Mehul Mohan, Advanced Web Development with React Paperback – 1 January 2020.


**E-RESOURCES:**

1. Parental Website - https://reactjs.org/
2. The Road to Learn React: Your journey to master plain yet pragmatic React.js by Robin Wieruch
3. Learning React: Functional Web Development with React and Redux by Alex Banks and Eve Porcello
4. Learning React by KirupaChinnathambi
5. "React Up & Running" by StoyanStefanov
6. https://www.edureka.co/reactjs-redux-certification-training
7. CodePen
8. CodeSandbox (Preferred)
9. Stackblitz

**LIST OF EQUIPMENTS:**

- NodeJS (v22.11.2)
- Github as code repository
- Visual studio code as IDE
- RTL as unit testing framework
- Responsive design w bootstrap
- ReactJS installation (v17)
- Chrome / FIreFox Browsers (latest)
- Responsive using Media Queries & Bootstrap Material & Antdesign
- Design based Apps

| 24GE411 | PRODUCT DEVELOPMENT LAB - 2<br>(Functional Design)<br>(Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To accurately capture the expectations, needs, and constraints of stakeholders to ensure that the system being developed aligns with user goals and real-world usage scenarios.
- To visually represent the system's structure and functional relationships, enabling clearer communication, easier analysis, and better planning of system architecture and workflow.
- To create a precise and comprehensive reference document that guides development, ensures clarity, and serves as a basis for verification, validation, and future system enhancements.

**DESCRIPTION**

The students may be grouped into a batch of strength 3 or 4 to work under a project supervisor. Further at the end of the semester they will make a final presentation to exhibit the functional design and the process to develop a product.

**LIST OF ACTIVITIES:**

1. Understand and document functional requirements based on stakeholder needs.
2. Map out how functions interact and relate to each other using functional block diagrams or flowcharts.
3. Write detailed specification describing each function's role, behavior, constraints, and expected outcomes.
4. Check if defined functions meet the intended requirements and can be validated/tested.
5. Present the design concepts carried out for the identified research gap in relation to the research problem being investigated.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Interpret stakeholder needs and document comprehensive functional requirements for the proposed system.

**CO2:** Develop functional block diagrams or flowcharts to represent system interactions and functional relationships.

**CO3:** Analyze functional specifications that define roles, behaviors, constraints, and performance expectations for each function.

**CO4:** Evaluate the defined functional model through verification and validation techniques to ensure alignment with original requirements.

**CO5:** Analyze and present functional design solutions aligned with the identified research problem and gap.

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS**

| S. No. | Description of Equipment | Quantity |
|---|---|---|
| 1 | CNC Router | 1 No |
| 2 | 3D Printer | 1 No |
| 3 | 3D Scanner | 1 No |
| 4 | Laser cutting Machine | 1 No |

| | | |
|---|---|---|
| 5 | Multimeter | 5 Nos |
| 6 | Solder Stations | 5 Sets |
| 7 | Desoldering Machine | 1 No |
| 8 | PCB Milling Machine | 1 No |
| 9 | Variable Power Supply | 1 No |
| 10 | Modelling Software(open source) | 30 Nos |

| 24CS411 | APTITUDE AND CODING SKILLS – II<br>(Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Develop advanced vocabulary for effective communication and reading skills.
- Build an enhanced level of logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.
- To apply data structures and algorithms in problem solving.

**List of Exercises:**

1. **English – Phase II**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. **Logical Reasoning – Phase II**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. **Quantitative Ability - Phase II**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. **Automata Fix – Phase II**

Logical, Compilation and Code reuse

5. **Automata - Phase II**

Data Structure Concepts: Array and Matrices, Linked list, String processing and manipulation, Stack/Queue, Sorting and Searching

Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Develop advanced vocabulary for effective communication skills.
**CO2:** Build an enhanced level of logical reasoning and quantitative skills.

**CO3:** Develop error correction and debugging skills in programming.
**CO4:** Apply data structures and algorithms in problem solving.
**CO5:** Develop advanced vocabulary for effective reading skills
**CO6:** Apply advanced algorithm design techniques to develop programs

## PROFESSIONAL ELECTIVE COURSES: VERTICALS
## CYBER SECURITY

| 24CS901 | ETHICAL HACKING (Lab Integrated) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**
**The Course will enable learners to:**

- To understand Information Security, Cyber threats, attacks, web security.
- To know about different modes of hacking tools and phases of penetration tests and Methodologies.
- To Gain the knowledge of the use and availability of tools to support an ethical hack
- To Gain the knowledge of interpreting the results of a controlled attack

| UNIT I | Fundamentals of Ethical Hacking | 6+6 |
|---|---|---|

Introduction to Cyber Security-Overview of Cyber threats – Data and Network Security Attacks – Threats: MAC spoofing – Access control Network protocol and services– Hacking terms - Ethical Hacking overview –Modes of Ethical Hacking – Ethics and Legality.

**List of Exercise/Experiments:**

1. Setup a honey pot and monitor the honey pot on network
2. Write a script or code to demonstrate SQL injection attacks
3. Write a code to demonstrate DoS attacks

| UNIT II | Hacking Methodology Reconnaissance | 6+6 |
|---|---|---|

Foot printing: Reconnaissance - Footprinting theory – Penetration test – Phases of Penetration test - Methods of Footprinting – Network Information gathering process – Terminologies of Foot printing –Footprinting through search engine directives – Whois tool –NetCraft – Extract Information from DNS - Foot printing from Email servers – Shodan – Dig – MetaGooFil – Social Engineering.

**List of Exercise/Experiments:**

1. Performing footprinting using Google Hacking, website information, information about an archived website, to extract contents of a website, to trace any received email, to fetch DNS information.
2. Create a social networking website login page using phishing techniques

| UNIT III | Scanning and Enumeration | 6+6 |
|---|---|---|

Scanning: Concept of Nmap -Port scanning with Nmap – Subnet - Scanning IPs with Nmap Pings and Ping sweeps – Port - Three way handshake – NmapSyn scanning – Nmap TCP Scan – Nmap UDP Scan - Bypass of IPS and IDS – Nmap Script Engine Enumeration: Service Fingerprinting – Vulnerability Scanners – Basic Banner Grabbing – Common Network services – SMTP – DNS – RPCBIND Enumeration – SMB – NetBIOS

**List of Exercise/Experiments:**

1. Implement Passive scanning, active scanning, session hijacking, cookies extraction using Burp suit tool
2. Use port scanning. network scanning tools,IDS tool, sniffing tool and generate reports.

| UNIT IV | System and Network Vulnerability | 6+6 |
|---|---|---|

Metasploit – Penetration testing with framework Metasploit – Scan services to identify vulnerabilities – Scan FTP services – Scan HTTP services – Exploitation – Post exploitation techniques – Meterpreter – Rootkit – Backdoor – Password hashes – Privilege Escalation - Scanning vulnerable services with Nessus

**List of Exercise/Experiments:**

1. Penetration Testing using Metasploit and metasploitable
2. Creating a simple keylogger in python
3. Creating a virus
4. Creating a trojan.
5. Install rootkits and study variety of options

| **UNIT V** | **Software Vulnerability (OWASP 10)** | **6+6** |
|---|---|---|

Fundamentals of OWASP Zed Attack Proxy (ZAP) – Web app vulnerability scan - Code Injection Attacks – Broken Authentication – Sensitive Data Exposure – XML External Entities – Broken Access Control – Security misconfiguration – Website pen testing - Cross Site Scripting (XSS) – Insecure Deserialization – Using Components with known vulnerabilities – Insufficient logging and monitoring.

**List of Exercise/Experiments:**

1. Install jcrypt tool (or any other equivalent) and demonstrate Asymmetric, Symmetric Crypto algorithm, Hash and Digital/PKI signatures studied in theory Network Security And Management

**TOTAL:30+30=60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Identify cybersecurity threats and network vulnerabilities to enhance data and system security.

**CO2:** Perform Penetration Testing using tools Metasploit and Nmap to evaluate system defenses.

**CO3:**Apply ethical hacking techniques reconnaissance, scanning, and enumeration to evaluate security posture.

**CO4:** Detect and exploit vulnerabilities in networks and systems while adhering to ethical standards.

**CO5:** Analyze Software Vulnerabilities and mitigate risks.

**CO6:** Develop and implement countermeasures against attacks such as SQL injection, DoS, and malware.

**TEXTBOOKS:**


1. McClure, S., Scambray, J. and Kurtz, G., 2012. Hacking Exposed 7Network Security Secrets and Solutions. New York: McGraw-Hill.
2. Engebretson, P., 2013. The Basics Of Hacking And Penetration Testing. Amsterdam: Syngress, an imprint of Elsevier.


**REFERENCES:**


13. Zaid Sabih, Learn Ethical Hacking from Scratch, 2018, PACKT publishing, ISBN: 978-1-78862-205-9
14. Harsh Bothra, Hacking be a hacker with ethics, Khanna Publishing, 2016, ISBN: 978-03-86173-05-8


**LIST OF SOFTWARE:**

1. Kali Linux -Metasploit Framework (MSF) **&** Nmap
2. WireShark, Jcrypt Tool
3. Burp suite

| 24CS902 | SOCIAL NETWORK SECURITY (Lab Integrated) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Learn the Concepts of Social Network Security
- Understand the methods of Social Network Anonymization
- Learn the techniques for security and privacy in social networks
- Learn the security challenges in social networks
- Explore the Tools to learn about the social network security implementation

| UNIT I | INTRODUCTION TO SOCIAL NETWORK SECURITY | 6+6 |
|---|---|---|

Introduction – Social Networking Applications – Social media Websites – Social Network Representation –Building Social Authority –Privacy and Information sharing – Controlling Application privacy – Cybercrime – Information Leakage – False information – Content Management in Social Networks

**List of Exercise/Experiments**

1. Explore a Social network analysis tools to learn about the users and networks
2. Learn a program / tool to illustrate information leakage

| UNIT II | SOCIAL NETWORK ANONYMIZATION | 6+6 |
|---|---|---|

Social Networks - Privacy in Social Networks – Social Network Representation – Social Network Analysis - Data Anonymization – Challenges in Anonymization – Privacy preservation – Social Network Anonymization Factors – Anonymization Algorithms – Link Anonymization techniques –Background Knowledge Attacks – Anonymity in Modern Social Networks

**List of Exercise/Experiments**

1. Experiment a link anonymization technique
2. Explore ARX anonymization tool

| UNIT III | ANALYZING AND SECURING SOCIAL NETWORKS | 6+6 |
|---|---|---|

Supporting Technologies - Aspects of Analyzing and Securing Social Networks - Techniques and Tools for Social Network Analytics - Social Network Analytics and Privacy Considerations - Access Control and Inference for Social Networks - Social Media Integration and Analytics Systems - Social Media Application Systems - Secure Social Media Systems - Secure Social Media Directions.

**List of Exercise/Experiments**

1. Implement a program for network access control to illustrate malware attacks
2. Create a simple social network application to show authentication mechanisms
3. Create an application for the following scenario: “Social networking users are presented with two apparently similar emails or websites. They must first identify the differences between them and then decide which one is a scam attempting to steal their information or money.”

| UNIT IV | SECURITY CHALLENGES IN SOCIAL NETWORKS | 6+6 |
|---|---|---|

Identity manipulation – Threats from third party applications - Trust in Social Networking Sites - Viruses, Phishing Attacks and Malwares–Tracking users – Privacy of Data – Identity Federation Challenges –Social media threats – Location disclosure – Spoofing – Profile cloning – Fake product sale – Cyber bullying – Prevention Strategies

**List of Exercise/Experiments**

1. Implement a program in python to estimate trust of social network users group
2. Write a SQL injection program in python/JAVA to handle session hijacking

3. Create an application using any social network platform to demonstrate profile cloning concept.

| UNIT V | SOCIAL NETWORK SECURITY TOOLS | 6+6 |
|---|---|---|

Analysis Tools for Social Media - AutoMap – Gephi – ORA Lite – ORA Pro – Wolfram Alpha – Social Media Data Collection –Blog Trackers –Crowd Tangle – MalTego – Pulse – SCRAAWL – Fact and Image Trackers – Google Fact Check Tools – Bot Mitigation – BotSlayer – Social Cyber Security

**List of Exercise/Experiments**

1. Perform fact checking of social networking content using google fact checking tools
2. Explore a tool that helps protect websites from bot traffic and bot attacks.
3. Create a fake news tracker program to collect, detect and help visualize fake news data from any social network

**TOTAL:30+30=60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Understand social network security concepts and applications.
**CO2:**Apply data anonymization techniques to enhance privacy in social networks.
**CO3:** Analyze and secure social networks using relevant technologies and tools.
**CO4:** Identify and address security challenges inherent in social networks.
**CO5:** Utilize security tools for monitoring and protecting social network activities.
**CO6:** Demonstrate ethical considerations in social network security practices.

**TEXTBOOKS:**


1. Brij B. Gupta, Somya Ranjan Sahoo, “Online Social Networks Security-Principles, Algorithm, Applications, and Perspectives”, First Edition, 2021.
2. Bhavani Thuraisingham, SatyenAbrol, Raymond Heatherly, Murat Kantarcioglu, Vaibhav Khadilkar, Latifur Khan, “Analyzing and Securing Social Networks”, First Edition, 2020.


**REFERENCES:**


1. B. K. Tripathy, Kiran Baktha, “Security, Privacy, and Anonymization in Social Networks: Emerging Research and Opportunities”, IGI Global Publication, 2019.
2. Michael Cross, “Social Media Security, Leveraging Social Networking While Mitigating Risk”, Elsevier Publication, First Edition, 2013.
3. El-Sayed M. El-Alfy; Mohamed Eltoweissy; Errin W. Fulp; Wojciech Mazurczyk, “Nature-Inspired Cyber Security and Resiliency: Fundamentals, Techniques and Applications”, IET Publication, 2019.
4. Yaniv Altshuler, “Security and Privacy in Social Networks”, Springer, 2013.


**LIST OF SOFTWARE:**

**Software/ Tools Required:**

Python
ARX anonymization tool
BotSlayer
GOOGLE FACT CHECK TOOLS

| 22CS903 | BLOCKCHAIN TECHNOLOGY (Lab Integrated) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To understand block chain system’s fundamental components, how they fit together and examine a decentralization using block chain.
- To explain how Crypto currency works.

- To explain the components of Ethereum and Programming Languages for Ethereum
- To study the basics of Web3 and Hyper ledger.
- To give an insight of alternative block chains and its emerging trends.

| UNIT I | INTRODUCTION TO BLOCKCHAIN | 6+6 |
|---|---|---|

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization – Symmetric Cryptography - Mathematics – Asymmetric Cryptography – public and private keys – Elliptic curve cryptography – Discrete logarithm problem in ECC

**List of Exercise/Experiments**

1. Create a Public Ledger vs. Private Ledger with the various attributes like Access, Network Actors, Native token, Security, Speed and examples.
2. Block chain Implementation Programming code.

| UNIT II | INTRODUCTION TO CRYPTOCURRENCY | 6+6 |
|---|---|---|

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments Wallets – innovation in Bitcoin – Alternative Coins – Theoretical Foundations – Bitcoin.

**List of Exercise/Experiments**

1. Prepare build system and Building Bitcoin Core.
2. Create a Maven project using Web3j.

| UNIT III | ETHEREUM | 6+6 |
|---|---|---|

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code – Blocks and Blockchain – Fee Schedule – Supporting Protocols – Solidity Language.

**List of Exercise/Experiments**

1. Implement an ICO on Ethereum.
2. Write Hello World smart contract in a higher programming language (Solidity).

| UNIT IV | WEB3 AND HYPERLEDGER | 6+6 |
|---|---|---|

Introduction to Web3 – Contract Deployment – POST Requests – Development frameworks Hyperledger as a protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger.

**List of Exercise/Experiments**

1. Building a Simple IOU CorDapp
2. Implement Asset Transfer on CorDapp.

| UNIT V | ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS | 6+6 |
|---|---|---|

Kadena – Ripple- Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research. Case Study - Install IPFS locally on our machine, initialize your node, view the nodes in network.

**List of Exercise/Experiments**

1. Install IPFS locally on our machine, initialize your node, view the nodes in network and add files and directories install Swarm and run any test file.

**TOTAL:30+30 = 60 PERIODS**

**OUTCOMES:**

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

**CO1:** Understand the fundamentals and history of blockchain technology.
**CO2:** Analyze different types of blockchain and their consensus mechanisms.
**CO3:** Apply cryptographic principles to blockchain systems.
**CO4:** Explore cryptocurrency concepts, including Bitcoin and alternative coins.
**CO5:**Evaluate Ethereum and its programming languages for decentralized applications.
**CO6:**Investigate other blockchain platforms like Hyperledger and emerging trends.

**TEXTBOOKS:**


1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd, March 2018.
2. BellajBadr, Richard Horrocks, Xun (Brian) Wu, "Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited, 2018.


**REFERENCES:**


1. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.


| 22CS904 | CLOUD AND DATA SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Learn the basics of cloud security, including the shared responsibility model and identity management.
- Set up a secure cloud infrastructure with features like virtual private clouds and security groups.
- Develop skills for identifying and managing security incidents in the cloud, adhering to best practices.
- Safeguard application data at rest and in transit using encryption.
- Understand the features of Database Security and Security in Data Warehouses.

| UNIT I | INTRODUCTION TO SECURITY IN CLOUD | 9 |
|---|---|---|

Introduction to Security, Security in the Cloud, Security design principles, Shared responsibility model, Activity: Shared Responsibility Model, Identity and Access Management (IAM) fundamentals, Authenticating and Authorizing with IAM, Examples of authorizing with IAM, Additional authentication and access management services, Using Organizations.

| UNIT II | SECURING INFRASTRUCTURE | 9 |
|---|---|---|

Structure of a three-tier web application, virtual private cloud (VPC), Setting up public and private subnets and internet protocols, Security groups, Network access control lists (ACLs), Load balancers, Protecting compute resources- Cloud service models: IaaS, PaaS, SaaS.

| UNIT III | INCIDENT RESPONSE AND RISK MANAGEMENT | 9 |
|---|---|---|

Identifying an incident, Services that support the discovery and recognition phase, AWS Config and AWS Lambda, Services that support the resolution and recovery phase, Best practices for handling an incident.

| UNIT IV | SECURING CLOUD: DATA SECURITY | 9 |
|---|---|---|

Overview of Data Security in Cloud Computing- Common Risks with Cloud Data Security- Data Encryption: Applications and Limits- Cloud Data Security: Sensitive Data

Categorization- Authentication and Identity- Data Categorization and the Use of Data Labels- Cloud Data Storage.

| UNIT V | DATABASE SECURITY | 9 |
|---|---|---|

Database Security: Recent Advances in Access Control, Access Control Models for XML, Database Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Understand security principles in cloud computing.
**CO2:** Implement infrastructure security measures in cloud environments.
**CO3:** Demonstrate incident response and risk management techniques in cloud systems.
**CO4:** Apply data security practices to protect cloud-based information.
**CO5:**Evaluate database security mechanisms for cloud-based data management.
**CO6:** Integrate ethical considerations into cloud security practices.

**TEXTBOOKS:**


1. Tim Mather, Subra Kumaraswamy, Shahed Latif, “Cloud Security and Privacy, An Enterprise Perspective on Risks and Compliance”, Oreilly Media 2009.
2. Vic (J.R.) Winkler, “Securing the Cloud, Cloud Computer Security Techniques and Tactics”, Syngress, April 2011.


**REFERENCES:**


1. Michael Gertz, Sushil Jajodia,” Handbook on Database security: Applications and Trends”,Springer, 2010.
2. John R. Vacca, “Cloud Computing Security”, CRC Press, 2016.
3. Giulio D'Agostino, “Data Security in Cloud Computing, Volume I”, Momentum Press, 2019.


| 24CS905 | ENTERPRISE CYBER SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To learn the fundamentals of cryptography.
- To learn the key management techniques and authentication approaches.
- To explore the network and transport layer security techniques.
- To understand the application layer security standards.
- To learn the real time security practices.

| UNIT I | INTRODUCTION TO CYBERSECURITY | 9 |
|---|---|---|

Cyber Security – Need of Cybersecurity in Organizations – CIA Triad- Confidentiality, Integrity, Availability; Reason for Cyber Crime –Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes– A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

| UNIT II | NETWORK SECURITY BASICS | 9 |
|---|---|---|

Network Security Concepts- Basics of Networks- Common Types of Network Attacks- Introduction to Firewalls- Types of Firewalls- IDS/IPS- Virtual Private Networks (VPN’s)- Secure configuration and management of network devices. Case Study: Install Kali Linux on Virtual box.

| UNIT III | SECURE COMMUNICATION PROTOCOLS | 9 |
|---|---|---|

Encryption Principles- Cryptography, Cryptanalysis, Feistel Cipher Structure. Block Encryption algorithms: DES, triple DES, and AES. Transport-Level Security: Secure Sockets Layer (SSL), Transport Layer Security TLS). Electronic Mail Security- Pretty Good

Privacy (PGP), S/MIME.

Securing wireless networks: WPA, WPA2, WPA3.

| UNIT IV | INTRUSION DETECTION AND PREVENTION SYSTEMS | 9 |
|---|---|---|

IDPS- Need of Intrusion Detection Systems in Cyber Security- Types of IDPS: Network-based and Host-based. Configuring and Managing IDPS for threat detection using Honeypots. Case Study: Setup a honey pot and monitor the honey pot on network.

| UNIT V | WEB APPLICATION SECURITY | 9 |
|---|---|---|

Introduction to Web Application Vulnerabilities – Cross Site Scripting (XSS) – SQL injection-
Denial of Service (DoS)- Web Application Testing - Types of Penetration Tests- OWASP and OWASP Top.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Understanding the core concepts and importance of cybersecurity in organizational settings.
**CO2:** Acquire the knowledge common network attacks and deploy appropriate security measures.
**CO3:** Implement encryption and secure communication protocols for data integrity and confidentiality.
**CO4:** Deploy and manage Intrusion Detection and Prevention Systems for threat detection.
**CO5:** Identify and mitigate common web application vulnerabilities.
**CO6:** Conduct penetration tests to evaluate the security posture of web applications.

**TEXTBOOKS:**


1. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education, 2018.


**REFERENCES:**


1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
2. Ravi Das and Greg Johnson, “Testing and Securing Web Applications”, 2021.
3. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, O’Reilly Media, Inc, 2020.


| 24CS906 | DIGITAL AND MOBILE FORENSICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Learn how to acquire digital forensic evidence.
- Learn how to investigate different digital artifacts and write reports
- Understand network forensics processes and procedures
- Understand mobile forensics processes and procedures.
- Able to analyze SIM cards and analyze mobile file systems.

| UNIT I | ACQUIRING DIGITAL FORENSICS EVIDENCE | 9 |
|---|---|---|

Types of Computer-Based Investigations - The Forensic Analysis Process- Acquisition of Evidence - Computer Systems.

| UNIT II | DIGITAL FORENSICS INVESTIGATION& REPORTING | 9 |
|---|---|---|

Computer Investigation Process–Windows Artifact Analysis–RAM Memory Forensic Analysis– Email Forensics-Investigation Techniques–Internet Artifacts.

| UNIT III | NETWORKING FORENSICS | 9 |
|---|---|---|

Characteristics in the network world–Identifying threats to the enterprise–Data breach surveys– Defining network forensics–Differentiating between computer forensics and network forensics–

Digital footprints–Collecting network traffic using tcp dump–Collecting network traffic using Wireshark–Collecting network logs–Acquiring memory using FTK Imager–Tapping into network traffic–Packet sniffing and analysis using Wireshark–Packet sniffing and analysis using Network Miner

| UNIT IV | MOBILE FORENSICS FUNDAMENTALS | 9 |
|---|---|---|

Mobile Devices vs. Computer Devices in the World of Forensics–Living in the Cloud: The Place to Hide and Store Mobile Data–Preparing, Protecting, and Seizing Digital Device Evidence

| UNIT V | ANALYSING MOBILE INTERNALS | 9 |
|---|---|---|

Analyzing SIM Cards - Advanced Android Analysis - Advanced iOS Analysis-Case Study: Use Andriller or equivalent to extract data from Android

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Understand the process of acquiring digital forensics evidence.
**CO2:** Apply digital forensics investigation techniques and report findings.
**CO3:** Analyze network forensics data to identify threats and breaches.
**CO4:** Explore fundamentals of mobile forensics and evidence preparation.
**CO5:** Investigate mobile device internals for forensic analysis.
**CO6:** Demonstrate ethical considerations in digital forensic practices.

**TEXTBOOKS:**


1. William Oettinger, “Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence”, Packt Publishing, 1st Edition, 2020
2. Samir Datt, “Learning Network Forensics”, Packt Publishing, 1st Edition, 2016
3. Lee Reiber, “Mobile Forensic Investigations: A Guide to Evidence Collection, Analysis, and Presentation”, McGraw Hill, 2nd Edition, 2018


**REFERENCES:**


1. Rohit Tamma, Oleg Skulkin, Heather Mahalik, Satish Bommisetty, “Practical Mobile Forensics”, Packt Publishing, 3rd Edition, 2018
2. Gerard Johansen, “Digital Forensics and Incident Response: Incident response tools and techniques for effective cyber threat response”, Packt Publishing, 3rd Edition, 2022

| 24CS907 | VULNERABILITY ANALYSIS & PENETRATION TESTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To learn the tools that can be used to perform information gathering.
- To identify operating systems, server applications to widen the attack surface and perform vulnerability assessment activity and exploitation phase.
- To learn how vulnerability assessment can be carried out by means of automatic tools or manual investigation.
- To learn the web application attacks starting from information gathering to exploitation phases.
- To learn how to metasploit and meterpreter are used to automate the attacks and penetration testing techniques.

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Introduction- Vulnerability Assessment- Understanding the Risks Posed by Vulnerabilities Detecting Vulnerabilities via Security Technologies- Categories of Penetration Testing - Types of Penetration Test – Structure of Penetration Testing Reports - Information Gathering Techniques - Active, Passive and Sources of Information Gathering - Approaches and Tools

- Traceroutes, Neotrace, Whatweb, Netcraft, Xcode Exploit Scanner and NSlookup. Host discovery - Scanning for open ports and services - Types of Port.

| UNIT II | NETWORK VULNERABILITY ASSESSMENT | 9 |
|---|---|---|

Project Scoping-Assessing Vulnerability assessment timeline-NVAT-Prioritizing risks and threats Assessment Methodology-Top down and Bottom up Examination-Case study with assessment report- Case Study: Web Based Email Attacks.

| UNIT III | MOBILE APPLICATION SECURITY | 9 |
|---|---|---|

Types of Mobile Application Key challenges in Mobile Application and its impact Need for mobile application penetration testing Mobile application penetration testing methodology Android and ios Vulnerabilities - OWASP mobile security risk - Exploiting WM - BlackBerry

Vulnerabilities - Vulnerability Landscape for Symbian - Exploit Prevention - Handheld Exploitation

| UNIT IV | WIRELESS NETWORK VULNERABILITY ANALYSIS | 9 |
|---|---|---|

WLAN and its inherent insecurities Bypassing WLAN Authentication uncovering hidden SSIDs MAC Filters Bypassing open and shard authentication - Attacking the client caffe latte attack Deauthenticating the client cracking WEP with the hirte attack AP-less WPA cracking - Advanced WLAN Attacks Wireless eavesdropping using MITM session hijacking over wireless

- WLAN Penetration Test Methodology

| UNIT V | PENETRATION TESTING | 9 |
|---|---|---|

Introduction to Kali and Backtrack-Linux tools – Attack Machine- Phases of penetration test- reconnaissance extracting information from DNS-scanning-pings and ping sweeps-port scanning- NMap-Vulnerability scanning.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Understand vulnerability assessment principles and methods.
**CO2:** Analyze network vulnerabilities and prioritize risks.
**CO3:** Evaluate mobile application security challenges and methodologies.
**CO4:** Assess wireless network vulnerabilities and conduct penetration testing.
**CO5:** Apply penetration testing methodologies using appropriate tools.
**CO6:** Demonstrate ethical considerations in penetration testing practices.

**TEXTBOOKS:**

1. Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2015.
2. Dr. Patrick Engebretson, The Basics of Hacking and Penetration Testing Ethical Hacking and Penetration Testing made easy, Syngress publications, Elsevier, 2013.

**REFERENCES:**

1. Steve Manzuik, Andre Gold, Chris Gatford, "Network Security Assessment from Vulnerability to Patch", Syngress Publishing Incorporation, 2007.
2. Mastering Modern Web Penetration Testing By Prakhar Prasad, October 2016.
3. Kali Linux 2: Windows Penetration Testing, By Wolf Halton, Bo Weaver, June 2016.

| 24CS908 | ENGINEERING SECURE SOFTWARE SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To Know the importance and need for software security.
- To Know about various attacks.
- To Learn about secure software design.
- To Understand risk management in secure software development.
- To Know the working of tools related to software security.

| UNIT I | NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS | 9 |
|---|---|---|

Software Assurance and Software Security – Threats to software security – Sources of software insecurity – Benefits of Detecting Software Security – Properties of Secure Software – Memory Based Attacks: Low-Level Attacks Against Heap and Stack – Defense Against Memory-Based Attacks

| UNIT II | SECURE SOFTWARE DESIGN | 9 |
|---|---|---|

Requirements Engineering for secure software- SQUARE process Model- Tools- SQUARE Final Results- Requirement Elicitation and Prioritization- The Critical Role of Architecture and Design- Issues and Challenges - Software Characterization - Threat Analysis - Architectural Vulnerability Assessment.

| UNIT III | SECURITY RISK MANAGEMENT | 9 |
|---|---|---|

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management.

| UNIT IV | SECURITY TESTING | 9 |
|---|---|---|

Software Security Testing- Contrasting Software Testing and Software Security Testing- Functional Testing- Risk-Based Testing-Secure Software Development Life Cycle- Unit Testing, Testing Libraries and Executable Files, Integration Testing, System Testing.

| UNIT V | SECURE PROJECT MANAGEMENT | 9 |
|---|---|---|

Governance and security – Adopting an enterprise software security framework – Security and project management – Maturity of Practice-Case Study: Implement the SQL Injection attack and Buffer Overflow attack.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Analyze low-level memory attacks and implement corresponding defenses.
**CO2:**Implement requirements engineering and architectural vulnerability assessment.
**CO3:** Evaluate and mitigate risks throughout the software development lifecycle.
**CO4:** Implement various testing techniques to ensure software security
**CO5:** Apply enterprise security frameworks in project governance.
**CO6:** Analyze case studies to understand real-world security threats in project management.

**TEXTBOOKS:**


1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2009.
2. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, First edition, Syngress Publishing, 2011.


**REFERENCES:**


1. Rajib Mall,” Fundamentals Of Software Engineering”, 5th Edition, PHI Learning, 2018.
2. Jon Erickson,”Hacking:The Art of Exploitation”,2nd Edition, No Starch Press, 2008.
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional, 2006.
4. Mike Shema,”Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, First Edition, Syngress Publishing,2012.
5. Bryan Sullivan and Vincent Liu,”Web Application Security, A Beginner’s Guide”,Kindle Edition, McGraw Hill,2012.
6. Lee Allen,”Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide(Open Source:Community Experience Distilled)”, Kindle Edition, Packt Publishing,2012.


| 24CS909 | NETWORK DESIGN AND PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To understand the basic networking principles.
- To explore various networking devices and protocols required for network design and management.
- To Gain knowledge in logical and physical designs for scalable LAN and WAN networks
- To study two novel networking technologies: SDN and DTN.
- To learn network programming in UNIX C.

| UNIT I | NETWORKING PRINCIPLES | 9 |
|---|---|---|

Advanced multiplexing – Code Division Multiplexing, DWDM and OFDM – Shared media networks – Collision detection and collision avoidance, Hidden and Exposed Terminals – Switched networks – Datagrams, Virtual circuits, Cell switching and Label switching – Wireless Networks – Infrastructure based, ad hoc and hybrid – End to end semantics – Connectionless, Connection oriented, Wireless Scenarios –Applications, Quality of Service – End to end level and network level solutions.

| UNIT II | PHYSICAL NETWORK DESIGN | 9 |
|---|---|---|

LAN cabling topologies – Ethernet Switches – High speed and Gigabit and 10Gbps – Building cabling topologies and Campus cabling topologies – Routers, Firewalls and L3 switches – Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP - WAN Design and Enterprise Networks – Core networks, distribution networks and access networks

| UNIT III | LOGICAL DESIGN AND MANAGEMENT | 9 |
|---|---|---|
| IPv4 and IPv6 Dynamic Addressing –Hierarchical routing – VLSMand CIDR – Transition from IPv4 to IPv6 – NAT and DHCP – Static and Dynamic routes – RIP, OSPF and BGP – VPN – RMON and SNMP | | |
| **UNIT IV** | **INNOVATIVE NETWORKS** | **9** |
| Software Defined Networks – Evolution of switches and control planes – Centralized and distributed data and control planes – OpenFlow and SDN Controllers – Network Function Virtualization – Needs of the Data Centres – SDN solutions for data centres - Delay Tolerant Networks – Overlay architecture – Bundle Protocol – Opportunistic routing and Epidemic routing | | |
| **UNIT V** | **NETWORK PROGRAMMING IN UNIX C** | **9** |
| Socket address structures – Byte ordering and byte manipulation functions – Elementary TCP sockets – socket, connect, bind, listen, accept and close functions – TCP client and server – Elementary UDP sockets –recvfrom and sendto functions, connect function with UDP – Raw sockets – Client-server design alternatives – Iterative and Concurrent servers. | | |
| | **TOTAL: 45 PERIODS** | |

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Understand advanced multiplexing methods like DWDM and OFDM.
**CO2:** Evaluate network protocols for efficient data transmission.
**CO3:** Develop logical and physical designs for scalable LAN and WAN networks.
**CO4:** Apply strategies for transitioning from IPv4 to IPv6.
**CO5:** Investigate Software Defined Networks and Delay Tolerant Networks.
**CO6:** Gain proficiency in network programming using socket APIs in C.

**TEXTBOOKS:**


1. Larry Peterson and Bruce Davie, “Computer Networks: A Systems Approach”, 5th edition, Morgan Kauffman, 2011
2. ParitoshPuri, M.P.Singh,”A survey paper on routing in delay tolerant networks”, International Conference on Information and Computer Networks (ISCON), 2013.


**REFERENCES:**


1. Paul Goransson, Chuck Black, “Software Defined Networks: A Comprehensive Approach”, Morgan Kauffman, 2016.
2. W.Richard Stevens, Bill Fenner and Andrew M Rudoff, “Unix Network Programming: The Sockets Networking API: Volume 1 “, 3rd Edition, Addison Wesley, 2003.
3. Ying Dar Lin, Ren-Hung Hwang and Fred Baker, “Computer Networks: An Open Source Approach”, McGraw Hill, 2011.


| 24CS910 | FAULT TOLERANT COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To create understanding of the fundamental concepts of fault tolerance systems
- To learn basic techniques for achieving fault tolerance in hardware
- To have in-depth understanding in software fault tolerance systems
- To gain knowledge in design & testing of fault tolerance systems
- To develop skills in modelling and evaluating fault tolerant architectures in Real time systems

| UNIT I | INTRODUCTION | 9 |
|---|---|---|
| Faults, Errors and Failures - Levels of Fault tolerance - Dependability measures - Dependability evaluation - Fault Tolerant techniques - Hardware redundancy - Information redundancy - Software redundancy- Time redundancy -Software Testing. | | |

| UNIT II | HARDWARE FAULT TOLERANCE | 9 |
|---|---|---|
| The Rate of Hardware Failures - Failure Rate, Reliability, and Mean Time to Failure - Canonical and Resilient Structures - Poisson Processes - Markov Models Fault-Tolerance Processor-Level Techniques - Byzantine failures. | | |
| **UNIT III** | **SOFTWARE FAULT TOLERANCE** | **9** |
| Single-Version Fault Tolerance – N Version programming - Recovery Block Approach - Exception-Handling - Software Reliability Models - Check pointing - Optimal Checkpointing - Checkpointing in Distributed Systems, Shared-Memory Systems and Real-Time Systems. | | |
| **UNIT IV** | **DESIGN DIVERSITY & TESTING** | **9** |
| Fault tolerant Control and coordination algorithms design – F-T system abstractions and functions- Pitfalls- Practical application- Modeling and analysing F-T Distributed systems - Software fault insertion testing- Fault manager- Categorization of Software faults, Errors, and failures- SIFT methodology and Test plans | | |
| **UNIT V** | **FAULT TOLERANCE IN REAL TIME SYSTEMS** | **9** |
| Time- Space tradeoff - Fault tolerant scheduling algorithms - Fault tolerant ATM switches - Fault tolerant Routing and sparing Techniques - Yield and reliability enhancement for VLSI/WSI array processors. Case studies: Non-stop systems, Stratus systems, Cassini command and data sub system, IBM G5, Itanium | | |
| | **TOTAL: 45 PERIODS** | |

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Understand the need for fault tolerance systems.

**CO2:** Evaluate hardware fault tolerance techniques and their reliability metrics.

**CO3:** Apply software redundancy and fault tolerance methods in program design.

**CO4:** Develop fault-tolerant algorithms and architectures for dependable systems.

**CO5:** Design and implement fault injection testing methodologies for software reliability.

**CO6:** Implement fault-tolerant algorithms for real-time applications and analyze their tradeoffs.

**TEXTBOOKS:**


1. E.Dubrova, “Fault-Tolerant Design”, Springer, 2013.
2. I. Korenand, M.Krishna, ”Fault Tolerant Systems”, Morgan Kaufmann, 2nd Edition, November 2020.


**REFERENCES:**


1. Kjetil Norvag, “An Introduction to fault tolerant systems”, IDI Technical report, July 2000.
2. Olga Goloubeva , Maurizio Rebaudengo , Matteo Sonza Reorda , Massimo Violante, “Software-Implemented Hardware Fault Tolerance”, Springer, 2006.

## CLOUD COMPUTING

| 24CS911 | CLOUD FOUNDATIONS (Lab Integrated) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

- ✓ To describe the different ways a user can interact with Cloud.
- ✓ To discover the different compute options in Cloud and implement a variety of structured and unstructured storage models.
- ✓ To confer the different application managed service options in the cloud and outline how security is administered in Cloud.
- ✓ To demonstrate how to build secure networks in the cloud and identify cloud automation and management tools.
- ✓ To determine a variety of managed big data services in the cloud.

| UNIT I | INTRODUCTION TO CLOUD | 6+6 |
|---|---|---|

Introduction to Cloud Computing - Cloud Versus Traditional Architecture - IaaS, PaaS, and SaaS - Cloud Architecture - The Console - Understanding projects – Billing - Install and configure Cloud SDK - Use Cloud Shell - APIs - Cloud Console Mobile App.

**List of Exercise/Experiments:**

1. Install and configure cloud SDK.
2. Connect to computing resources hosted on Cloud via Cloud Shell.

| UNIT II | COMPUTE AND STORAGE | 6+6 |
|---|---|---|

Compute options in the cloud - Exploring IaaS with Compute Engine - Configuring elastic apps with autoscaling - Exploring PaaS - Event driven programs - Containerizing and orchestrating apps - Storage options in the cloud - Structured and unstructured storage in the cloud - Unstructured storage using Cloud Storage - SQL managed services - NoSQL managed services.

**List of Exercise/Experiments:**

1. Create virtual machine instances of various machine types using the Cloud Console and the command line. Connect an NGINX web server to your virtual machine.
2. Create a small App Engine application that displays a short message.

| UNIT III | APIs AND SECURITY IN THE CLOUD | 6+6 |
|---|---|---|

The purpose of APIs – API Services - Managed message services - Introduction to security in the cloud - The shared security model - Encryption options - Authentication and authorization with Cloud IAM - Identify Best Practices for Authorization using Cloud IAM.

**List of Exercise/Experiments:**

1. Publish messages with managed message service using the Python client library.
2. Create a storage bucket, upload objects to it, create folders and subfolders in it, and make objects publicly accessible using the Cloud command line.

| UNIT IV | NETWORKING, AUTOMATION AND MANGAEMENT TOOLS | 6+6 |
|---|---|---|

Introduction to networking in the cloud - Defining a Virtual Private Cloud - Public and private IP address basics - Cloud network architecture - Routes and firewall rules in the cloud - Multiple VPC networks - Building hybrid clouds using VPNs - Different options for load balancing - Introduction to Infrastructure as Code - Terraform - Monitoring and management tools.

**List of Exercise/Experiments:**

1. Create several VPC networks and VM instances and test connectivity across networks.
2. Create two managed instance groups in the same region. Then, configure and test an Internal Load Balancer with the instances groups as the backends.

| **UNIT V** | **BIG DATA AND MACHINE LEARNING SERVICES** | **6+6** |
|---|---|---|

Introduction to big data managed services in the cloud - Leverage big data operations - Build Extract, Transform, and Load pipelines - Enterprise Data Warehouse Services - Introduction to machine learning in the cloud - Building bespoke machine learning models with AI Platform - Pre-trained machine learning APIs.

**List of Exercise/Experiments:**

1. Create a cluster, run a simple Apache Spark job in the cluster, then modify the number of workers in the cluster.
2. Set up your Python development environment, get the relevant SDK for Python, and run an example pipeline using the Cloud Console.

**TOTAL: 30 + 30 = 60 PERIODS**

**OUTCOMES:**

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

**CO1:** Explain the basic concepts of cloud computing and the different cloud service models.
**CO2:** Deploy and manage various cloud compute and storage options.
**CO3:** Implement security measures in the cloud, including Cloud IAM for authentication and authorization.
**CO4:** Design and manage cloud networks and use automation tools like Terraform.
**CO5:** Use cloud monitoring tools to optimize cloud resource performance.
**CO6:** Leverage cloud-based big data and machine learning services to build data pipelines and models.

**REFERENCES:**


1. https://cloud.google.com/docs
2. https://www.cloudskillsboost.google/paths/36
3. https://nptel.ac.in/courses/106105223
4. Anthony J. Sequeira, “AWS Certified Cloud Practitioner (CLF-C01) Cert Guide”, First Edition, Pearson Education, 2020.
5. AWS Documentation (amazon.com)
6. AWS Skill Builder
7. AWS Academy Cloud Foundations Course - https://www.awsacademy.com/vforcesite/LMS_Login


**LIST OF EQUIPMENTS:**

GCP / CloudSkillBoost Platform/AWS Console /AWS Academy Learner Lab.

| 24CS912 | VIRTUALIZATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- ✓ To explain the fundamental concepts of virtualization
- ✓ To analyze the role of hypervisors in hardware virtualization
- ✓ To apply the understanding of CPU, memory (MMU), and I/O virtualization techniques
- ✓ To assess security considerations of virtualized environments
- ✓ To discuss strategies for protecting VMs and data centers

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Virtualization - Virtual Machines - Hypervisors - Type-1 and Type-2 Hypervisors - Multiplexing and Emulation - Approaches to Virtualization and Paravirtualization - Benefits of Using Virtual Machines. Working with Virtual Machines.

| UNIT II | HARDWARE VIRTUALIZATION | 9 |
|---|---|---|

The Popek/Goldberg Theorem - Virtualization without Architectural Support: Full Virtualization - Paravirtualization - Designs Options for Type-1 Hypervisors. Hypervisors: Describing a Hypervisor - Role of Hypervisor - VMWare ESX - Citrix Hypervisor - Microsoft Hyper-V.

| UNIT III | TYPES OF VIRTUALIZATIONS | 10 |
|---|---|---|

CPU Virtualization with VT-x: Design requirements - The VT-x Architecture - KVM. MMU Virtualization: Extended Paging - Virtualizing Memory in KVM. I/O Virtualization: Benefits of I/O Interposition - Physical I/O - Virtual I/O Without Hardware Support- Virtual I/O with Hardware Support. Virtualization Support in ARM Processors.

| UNIT IV | VIRTUALIZATION SECURITY | 9 |
|---|---|---|

Fundamentals of Virtualization Security: Virtualization Architecture - Threats to a Virtualized Environment. Securing Hypervisors: Hypervisor Configuration and Security. Designing Virtual Networks for Security: Comparing Virtual and Physical Networks - Virtual Network Security Considerations - Configuring Virtual Switches for Security.

| UNIT V | VIRTUALIZATION AND AVAILABILITY | 8 |
|---|---|---|

Availability - Protecting a Virtual Machine - Protecting Multiple Virtual Machines - Protecting Datacenters - Deploying Applications in a Virtual Environment - Recent Trends in Virtualization.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**CO1:** Understand the basics of virtualization and its benefits.

**CO2:** Assess the significance of hypervisors in hardware virtualization, examining their roles and implications for system efficiency and performance

**CO3:** Utilize knowledge of virtualization technologies to solve practical problems and implement effective solutions

**CO4:** Analyze security threats and design secure virtual networks

**CO5:** Discuss strategies to improve availability in virtual environment and for protecting VMs and data centers

**CO6:** Integrate virtualization concepts and technologies to design, implement, and manage secure, efficient, and resilient virtualized environments.

**TEXTBOOKS:**


1. Edouard Bugnion, Jason Nieh, Dan Tsafrir, “Hardware and Software Support for Virtualization”, Morgan & Claypool Publishers, 2017.
2. Matthew Portnoy, “Virtualization Essentials”, Third Edition, Sybex - John Wiley & Sons, 2023.
3. Dave Shackleford, “Virtualization Security: Protecting Virtualized Environments”, Sybex - John Wiley & Sons, 2012.


**REFERENCES:**


1. Nelson Ruest, Danielle Ruest, Virtualization, A beginners guide, 2009, McGrawHill.
2. Nadeau,Tim Cerng, Je Buller, Chuck Enstall, Richard Ruiz, Mastering Microsoft Virtualization, Wiley Publication, 2010.
3. William Von Hagen, Professional Xen Virtualization, Wiley Publication, 2008.


| 24CS913 | DATA ENGINEERING IN CLOUD | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- ✓ To grasp the fundamentals of data engineering, emphasizing cloud-based data access.
- ✓ To construct robust and secure data pipelines using AWS services.
- ✓ To select and implement appropriate data storage solutions while prioritizing pipeline security.
- ✓ To utilize cloud tools for handling extensive data for machine learning purposes.
- ✓ To efficiently analyze, visualize, and automate data pipelines to streamline operations.

| UNIT I | INTRODUCTION | 8 |
|---|---|---|

Introduction to data Engineering - The Data Engineering Life Cycle - Data Engineering and Data Science - Data-Driven Organizations: Data-driven decisions - The data pipeline - The role of the data engineer in data-driven organizations - Modern data strategies - The Elements of Data: The five Vs of data – volume, velocity, variety, veracity, and value. Demo: Accessing and Analyzing Data by Using Amazon S3.

| UNIT II | SECURE AND SCALABLE DATA PIPELINES | 10 |
|---|---|---|

The evolution of data architectures - Modern data architecture on AWS - Modern data architecture pipeline: Ingestion and storage - Processing and consumption - Streaming analytics pipeline - Security of analytics workloads - Scaling - Creating a scalable infrastructure and components. ETL and ELT comparison - Data wrangling.

| UNIT III | STORING AND ORGANIZING DATA | 9 |
|---|---|---|

Comparing batch and stream ingestion - Batch ingestion processing - Purpose-built ingestion tools - AWS Glue for batch ingestion processing - Kinesis for stream processing - Scaling considerations for batch processing and stream processing - Storage in the modern data architecture - Data lake storage - Data warehouse storage - Purpose-built databases - Storage in support of the pipeline - Securing storage.

| UNIT IV | PROCESSING BIG DATA AND DATA FOR ML | 10 |
|---|---|---|

Big data processing concepts - Apache Hadoop - Apache Spark - Amazon EMR - Managing your Amazon EMR clusters - Apache Hudi - The ML lifecycle - Collecting data - Applying labels to training data with known targets - Preprocessing data - Feature engineering - Developing a model - Deploying a model - ML infrastructure on AWS - SageMaker - Amazon CodeWhisperer - AI/ML services on AWS.

| UNIT V | DATA ANALYSIS AND VISUALIZATION | 8 |
|---|---|---|

Analyzing and Visualizing Data: Considering factors that influence tool selection - Comparing AWS tools and services - Selecting tools for a gaming analytics use case. Automating the Pipeline: Automating infrastructure deployment - CI/CD - Automating with Step Functions.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

CO1: Understand data engineering, pipelines & access data in the cloud.
CO2: Build secure & scalable data pipelines using AWS services.
CO3: Choose the right data storage & secure your data pipelines.
CO4: Process big data for machine learning with cloud tools.
CO5: Analyze & visualize data and automate data pipelines.
CO6: Apply data engineering techniques and cloud tools to design comprehensive data solutions that meet business needs effectively.

**TEXT BOOKS:**

1. Martin Kleppman, "Data Engineering: Building Reliable Scalable Data Systems", O'Reilly Media, 2017.
2. Wes McKinney, "Python for Data Analysis", 2nd Edition, O'Reilly Media, 2017.
3. Martin Kleppman, "Designing Data-Intensive Applications", O'Reilly Media, 2017.

**REFERENCES:**

1. AWS Documentation (amazon.com)
2. AWS Skill Builder
3. AWS Academy Data Engineering Course - https://www.awsacademy.com/vforcesite/LMS_Login

| 24CS917 | SOFTWARE DEFINED NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- ✓ To understand the need for SDN and its data plane operations
- ✓ To understand the functions of control plane
- ✓ To comprehend the migration of networking functions to SDN environment
- ✓ To explore various techniques of network function virtualization
- ✓ To comprehend the concepts behind network virtualization

| UNIT I | SDN: INTRODUCTION | 9 |
|---|---|---|

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane, Control plane and Application Plane.

| UNIT II | SDN DATA PLANE AND CONTROL PLANE | 9 |
|---|---|---|

Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers.

| UNIT III | SDN APPLICATIONS | 9 |
|---|---|---|

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking.

| UNIT IV | NETWORK FUNCTION VIRTUALIZATION | 9 |
|---|---|---|

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture.

| UNIT V | NFV FUNCTIONALITY | 9 |
|---|---|---|
| NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV. | | |
| | | **TOTAL: 45 PERIODS** |

**OUTCOMES:**

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

**CO1:** Describe the motivation behind SDN

**CO2:** Identify the functions of the data plane and control plane

**CO3**: Design and develop network applications using SDN

**CO4:** Orchestrate network services using NFV

**CO5:** Explain various use cases of SDN and NFV

**CO6:** Evaluate the impact of SDN and NFV on modern networking infrastructures and their potential for future innovations.

**TEXTBOOKS:**

1. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”, Pearson Education, 1st Edition, 2015.

**REFERENCES:**

1. Ken Gray, Thomas D. Nadeau, “Network Function Virtualization”, Morgan Kauffman, 2016.
2. Thomas D Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 2013.
3. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, 1st Edition, CRC Press, 2014.
4. Paul Goransson, Chuck Black Timothy Culver, “Software Defined Networks: A Comprehensive Approach”, 2nd Edition, Morgan Kaufmann Press, 2016.
5. Oswald Coker, Siamak Azodolmolky, “Software-Defined Networking with OpenFlow”, 2nd Edition, O’Reilly Media, 2017.

| 24CS918 | STORAGE TECHNOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- ✓ Characterize the functionalities of logical and physical components of storage
- ✓ Describe various storage networking technologies
- ✓ Identify different storage virtualization technologies
- ✓ Discuss the different backup and recovery strategies
- ✓ Understand common storage management activities and solutions

| UNIT I | STORAGE SYSTEMS | 9 |
|---|---|---|

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

| UNIT II | INTELLIGENT STORAGE SYSTEMS AND RAID | 8 |
|---|---|---|

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale-out storage Architecture. Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage.

| **UNIT III** | **STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION** | **10** |
|---|---|---|

Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

| **UNIT IV** | **BACKUP, ARCHIVE AND REPLICATION** | **10** |
|---|---|---|

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS)**.**

| **UNIT V** | **SECURING STORAGE INFRASTRUCTURE** | **8** |
|---|---|---|

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**CO1**: Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment

**CO2**: Illustrate the usage of advanced intelligent storage systems and RAID

**CO3**: Interpret various storage networking architectures - SAN, including storage subsystems and virtualization

**CO4**: Examine the different role in providing disaster recovery and remote replication technologies

**CO5:** Infer the security needs and security measures to be employed in information storage management

**C06:** Apply integrated knowledge of storage technologies to design effective storage solutions aligned with organizational requirements.

**TEXTBOOKS:**


1. EMC Corporation, Information Storage and Management, Wiley, India.
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017.
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained, Second Edition, Wiley, 2009.

| 24CS919 | CLOUD SECURITY FOUNDATIONS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- ✓ Learn the basics of cloud security, including the shared responsibility model and identity management.
- ✓ Set up a secure cloud infrastructure with features like virtual private clouds and security groups.
- ✓ Safeguard application data at rest and in transit using encryption and Amazon S3 protection features.
- ✓ Learn to capture and analyze log data using AWS services like CloudTrail and CloudWatch.
- ✓ Develop skills for identifying and managing security incidents in the cloud, adhering to best practices.

| UNIT I | SECURITY IN CLOUD | 9 |
|---|---|---|

Introduction to Security, Security in the Cloud, Security design principles, Shared responsibility model, Activity: Shared Responsibility Model, Identity and Access Management (IAM) fundamentals, Authenticating and Authorizing with IAM, Examples of authorizing with IAM, Additional authentication and access management services, Using Organizations.

| UNIT II | SECURING INFRASTRUCTURE | 9 |
|---|---|---|

Structure of a three-tier web application, virtual private cloud (VPC), Setting up public and private subnets and internet protocols, Security groups, Network access control lists (ACLs), Load balancers, Protecting compute resources.

| UNIT III | PROTECTING APPLICATION DATA | 9 |
|---|---|---|

Basics on Data Protection, Protect data at rest, Amazon S3 protection features, Protection through encryption, Protect data in transit, protect data in Amazon S3, additional data protection services.

| UNIT IV | LOGGING AND MONITORING | 9 |
|---|---|---|

Importance of logging and monitoring, Capture and collect, Reading a Log File, AWS services with built-in logs, Monitor and report, CloudTrail and Amazon CloudWatch, methods for logging and monitoring, additional AWS services for logging and monitoring, AWS Security Hub.

| UNIT V | RESPONDING AND MANAGING AN INCIDENT | 9 |
|---|---|---|

Identifying an incident, Services that support the discovery and recognition phase, AWS Config and AWS Lambda, Services that support the resolution and recovery phase, Best practices for handling an incident.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Learn essential cloud security principles and identity management fundamentals.

**CO2:** Design and implement secure cloud infrastructure components for effective resource protection.

**CO3:** Explore methods for securing application data stored in the cloud, including encryption techniques and data protection features.

**CO4:** Gain proficiency in implementing logging and monitoring practices to detect and respond to security events efficiently in cloud environments.

**CO5:** Acquire skills to identify and manage security incidents in the cloud, utilizing appropriate tools and techniques for incident detection, analysis, and resolution.

**CO6:** Apply comprehensive cloud security principles and practices to design and manage secure cloud environments.

**TEXT BOOKS:**

3. Tim Mather, Subra Kumaraswamy, Shahed Latif, “Cloud Security and Privacy, An Enterprise Perspective on Risks and Compliance”, Oreilly Media 2009.
4. Vic (J.R.) Winkler, “Securing the Cloud, Cloud Computer Security Techniques and Tactics”, Syngress, April 2011.

**REFERENCES:**

15. Rajkumar Buyya, James Broberg, Andrzej, “Cloud Computing: Principles and Paradigms”, Wiley India Publications 2011.
16. Arshdeep Bahga and Vijay Madisetti, “Cloud Computing –A Hands on Approach”, Universities Press (India) Pvt Ltd. 2014.

| 24CS920 | CLOUD SERVICES MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- ✓ Introduce Cloud Service Management terminology, definition & concepts
- ✓ Compare and contrast cloud service management with traditional IT service management
- ✓ Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- ✓ Select appropriate structures for designing, deploying and running cloud-based services in a business environment
- ✓ Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

| UNIT I | CLOUD SERVICE MANAGEMENT FUNDAMENTALS | 9 |
|---|---|---|

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

| UNIT II | CLOUD SERVICES STRATEGY | 9 |
|---|---|---|

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.

| UNIT III | CLOUD SERVICE MANAGEMENT | 9 |
|---|---|---|

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service
Operations Management.

| UNIT IV | CLOUD SERVICE ECONOMICS | 9 |
|---|---|---|

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

| UNIT V | CLOUD SERVICE GOVERNANCE & VALUE | 9 |
|---|---|---|

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**CO1:** Exhibit cloud-design skills to build and automate business solutions using cloud technologies.

**CO2:** Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services

**CO3:** Solve the real world problems using Cloud services and technologies

**CO4:** Develop and deploy services on the cloud and set up a cloud environment

**CO5:** Explain security challenges in the cloud environment

**C06:** Evaluate the impact of cloud services management strategies on organizational efficiency and scalability.

**TEXT BOOKS:**

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications, 2023.
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013.
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour.

**REFERENCES:**

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing.
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi.

## FULL STACK TECHNOLOGY

| 24CS921 | UI/UX DESIGN (Lab Integrated) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

**The Course will enable learners:**

- Explain the principles of User Interface (UI) in order to do design with intention.
- Define the User experience (UX) and the psychology behind user decision making.
- Discuss about UX process and user Psychology.
- Apply technology for designing web applications with multimedia effects.
- Create a wireframe and prototype.

| UNIT I | INTRODUCTION TO UI | 6+6 |
|---|---|---|

Introduction to UI - Designing Behavior: Designing with Intention - Conditioning and Addiction - Timing Matters - Gamification - Social/Viral Structure–Trust - Hidden versus Visible. Basic Visual Design Principles: Visual Weight - Contrast - Depth and Size – Color- Layout: Page Framework - Footers - Navigation -Images, and Headlines - Forms - Input Types - Labels and Instructions - Primary and Secondary Buttons - Adaptive and Responsive Design - Touch versus Mouse.

**List of Exercise/Experiments:**

1. Design UI for a Game website.
2. Design one-page UI for a website.

| UNIT II | USER OBSERVATION AND EXPERIENCE | 6+6 |
|---|---|---|

User Research - Subjective Research - Objective Research - Sample size - Three Basic Types of Questions. Observe a user: Watch How They Choose - Interviews - Surveys - Card Sorting - Creating User Profiles - Bad profile - Useful profile.

**List of Exercise/Experiments:**

1. Design UI for a mobile.
2. Explore the Look and Feel of the new Project developed in Ex1.

| **UNIT III** | **INTRODUCTION TO UX** | **6+6** |
|---|---|---|

Introduction about UX - Five Main Ingredients of UX - Three "Whats" of user Perspective - Pyramid of UX Impact - UX Is a Process - UX - Not an Event or Task. Behaviour Basics: Psychology versus Culture - User Psychology - Experience - Conscious vs Subconscious Experience - Emotions - Gain and Loss – Motivations.

**List of Exercise/Experiments:**

1. Design a mascot for an imaginary brand.
2. Create a Sample Pattern Library for a product (Mood board, Fonts, Colors based on UI principles).

| **UNIT IV** | **WEB INTERFACE DESIGN** | **6+6** |
|---|---|---|

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Using Motion for UX - Design Pattern: Z-Pattern - F- Pattern - Visual Hierarchy - Lookup patterns – Feedback patterns.

**List of Exercise/Experiments:**

1. Design a mock-up website for a service sector company.
2. Create a brainstorming feature for proposed product.

| **UNIT V** | **WIREFRAMING, PROTOTYPING AND TESTING** | **6+6** |
|---|---|---|

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wire flows - Building a Prototype - Building High-Fidelity Mock-ups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

**List of Exercise/Experiments:**

1. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements.
2. Design a mobile mock-up website for an online store.

**TOTAL: 30+30=60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Create visually appealing and functional interfaces that enhance user interaction**.**

**CO2:** Ensure products are intuitive, accessible, and meet user needs.

**CO3:** Build and test design concepts to optimize user experience.

**CO4:** Evaluate and refine designs based on user feedback.

**CO5:** Structure content effectively for intuitive navigation.

**CO6:** Design engaging interactions that improve usability.

**TEXT BOOKS:**

1. Joel Marsh, "UX for Beginners", O'Reilly Media, Inc., 1st Edition 2015.
2. Xia Jiajia, "UI UX Design", O'Reilly, Artpower International, 2016.
3. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3rd Edition, O'Reilly 2020

**REFERENCES:**

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3rd Edition, O'Reilly 2020.

**SOFTWARE REQUIREMENTS:**

Javascript, Applets, Equivalent Frontend tools, MySQL, Figma or equivalent.

| 24CS924 | MERN FULL STACK DEVELOPMENT (Lab Integrated) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Design applications using Node .JS
- Create architecture involving Express and graphQL
- Develop applications using mongoDB
- Apply the concepts of React Components and State
- Build web applications using React Router, Forms and Bootstrap

| UNIT I | INTRODUCTION TO MERN and NODE JS | 6+6 |
|---|---|---|

Introduction - MERN Components - Node JS: Introduction to Node JS, Setting up Node.js, Node.js Modules - HTTP Servers and Clients - Request Handling - Database connectivity - Data Storage and Retrieval - Dynamic Client/Server Interaction with Socket.IO

**List of Exercise/Experiments:**

1. Create your own modules and return Current date and time.
2. Create the HTTP server using createServer() method that listens to server ports and gives a response back to the client.

| UNIT II | EXPRESS | 6+6 |
|---|---|---|

Express - Routing - Request Matching - Route parameters - Route Lookup - Handler Function - Request Object - Response Object - Middleware - REST API - GraphQL - About API - List API - List API Integration - Custom Scalar Types - Create API Integration - Query Variables - Input Validations - Displaying Errors

**List of Exercise/Experiments:**

1. Create an application using Express.js to print Hello world on the Homepage.
2. Build a Simple Node.js/Express server that handles GET and POST request and returns data in JSON format.

| UNIT III | MongoDB | 6+6 |
|---|---|---|

MongoDB Basics - CRUD Operations - NODE.js driver - Schema Initialization - Reading from MongoDB - Writing to MongoDB - UI Server - Multiple Environments - Proxy-based Architecture - ESLint - ESLint for Front End - React PropTypes - Back End Modules - Front End Modules and Webpack - Transform and bundle - Libraries Bundle - Module Replacement - Debugging - Defineplugin - Product Optimization.

**List of Exercise/Experiments:**

1. Build an application to perform Basic CRUD operation in MongoDB using Node/Express.
2. Building the MongoDB database for the My To-do List app.

| UNIT IV | REACT COMPONENTS AND STATE | 6+6 |
|---|---|---|

React Components- Issue Tracker - React Classes - Composing Components - Passing Data - Dynamic Composition - React State - Hooks - Event handling - Stateless Components - Designing Components.

**List of Exercise/Experiments:**

1. Write a program to create a simple calculator Application using React JS
2. Build a simple React application that displays the list of items and allows the user to add new items to the list.

| UNIT V | REACT ROUTER, FORMS AND BOOTSTRAP | 6+6 |
|---|---|---|

React Router - Simple Routing - Route Parameters - Query Parameters - Links - Programmatic Navigation - Nested Routes - React Forms - Controlled Components - Specialized Input Components - Update API - Delete API - React Bootstrap - Buttons -Navigation - Panels - Tables - Forms - Grid - Inline Forms - Horizontal Forms - Validation Alerts - Toasts – Modals.

**List of Exercise/Experiments:**

1. Create a Simple Login form using React JS.
2. Build an application for E-Commerce platform.
3. Build a full-stack MERN app that allows the user to register, login, and create a list of items that are stored in a MongoDB database. The app should also display the list of items using React components.

**TOTAL: 30+30=60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Develop applications using Node.js for backend functionality and server-side logic.
**CO2:** Handle data queries with GraphQL on an Express server for efficient API management.
**CO3:** Build applications using MongoDB to perform CRUD operations and manage databases.
**CO4:** Apply dynamic composition and event handling techniques.
**CO5:** Implement React forms and Bootstrap for creating responsive, user-friendly interfaces.
**CO6:** Design and develop full-stack applications with the MERN stack.

**TEXT BOOKS:**


1. Vasan Subramanian, Pro MERN Stack - Full stack web app development, 2nd Edition, Apress, 2019 (Unit 2 to 5)
2. David Herron , Node.js Web Development - Fourth Edition, Packt Publishing, 2018. (Unit 1)


**REFERENCES:**


1. Adam Freeman, Essential TypeScript, Apress, 2019.
2. Shama Hoque, Full-Stack React Projects, 2nd edition, Apress,2022
3. Karl Seguin, “The Little Mongo DB Book”, https://github.com/karlseguin/the-little-mongodb-book.
4. https://aws.amazon.com/education/awseducate/
5. http://packaging.ubuntu.com/html/packaging-new-software.html
6. https://www.tutorialspoint.com/nodejs/nodejs_express_framework.htm


**LIST OF EQUIPMENTS:**

Node, Express, MongoDB, React

**HONOR – ARTIFICIAL INTELLIGENCE**

| 24CS929 | SOFT COMPUTING (Lab Integrated) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Learn the basic concepts of Soft Computing.
- Understand artificial neural networks.
- Explain fuzzy systems.
- Explain Genetic Algorithms.
- Discuss the various Hybrid algorithms and various Swarm Intelligence algorithms.

| UNIT I | INTRODUCTION | 6+6 |
|---|---|---|

Neural Networks - Application Scope of Neural Networks - Fuzzy Logic - Genetic Algorithm - Hybrid Systems - Soft Computing - Artificial Neural Network - Evolution of Neural Networks - Basic Models of ANN – Weights – Bias – Threshold – Learning Rate – Momentum Factor – Vigilance Parameter- McCulloch–Pitts Neuron - Linear Separability - Hebb Network.

**List of Exercise/Experiments**

1. Write a program to implement Hebb's rule.
2. Implement McCulloh-Pitts model using Simple Neural Network.

| UNIT II | ARTIFICIAL NEURAL NETWORKS | 6+6 |
|---|---|---|

Perceptron Networks - Adaptive Linear Neuron - Multiple Adaptive Linear Neurons - Back-Propagation Network - Radial Basis Function Network - Pattern Association – Auto associative and Hetero associative Memory Networks - Bidirectional Associative Memory (BAM) - Hopfield Networks - Fixed Weight Competitive Nets - Kohonen Self-Organizing Feature Maps.

**List of Exercise/Experiments**

1. Implement Kohonen self-Organizing feature maps
2. Write a program for solving linearly separable problem using Perceptron Model

| UNIT III | FUZZY SYSTEMS | 6+6 |
|---|---|---|

Fuzzy Logic - Classical Sets (Crisp Sets) - Fuzzy Sets – Fuzzy Relation - Features of the Membership Functions - Fuzzification - Methods of Membership Value Assignments - Defuzzification - Lambda-Cuts for Fuzzy Sets (Alpha-Cuts) - Lambda-Cuts for Fuzzy Relations - Defuzzification Methods – Fuzzy Reasoning – Fuzzy Inference Systems.

**List of Exercise/Experiments**

1. Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
2. Implementation of fuzzy relations (Max-Min Composition)

| UNIT IV | GENETIC ALGORITHMS | 6+6 |
|---|---|---|

Biological Background - Traditional Optimization and Search Techniques- Genetic Algorithm and Search Space- - Simple GA - General Genetic Algorithm - Operators - Stopping Condition - Constraints - Problem Solving - The Schema Theorem- Classification - Holland Classifier Systems- Genetic Programming - Advantages and Limitations- Applications.

**List of Exercise/Experiments**

1. Implement travelling salesperson problem (tsp) using genetic algorithms.
2. Implement two classes city and fitness using genetic algorithm.

| UNIT V | HYBRID SOFT COMPUTING AND SWARM INTELLIGENCE ALGORITHMS | 6+6 |
|---|---|---|

Neuro-Fuzzy Hybrid Systems - Genetic Neuro-Hybrid Systems - Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid Systems - Simplified Fuzzy ARTMAP – Swarm Intelligence Algorithms - Ant Colony Optimization – Artificial Bee Colony – Particle Swarm Optimization – Firefly Algorithm.

**List of Exercise/Experiments**

1. To design and implement fuzzy logic for a washing machine system.
2. Case study on hybrid system. To study the designing of Neuro-Fuzzy Systems

**Mini Project:**

1. Apply Swarm Intelligence Algorithms for any one of the following applications:
    a. Disease diagnosis
    b. Image Processing
    c. Business Intelligence
    d. Cyber Security etc.
2. Case study on Hybrid Systems.
3. To study the designing of Neuro Fuzzy systems.
4. To design and implement fuzzy logic for a washing machine system.

**TOTAL: 30+30 = 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

**CO1:** Understand the basic concepts of Soft Computing
**CO2:** Artificial neural networks and its applications.
**CO3:** Fuzzy logic and its applications.
**CO4:** Solving problems using Genetic algorithms.
**CO5:** Applications of Soft computing to solve problems in varieties of application domains.
**CO6:** Use various algorithms in Soft computing to solve real-world problems

**TEXT BOOKS:**


1. S. N. Sivanandam , S. N. Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2019.
2. Adam Slovik, “Swarm Intelligence Algorithms: Modification and Applications”, Taylor & Francis, First Edition, 2020.


**REFERENCES:**


1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.
2. Kwang H. Lee, First course on Fuzzy Theory and Applications‖, Springer, 2005.
3. N.P. Padhy, S. P. Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
4. S. Rajasekaran, G. A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.
5. NPTEL Courses:
    a. Introduction To Soft Computing - https://onlinecourses.nptel.ac.in/noc23_cs40/preview