# B.Tech. Degree

in

# INFORMATION TECHNOLOGY

# CURRICULUM & SYLLABUS (CBCS)

(For students admitted from the Academic Year 2022-2023)

## DEPARTMENT OF INFORMATION TECHNOLOGY

## St. XAVIER'S CATHOLIC COLLEGE OF ENGINEERING

CHUNKANKADAI, NAGERCOIL – 629 003.

KANYAKUMARI DISTRICT, TAMIL NADU, INDIA

# St. XAVIER'S CATHOLIC COLLEGE OF ENGINEERING

**Chunkankadai, Nagercoil – 629 003.**

**AUTONOMOUS COLLEGE AFFILIATED TO ANNA UNIVERSITY**

**ACADEMIC REGULATIONS 2022**

**B.TECH. INFORMATION TECHNOLOGY CURRICULUM**

**CHOICE BASED CREDIT SYSTEM**

Inconsonance to the vision of our college,

An engineering graduate we form would be a person with optimal human development, i.e. physical, mental, emotional, social and spiritual spheres of personality.

He/she would be also a person mature in relationships, especially knowing how to treat everyone with respect, including persons of complementary gender with equality and gender sensitivity guided by clear and pro-social values.

He/she would be patriotic and would hold the Indian Constitution and all the precepts it outlays close to his heart and would have a secular spirit committed to safeguard and cherish the multi-cultural, multi-religious and multi-linguistic ethos of Indian Society.

Academically, he/she would be a graduate with a strong engineering foundation with proficient technical knowledge and skills. He/she would have enough exposure and experience into the ethos of relevant industry and be industry ready to construct a successful career for himself and for the benefit of the society.

He/she would have been well trained in research methodology and would have established himself as a researcher having taken up many research projects, with sound ethical standards and social relevance. He/she would be a person with a passion for technical innovations committed to lifelong learning and research.

He/she would be well prepared and confident to develop ingenuous solutions to the problems people face as an individual and as a team and work for the emancipation of our society with leadership and courage.

This Information Technology programme intends to produce graduates with essential skills to take on appropriate professional positions upon graduation and progress into leadership qualities, pursue research or post graduate studies in the field of IT.

Upon graduation a student should be able to explain and apply appropriate methodologies on scientific and mathematical foundations and adapt emerging technologies in the management of IT resources to help individuals or organizations to achieve its goals and objectives for the welfare of humane society.

## 1. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

| | |
|---|---|
| 1. | Apply analytical and critical thinking to meet the requirements of industry, academia and research. |
| 2. | Develop an intelligent system by applying the knowledge of computing tools and techniques to solve real world problems. |
| 3. | Develop computerware by understanding the importance of social, business and environmental needs in the human context. |
| 4. | Design optimal solution with work ethics and adaptability to address complex engineering problems in multi-disciplinary industries. |
| 5. | Inculcate a high degree of professionalism, leadership skills, effective communication and team-spirit in heterogeneous environment. |

## 2. PROGRAM OUTCOMES (POs)

| PO# | Graduate Attribute |
|---|---|
| 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 needs with 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 modeling 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 of technological change. |

## 3. PROGRAM SPECIFIC OUTCOMES (PSOs)

| | |
|---|---|
| 1 | Apply programming proficiencies to solve complex engineering problems. |
| 2 | Build and manage IT infrastructure to solve real world problems with modelling and prediction tools, techniques and resources. |
| 3 | Comprehend the lifelong learning on technological advancement and practice professional ethics in concern for social well-being. |

**PEO's - PO's & PSO's MAPPING:**

| PEO# | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| PEO1 | 3 | 3 | 2 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | - | 1 |
| PEO2 | 3 | 2 | 2 | 2 | 3 | 1 | - | - | - | - | - | 2 | 1 | 3 | 1 |
| PEO3 | - | - | 3 | 2 | 2 | 2 | 3 | - | - | - | 1 | 1 | 1 | 3 | 1 |
| PEO4 | 3 | 2 | 3 | 3 | 1 | - | - | 3 | - | 2 | - | 1 | 1 | 2 | 1 |
| PEO5 | - | - | - | - | - | 1 | - | - | 3 | 3 | 3 | 2 | - | - | 2 |

## PROGRAM ARTICULATION MATRIX

| Year | Semester | Course Code | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| I | I | MA22101 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| | | PH22101 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| | | CH22101 | 3 | 2 | 2 | 1 | - | - | 2 | - | - | - | - | 1 | 2 | - | - |
| | | CS22101 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | 3 | - | - |
| | | HS22102 | 1 | - | - | - | - | 2 | 2 | 3 | 1 | 1 | - | 1 | - | - | 3 |
| | | GE3152 | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - |
| | | EN22101 | - | - | - | - | - | - | - | - | 2 | 2 | - | 2 | - | - | 1 |
| | | BS22101 | 3 | 1 | - | - | - | 2 | 2 | - | 2 | 1 | - | 1 | 2 | - | - |
| | | CS22102 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 1 | 3 | - | - |
| | | HS22101 | 3 | 2 | 2 | 1 | - | - | 2 | - | 2 | - | 1 | 1 | - | 3 | - |
| | II | MA22201 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| | | ES22202 | 2 | 2 | - | - | - | 1 | - | - | - | - | - | 1 | - | 2 | - |
| | | CS22201 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ME22201 | 3 | 1 | - | - | - | - | - | - | 3 | 1 | - | 1 | - | 2 | - |
| | | GE3252 | - | - | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - |
| | | EN22201 | - | - | - | - | - | - | - | - | 2 | 3 | - | 2 | - | - | 1 |
| | | PH22203 | 2 | 1 | - | - | - | - | - | - | 2 | 1 | - | 1 | 2 | - | - |
| | | CH22201 | 3 | - | - | - | - | - | 3 | - | 1 | 1 | - | 1 | - | - | 2 |
| | | CS22202 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| | | ES22203 | 3 | - | - | - | - | - | - | - | 3 | 1 | - | 1 | - | 1 | - |
| II | III | MA22302 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - | - |
| | | IT22301 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| | | IT22302 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| | | CS22301 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| | | CS22302 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | - | 2 | - |
| | | CS22305 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| | | CS22306 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | - | 3 | - |
| | | SD22301 | 3 | 2 | 2 | - | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 2 | 2 | 1 | 2 |
| | | AC22301 | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - | - | 2 |
| | | HS22301 | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |
| | IV | IT22401 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - | - |
| | | CS22402 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| | | CS22403 | 3 | 1 | 1 | 2 | - | - | - | - | - | - | - | 1 | 2 | - | - |
| | | IT22402 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |
| | | IT22403 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| | | CS22405 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| | | IT22404 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| | | SD22401 | 3 | 2 | 2 | - | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 2 | 2 | 1 | 2 |
| | | AC22401 | 2 | 1 | 2 | - | - | 2 | 1 | - | - | - | - | 1 | - | - | 2 |
| III | V | IT22501 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| | | IT22502 | 3 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - | 2 | - | - |
| | | IT22503 | 3 | 2 | 1 | 1 | 3 | - | - | - | - | - | - | 1 | 3 | - | - |
| | | IT22504 | 2 | 2 | - | - | - | - | - | - | 2 | 2 | 1 | 2 | - | 2 | 3 |
| | | IT22505 | 2 | 2 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 3 |
| | | SD22501 | 2 | 2 | 2 | - | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 |
| | | AC22501 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | - | - | 1 |
| | | HS22501 | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |
| | VI | HS22601 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | - | - | 3 |
| | | CS22601 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| | | IT22601 | 3 | 2 | 2 | - | 2 | - | - | - | - | 1 | - | - | - | 2 | - |
| | | SD22601 | 3 | 2 | 2 | - | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 2 | 2 | - | 2 |
| IV | VII | MS22701 | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | - | - | 3 |
| | | IT22701 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| | | IT22702 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| | | IT22703 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| | | SD22701 | 3 | 2 | 2 | - | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 2 | 2 | - | 2 |
| | VIII | IT22801 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

## SEMESTER I

| SL. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY COURSES** | | | | | | | | |
| 1. | MA22101 | Matrices and Calculus | BSC | 3 | 1 | 0 | 4 | 4 |
| 2. | PH22101 | Engineering Physics | BSC | 3 | 0 | 0 | 3 | 3 |
| 3. | CH22101 | Engineering Chemistry | BSC | 3 | 0 | 0 | 3 | 3 |
| 4. | CS22101 | Problem Solving and Python Programming | ESC | 3 | 0 | 0 | 3 | 3 |
| 5. | HS22102 | Universal Human Values: Understanding Harmony and Ethical Human Conduct | HSMC | 2 | 0 | 0 | 2 | 2 |
| 6. | GE3152 | தமிழர் மரபு /Heritage of Tamils | HSMC | 1 | 0 | 0 | 1 | 1 |
| **THEORY COURSES WITH PRACTICAL COMPONENT** | | | | | | | | |
| 7. | EN22101 | Communicative English | HSMC | 2 | 0 | 2 | 4 | 3 |
| **PRACTICAL COURSES** | | | | | | | | |
| 8. | BS22101 | Physics & Chemistry Laboratory | BSC | 0 | 0 | 4 | 4 | 2 |
| 9. | CS22102 | Python Programming Laboratory | ESC | 0 | 0 | 4 | 4 | 2 |
| **MANDATORY COURSES** | | | | | | | | |
| 10. | IP22101 | Induction Programme | - | - | - | - | - | 0 |
| 11. | HS22101 | Higher Order Thinking | MC | 1 | 0 | 0 | 1 | 1 |
| **TOTAL** | | | | **18** | **1** | **10** | **29** | **24** |

## SEMESTER II

| SL. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY COURSES** | | | | | | | | |
| 1. | MA22201 | Statistics and | BSC | 3 | 1 | 0 | 4 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Numerical Methods | | | | | | |
| 2. | ES22202 | Basic Electrical and Electronics Engineering | ESC | 3 | 0 | 0 | 3 | 3 |
| 3. | CS22201 | Programming in C | ESC | 3 | 0 | 0 | 3 | 3 |
| 4. | ME22201 | Engineering Graphics | ESC | 2 | 0 | 2 | 4 | 3 |
| 5. | GE3252 | தமிழரும் தொழில்நுட்பமும் /Tamils and Technology | HSMC | 1 | 0 | 0 | 1 | 1 |
| **THEORY COURSES WITH PRACTICAL COMPONENT** | | | | | | | | |
| 6. | EN22201 | Technical English | HSMC | 2 | 0 | 2 | 4 | 3 |
| 7. | PH22203 | Physics for Information Science | BSC | 2 | 0 | 2 | 4 | 3 |
| 8. | CH22201 | Environment and Sustainability | BSC | 2 | 0 | 2 | 4 | 3 |
| **PRACTICAL COURSES** | | | | | | | | |
| 9. | CS22202 | C Programming Laboratory | ESC | 0 | 0 | 4 | 4 | 2 |
| 10. | ES22203 | Engineering Practices Laboratory | ESC | 0 | 0 | 4 | 4 | 2 |
| **TOTAL** | | | | **18** | **1** | **16** | **35** | **27** |

## SEMESTER III

| SL. NO. | COURSE CODE | COURSE TITLE | CATE - GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY COURSES** | | | | | | | | |
| 1. | MA22302 | Discrete Mathematics | BSC | 3 | 1 | 0 | 4 | 4 |
| 2. | IT22301 | Computer Architecture | PCC | 3 | 0 | 0 | 3 | 3 |
| 3. | IT22302 | Digital Systems | PCC | 3 | 0 | 0 | 3 | 3 |
| 4. | CS22301 | Object Oriented Programming | PCC | 3 | 0 | 0 | 3 | 3 |
| 5. | CS22302 | Data Structures | PCC | 3 | 0 | 0 | 3 | 3 |
| **PRACTICAL COURSES** | | | | | | | | |
| 6. | CS22305 | Object Oriented Programming Laboratory | PCC | 0 | 0 | 4 | 4 | 2 |
| 7. | CS22306 | Data Structures Laboratory | PCC | 0 | 0 | 4 | 4 | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 8. | SD22301 | Coding Skills and Soft Skills Training – Phase I | EEC | 0 | 0 | 4 | 4 | 2 |
| **MANDATORY COURSES** | | | | | | | | |
| 9. | AC22301 | Constitution of India | MC | 2 | 0 | 0 | 2 | 0 |
| 10. | HS22301 | Value Education-I | MC | 1 | 0 | 0 | 1 | 0 |
| **TOTAL** | | | | **18** | **1** | **12** | **31** | **22** |

## SEMESTER IV

| SL. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY COURSES** | | | | | | | | |
| 1. | IT22401 | Fundamentals of Algorithm Analysis | PCC | 3 | 0 | 0 | 3 | 3 |
| 2. | CS22402 | Database Management Systems | PCC | 3 | 0 | 0 | 3 | 3 |
| 3. | CS22403 | Operating Systems | PCC | 3 | 0 | 0 | 3 | 3 |
| **THEORY COURSES WITH PRACTICAL COMPONENT** | | | | | | | | |
| 4. | IT22402 | Probability and Machine Learning | PCC | 2 | 0 | 2 | 4 | 3 |
| 5. | IT22403 | Web Essentials | PCC | 2 | 0 | 2 | 4 | 3 |
| **PRACTICAL COURSES** | | | | | | | | |
| 6. | CS22405 | Database Management Systems Laboratory | PCC | 0 | 0 | 4 | 4 | 2 |
| 7. | IT22404 | Operating Systems Laboratory | PCC | 0 | 0 | 4 | 4 | 2 |
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 8. | SD22401 | Coding Skills and Soft Skills Training - Phase II | EEC | 0 | 0 | 4 | 4 | 2 |
| **MANDATORY COURSES** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9. | AC22401 | Industrial Safety Engineering | MC | 2 | 0 | 0 | 2 | 0 |
| **TOTAL** | | | | **15** | **0** | **16** | **31** | **21** |

On the completion of second-year the students can understand and apply the knowledge of scientific, mathematical, theoretical foundations and computing tools to solve real world problems.

**SEMESTER V**

| SL. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY COURSES WITH PRACTICAL COMPONENT** | | | | | | | | |
| 1. | IT22501 | Data Communication and Networking | PCC | 2 | 0 | 2 | 4 | 3 |
| 2. | IT22502 | Software Engineering | PCC | 2 | 0 | 2 | 4 | 3 |
| 3. | | Professional Elective - I | PEC | 2 | 0 | 2 | 4 | 3 |
| 4. | | Professional Elective – II | PEC | 2 | 0 | 2 | 4 | 3 |
| **PRACTICAL COURSES WITH THEORY COMPONENT** | | | | | | | | |
| 5. | IT22503 | Mobile Application Development Laboratory | PCC | 1 | 0 | 2 | 3 | 2 |
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 6. | IT22504 | Technical Seminar | EEC | 0 | 0 | 2 | 2 | 1 |
| 7. | IT22505 | Inplant / Industrial Training (2 weeks - During 4th semester Summer Vacation) | EEC | - | - | - | - | 1 |
| 8. | SD22501 | Coding Skills and Soft Skills Training - Phase III | EEC | 0 | 0 | 4 | 4 | 2 |
| **MANDATORY COURSES** | | | | | | | | |
| 9. | AC22501 | Entrepreneurship Development | MC | 2 | 0 | 0 | 2 | 0 |
| 10. | HS22501 | Value Education - II | MC | 1 | 0 | 0 | 1 | 0 |
| **TOTAL** | | | | **12** | **0** | **16** | **28** | **18** |

## SEMESTER VI

| SL. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY COURSES** | | | | | | | | |
| 1. | HS22601 | Professional Ethics | HSMC | 3 | 0 | 0 | 3 | 3 |
| 2. | CS22601 | Compiler Design | PCC | 3 | 0 | 0 | 3 | 3 |
| 3. | | Open Elective – I | OEC | 3 | 0 | 0 | 3 | 3 |
| **THEORY COURSES WITH PRACTICAL COMPONENT** | | | | | | | | |
| 4. | IT22601 | Data Science | PCC | 2 | 0 | 2 | 4 | 3 |
| 5. | | Professional Elective – III | PEC | 2 | 0 | 2 | 4 | 3 |
| 6. | | Professional Elective – IV | PEC | 2 | 0 | 2 | 4 | 3 |
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 7. | SD22601 | Coding Skills and Quantitative Aptitude – Phase I | EEC | 0 | 0 | 4 | 4 | 2 |
| **TOTAL** | | | | **15** | **0** | **10** | **25** | **20** |

On the completion of third-year the students can adapt emerging IT technologies to solve challenging engineering problems in multi-disciplinary industries.

## SEMESTER VII

| SL. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY COURSES** | | | | | | | | |
| 1. | MS22701 | Principles of Management | HSMC | 3 | 0 | 0 | 3 | 3 |
| 2. | IT22701 | Cryptography and Network Security | PCC | 3 | 0 | 0 | 3 | 3 |
| 3. | | Open Elective – II | OEC | 3 | 0 | 0 | 3 | 3 |
| 4. | | Open Elective - III | OEC | 3 | 0 | 0 | 3 | 3 |
| **THEORY COURSES WITH PRACTICAL COMPONENT** | | | | | | | | |
| 5. | | Professional Elective – V | PEC | 2 | 0 | 2 | 4 | 3 |
| 6. | | Professional Elective – VI | PEC | 2 | 0 | 2 | 4 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **PRACTICAL COURSES** | | | | | | | | |
| 7. | IT22702 | Security Lab | PCC | 0 | 0 | 4 | 4 | 2 |
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 8. | IT22703 | Mini project work | EEC | 0 | 0 | 6 | 6 | 3 |
| 9. | SD22701 | Coding Skills and Quantitative Aptitude - Phase II | EEC | 0 | 0 | 4 | 4 | 2 |
| **TOTAL** | | | | **16** | **0** | **18** | **34** | **25** |

**SEMESTER VIII**

| SL. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **PRACTICAL COURSES** | | | | | | | | |
| 1. | IT22801 | Project Work | EEC | | | 16 | | 8 |
| **TOTAL** | | | | **0** | **0** | **16** | **0** | **8** |

On the completion of final year, the students can design ethical solutions and manage IT infrastructure for the sustainable development of humane society.

## SUMMARY

| INFORMATION TECHNOLOGY | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sl.No** | **Subject Area** | **Credits Per Semester** | | | | | | | **Total Credits** |
| | | **I** | **II** | **III** | **IV** | **V** | **VI** | **VII** | **VIII** |
| **1** | **HSMC** | 6 | 4 | | | | 3 | 3 | | 16 |
| **2** | **BSC** | 12 | 10 | 4 | | | | | | 26 |
| **3** | **ESC** | 5 | 13 | | | | | | | 18 |
| **4** | **PCC** | | | 16 | 19 | 8 | 6 | 5 | | 54 |
| **5** | **PEC** | | | | | 6 | 6 | 6 | | 18 |
| **6** | **OEC** | | | | | | 3 | 6 | | 9 |
| **7** | **EEC** | | | 2 | 2 | 4 | 2 | 5 | 8 | 23 |
| **8** | **MC** | 1 | | √ | | √ | | | | 1 |
| **9** | **AC** | | | √ | √ | √ | | | | 0 |
| **Total** | | 24 | 27 | 22 | 21 | 18 | 20 | 25 | 8 | 165 |

ST.XAVIER'S CATHOLIC COLLEGE OF ENGINEERING
EFFICIENCY * EXCELLENCE * EMINENCE

## OPEN ELECTIVE - I

| SL.NO | COURSE CODE | COURSE TITLE | CATE-GORY | PEROIDS PER WEEK | | | TOTAL CONTACT PERIODS | CERDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | IT22681 | Data Science using Python | OEC | 3 | 0 | 0 | 3 | 3 |
| 2 | IT22682 | Internet of Things | OEC | 3 | 0 | 0 | 3 | 3 |

## OPEN ELECTIVE – II

| SL.NO | COURSE CODE | COURSE TITLE | CATE-GORY | PEROIDS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | IT22781 | Front End Web Development | OEC | 2 | 0 | 2 | 4 | 3 |
| 2 | IT22782 | Introduction to Devops | OEC | 2 | 0 | 2 | 4 | 3 |

## OPEN ELECTIVE – III

| SL.NO | COURSE CODE | COURSE TITLE | CATE-GORY | PEROIDS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | IT22783 | Introduction to Mobile Application Development | OEC | 3 | 0 | 0 | 3 | 3 |
| 2 | IT22784 | Multi Variate Data Analytics | OEC | 2 | 0 | 2 | 4 | 3 |

## PROFESSIONAL ELECTIVE COURSES

| LIST OF IDENTIFIED VERTICALS | |
|---|---|
| 1 | INTERNET TECHNOLOGIES |
| 2 | ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING |
| 3 | DATA SCIENCE |
| 4 | INFORMATION ASSURANCE AND SECURITY |
| 5 | COGNITIVE TECHNOLOGIES |

| VERTICAL 1 | VERTICAL 2 | VERTICAL 3 | VERTICAL 4 | VERTICAL 5 |
|---|---|---|---|---|
| **Internet Technologies** | **Artificial Intelligence and Machine Learning** | **Data Science** | **Information Assurance and Security** | **Cognitive Technologies** |
| Full Stack Web Development | Soft Computing | Data Analytics | Cyber Ethics and Legal Issues | Quantum Computing |
| Cloud Computing | Artificial Intelligence | NoSQL Databases | Penetration Testing and Vulnerability Analysis | Site Reliability Engineering |
| UI/UX Design | Optimization Techniques | Data Visualization Techniques | Digital Forensics | Edge Computing |
| DevOps | Deep Learning | Text and Speech Analysis | Information Security | AR/VR Mixed Reality |
| Advanced Web Application Development | Cognitive Science | Business Intelligence | Multimedia Security | Prompt Engineering |
| Digital Marketing | Generative AI | Social Media Analytics | Blockchain Technologies | Robotics Process Automation |
| Salesforce Administration | | | | Modern Application Development |

**VERTICAL 1: (6 courses)**

**INTERNET TECHNOLOGIES**

| SL.NO | COURSE CODE | COURSE TITLE | CATE - GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | IT22511 | Full Stack Web Development | PEC-1 | 2 | 0 | 2 | 4 | 3 |
| 2 | IT22512 | Cloud Computing | PEC-2 | 2 | 0 | 2 | 4 | 3 |
| 3 | CS22641 | UI/UX Design | PEC-3 | 2 | 0 | 2 | 4 | 3 |
| 4 | IT22611 | DevOps | PEC-4 | 2 | 0 | 2 | 4 | 3 |
| 5 | IT22711 | Advanced Web Application Development | PEC-5 | 2 | 0 | 2 | 4 | 3 |
| 6 | IT22712 | Digital Marketing | PEC-6 | 2 | 0 | 2 | 4 | 3 |
| 7 | CS22753 | Salesforce Administration | PEC-7 | 2 | 0 | 2 | 4 | 3 |

**VERTICAL 2 :(6 courses)**

**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

| SL.NO | COURSE CODE | COURSE TITLE | CATE - GORY | PEROIDS PER WEEK | | | TOTAL CONTACT PERIODS | CERDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | CS22521 | Soft Computing | PEC-1 | 2 | 0 | 2 | 4 | 3 |
| 2 | IT22521 | Artificial Intelligence | PEC-2 | 2 | 0 | 2 | 4 | 3 |
| 3 | IT22621 | Optimization Techniques | PEC-3 | 2 | 0 | 2 | 4 | 3 |
| 4 | CS22622 | Deep Learning | PEC-4 | 2 | 0 | 2 | 4 | 3 |
| 5 | IT22721 | Cognitive Science | PEC-5 | 2 | 0 | 2 | 4 | 3 |
| 6 | IT22722 | Generative AI | PEC-6 | 2 | 0 | 2 | 4 | 3 |

**VERTICAL 3: (6 courses)**

**DATA SCIENCE**

| SL.NO | COURSE CODE | COURSE TITLE | CATE-GORY | PEROIDS PER WEEK | | | TOTAL CONTACT PERIODS | CERDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | IT22531 | Data Analytics | PEC-1 | 2 | 0 | 2 | 4 | 3 |
| 2 | CS22512 | NoSQL Databases | PEC-2 | 2 | 0 | 2 | 4 | 3 |
| 3 | IT22631 | Data Visualization Techniques | PEC-3 | 2 | 0 | 2 | 4 | 3 |
| 4 | IT22632 | Text and Speech Analysis | PEC-4 | 2 | 0 | 2 | 4 | 3 |
| 5 | IT22731 | Business Intelligence | PEC-5 | 2 | 0 | 2 | 4 | 3 |
| 6 | IT22732 | Social Media Analytics | PEC-6 | 2 | 0 | 2 | 4 | 3 |

**VERTICAL 4: (6 courses)**

**INFORMATION ASSURANCE AND SECURITY**

| SL.NO | COURSE CODE | COURSE TITLE | CATE-GORY | PEROIDS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | IT22541 | Cyber Ethics and Legal Issues | PEC-1 | 2 | 0 | 2 | 4 | 3 |
| 2 | IT22542 | Penetration Testing and Vulnerability Analysis | PEC-2 | 2 | 0 | 2 | 4 | 3 |
| 3 | IT22641 | Digital Forensics | PEC-3 | 2 | 0 | 2 | 4 | 3 |
| 4 | IT22642 | Information Security | PEC-4 | 2 | 0 | 2 | 4 | 3 |
| 5 | IT22741 | Multimedia Security | PEC-5 | 2 | 0 | 2 | 4 | 3 |
| 6 | CS22732 | Blockchain Technologies | PEC-6 | 2 | 0 | 2 | 4 | 3 |

**VERTICAL 5: (6 courses)**

**COGNITIVE TECHNOLOGIES**

| SL.NO | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | IT22551 | Quantum Computing | PEC-1 | 2 | 0 | 2 | 4 | 3 |
| 2 | IT22552 | Site Reliability Engineering | PEC-2 | 2 | 0 | 2 | 4 | 3 |
| 3 | IT22651 | Edge Computing | PEC-3 | 2 | 0 | 2 | 4 | 3 |
| 4 | IT22652 | AR/VR Mixed Reality | PEC-4 | 2 | 0 | 2 | 4 | 3 |
| 5 | IT22751 | Prompt Engineering | PEC-5 | 2 | 0 | 2 | 4 | 3 |
| 6 | IT22752 | Robotics Process Automation | PEC-6 | 2 | 0 | 2 | 4 | 3 |
| 7 | CS22713 | Modern Application Development | PEC-7 | 2 | 0 | 2 | 4 | 3 |

**SYLLABUS**

| MA22101 | MATRICES AND CALCULUS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**COURSE OBJECTIVES:**

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications
- To familiarize the students with differential calculus
- To familiarize the student with functions of several variables. This is needed in many branches of engineering
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications
- To make the students understand various techniques ODE

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

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Problem solving using Cayley-Hamilton method – Orthogonal transformation of a symmetric matrix to Diagonal form – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature, rank, index.

| UNIT II | DIFFERENTIAL CALCULUS | 12 |
|---|---|---|
| Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules: sum, product, quotient, chain rules - Implicit differentiation – Logarithmic differentiation – Applications: Maxima and Minima of functions of one variable. | | |
| **UNIT III** | **FUNCTIONS OF SEVERAL VARIABLES** | **12** |
| Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers. | | |
| **UNIT IV** | **MULTIPLE INTEGRALS** | **12** |
| Double integrals – Double integrals in Cartesian and polar coordinates –Area enclosed by plane curves - Change of order of integration – Triple integrals – Volume of solids: cube, rectangular parallelopiped. | | |
| **UNIT V** | **ORDINARY DIFFERENTIAL EQUATIONS** | **12** |
| Linear differential equations of second and higher order with constant coefficients when the R.H.S is $e^{ax}$, $x^n$ , sin ax, cos ax, $e^{ax}$ $x^n$, $e^{ax}$ sinbx, $e^{ax}$ cosbx – Linear differential equations of second and third order with variable coefficients: Cauchy's and Legendre's linear equations – Method of variation of parameter . | | |
| **TOTAL: 60 PERIODS** | | |

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Define the basic concepts of matrices, limit and continuity of a function, differentiation, ODE and integration |
| **CO2:** | Explain the properties of matrices and nature of the quadratic form |
| **CO3:** | Interpret the techniques of differentiation, partial differentiation, ODE and integration |
| **CO4:** | Apply diagonalization of matrices in quadratic form and apply Cayley Hamilton theorem to find the inverse of matrices |
| **CO5:** | Solve problems on differentiation, partial differentiation, integration and ODE using different methods |

**TEXT BOOKS:**

| | |
|---|---|
| 1. | Narayanan, S. and ManicavachagomPillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, Reprint 2017. |
| 2. | Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition,2014. |

**REFERENCES:**

| | |
|---|---|
| 1. | Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016. |
| 2. | Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016. |
| 3. | Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007. |
| 4. | Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, |

| | |
|---|---|
| | New Delhi, 2016. |
| 5. | Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |

3-High, 2- Medium, 1-Low

| PH22101 | ENGINEERING PHYSICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology
- To help the students to interrelate the topics such as properties of matter, thermal physics, ultrasonics, quantum theory and crystals, learned in the course
- To motivate students to compare and contrast the available equipment in the respective fields
- To induce the students to design new devices that serve humanity by applying the knowledge gained during the course

| UNIT I | PROPERTIES OF MATTER | 9 |
|---|---|---|

Elasticity – Types of Elastic moduli – Factors affecting elasticity - Stress-strain diagram and its uses - beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: determination of young's modulus – I shaped Girders - twisting couple - torsion pendulum: determination of rigidity modulus and moment of inertia – torsion springs - other states of matter

| UNIT II | THERMAL PHYSICS | 9 |
|---|---|---|

Modes of Heat transfer – Thermal conductivity – Newton's law of cooling – Linear heat flow – Thermal conductivity in compound media - Lee's Disc method – Radial heat flow – Rubber tube method – Solar water heater - Thermodynamics – Isothermal and adiabatic process – Otto cycle – Diesel cycle

| UNIT III | ULTRASONICS | 9 |
|---|---|---|
| Sound waves – ultrasonics – properties - production: magnetostriction method - piezoelectric method – cavitation - acoustic grating: wavelength and velocity of ultrasonic waves in liquids – applications: welding, machining, cleaning, soldering and mixing (qualitative) - SONAR – ultrasonic flaw detector - ultrasonography. | | |
| **UNIT IV** | **QUANTUM PHYSICS** | **9** |
| Black body radiation – Planck's radiation law – Deduction of Wien's displacement law and Rayleigh Jean's law - Compton effect, Photoelectric effect (qualitative) – matter waves – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – scanning tunneling microscope. | | |
| **UNIT V** | **CRYSTAL PHYSICS** | **9** |
| Crystalline and amorphous materials – unit cell, crystal systems, Bravais lattices, Crystal planes, directions and Miller indices – Characteristics of crystal structures: SC, BCC, FCC and HCP structures - crystal imperfections: point, line and surface defects – crystal growth : epitaxial and lithography techniques | | |
| | | **TOTAL: 45 PERIODS** |

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Recall the basics of properties of matter, thermal physics and ultrasonics, to improve their engineering knowledge |
| **CO2:** | Define the advanced physics concepts of quantum theory and the characteristics of crystalline materials |
| **CO3:** | Illustrate Bending of beams, thermal behavior and ultrasonic devices to assess societal and safety issues |
| **CO4:** | Summarize the dual aspects of matter, crystal structures and imperfections of crystals |
| **CO5:** | Apply the moduli of elasticity of different materials, thermal energy, ultrasonics, scanning tunneling microscope and crystal growth techniques in engineering fields |

**TEXT BOOKS:**


| | |
|---|---|
| 1. | Gaur, R.K & Gupta.S.L, Engineering Physics, Dhanpat Rai Publishers, 2016. |
| 2. | Shatendra Sharma & Jyotsna Sharma, Engineering Physics, Pearson India Pvt Ltd., 2018 |


**REFERENCES:**


| | |
|---|---|
| 1. | Halliday.D, Resnick, R. & Walker. J, "Principles of Physics", Wiley, 2015. |
| 2. | Bhattacharya, D.K. & Poonam.T., Engineering Physics, Oxford University Press, 2015. |
| 3. | Pandey.B.K, & Chaturvedi.S, Engineering Physics, Cengage Learning India. 2012. |
| 4. | Malik H K & Singh A K, "Engineering Physics", McGraw Hill Education (India Pvt. Ltd.) 2nd edition 2018. |
| 5. | Serway.R.A. & Jewett, J.W, "Physics for Scientists and Engineers", Cengage Learning India. 2010. |


**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |

3-High, 2- Medium, 1-Low

| CH22101 | ENGINEERING CHEMISTRY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To make the students conversant with water treatment methods and electrochemistry Concept
- To gain basic knowledge of corrosion and protection methods
- To understand the basic concepts and synthesis of various engineering materials, nano materials and fuels
- To familiarise the students with the principles, working process and application of energy storage devices

| UNIT I | WATER TREATMENT | 9 |
|---|---|---|

Water: Sources, impurities - Hardness of water: Types - Estimation of hardness (EDTA method) - Disadvantages of hard water in boilers (Scale, Sludge) – Softening methods: Internal treatment (Calgon, Sodium Aluminate) and External treatment (Demineralisation process). Domestic water treatment – Desalination of brackish water: RO and Solar desalination method.

| UNIT II | ELECTROCHEMISTRY AND CORROSION | 12 |
|---|---|---|

Electrochemical cell – Free energy and emf – Nernst equation and applications – Oxidation and reduction potential – Standard electrodes: Standard Hydrogen electrode, Saturated calomel electrode, Glass electrode – pH measurement – Conductometric titration (acid-base, precipitation) and Potentiometric titrations: Redox titration ($Fe^{2+}$ x $Cr_2O_7^{2-}$).

Corrosion – Types: Chemical corrosion and Electrochemical corrosion – Corrosion control methods: Sacrificial anodic and Impressed current Cathodic protection method

| UNIT III | FUELS AND COMBUSTION | 8 |
|---|---|---|

Fuels - classification of fuels – Comparison of solid, liquid and gaseous fuel - Solid fuel - coal - analysis of coal (proximate only) – Liquid fuel - Petroleum – Refining of petroleum - manufacture of synthetic petrol (Bergius process) – Biodiesel – preparation, properties and uses. Gaseous fuel – CNG, LPG.

Combustion – Calorific value – Types (Gross and Net calorific value) – Dulong's formula – GCV and LCV calculation using Dulong's formula. Flue gas – Analysis of flue gas by Orsat

| | | |
|---|---|---|
| method. | | |
| **UNIT IV** | **ENERGY STORAGE DEVICES** | **8** |
| Batteries – Types (Primary and Secondary) - Lead acid battery, Lithium ion battery - Super capacitors – Storage principle, types and examples – Electric vehicle – working principle - Fuel cells – microbial fuel cell and polymer membrane fuel cell.<br>Nanomaterials in energy storage – CNT –Types, properties and applications. | | |
| **UNIT V** | **ENGINEERING MATERIALS** | **8** |
| Abrasives – Types: Natural and Artificial – SiC – preparation, properties and uses. Refractories – Types Acidic, Basic, Neutral – Refractoriness, RUL. Cement – Manufacture – Special cement – white cement and water proof cement. Glass – Manufacture, properties and uses | | |
| | | **TOTAL: 45 PERIODS** |

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Recall the basic concepts of water softening, nano materials and batteries |
| **CO2:** | Summarize the types of corrosion, fuels and energy storage devices |
| **CO3:** | Explain the basic principles of electrochemistry and engineering materials |
| **CO4:** | Identify suitable methods for water treatment, fuel and corrosion control |
| **CO5:** | Apply the knowledge of engineering materials, fuels and energy storage devices for material selection and also in energy sectors |

**TEXT BOOKS:**

| | |
|---|---|
| 1. | P. C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015. |
| 2. | S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015. |

**REFERENCES:**

| | |
|---|---|
| 1. | Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014. |
| 2. | Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi 2015. |
| 3. | Sivasankar B. ''Engineering chemistry'', Tata McGraw Hill Publishing company Ltd, New Delhi, 2008. |
| 4. | B.S.Murty, P.Shankar, Baldev Raj, B B Rath and James Murday, '' Text book of nano science and technology'' Universities press. |
| 5. | O.G. Palanna, ―Engineering Chemistry‖ McGraw Hill Education (India) Private Limited, 2nd Edition, 2017. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO2 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 1 | 2 | - | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | 3 | 2 | 2 | 1 | - | - | 1 | - | - | - | - | 1 | 2 | - | - |
| CO4 | 3 | 2 | 2 | 1 | - | - | 2 | - | - | - | - | 1 | 2 | - | - |
| CO5 | 3 | 2 | 2 | 1 | - | - | 2 | - | - | - | - | 1 | 2 | - | - |
| CO | 3 | 2 | 2 | 1 | - | - | 2 | - | - | - | - | 1 | 2 | - | - |

3-High, 2- Medium, 1-Low

| CS22101 | PROBLEM SOLVING AND PYTHON PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To understand the basics of algorithmic problem solving
- To learn to solve problems using Python conditionals and loops
- To define Python functions and use function calls to solve problems
- To use Python data structures - lists, tuples, and dictionaries to represent complex Data
- To do input/output with files in Python

| UNIT I | INTRODUCTION TO COMPUTERS AND PROBLEM SOLVING STRATEGIES | 9 |
|---|---|---|

Introduction- Components and functions of a computer system- Hardware and Software. Problem solving strategies- Program design tools: Algorithms, Flow charts, Pseudo code

| UNIT II | DATA TYPES, EXPRESSIONS, STATEMENTS AND CONTROL FLOW | 10 |
|---|---|---|

Features of Python -Variables and Identifiers – Data types: Numbers, Strings, Boolean, Tuples, List, Dictionary, Sets - Input operation - Comments, Reserved words, Indentation - Operators and Expressions – Type Conversion - Selection / Conditional Branching Statements - Basic Loop Structures / Iterative Statements - Nested Loops – break statement – continue statement – pass statement

| UNIT III | FUNCTIONS AND STRINGS | 9 |
|---|---|---|

Functions: Function Definition, function call- variable scope and lifetime – return statements. Strings: Definition, operations (concatenation, appending, multiply, slicing) - immutability, comparison, iterations, string methods

| UNIT IV | LIST, TUPLES AND DICTIONARIES | 9 |
|---|---|---|

Lists: Access, updating values- nested, cloning- list operations- list methods- looping in list. Tuples: Tuple operations- nested tuple; Dictionaries- Creating, Accessing, adding, modifying, deleting items

| UNIT V | FILES, EXCEPTIONS AND PACKAGES | 8 |
|---|---|---|

Files: Types of files, Opening and closing Files, Reading and writing files, File positions, Renaming and deleting files. Exceptions: Errors and exceptions, Handling exceptions, Packages

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES**

| Upon completion of the course, the students will be able to | |
|---|---|
| **CO1:** | Describe the algorithmic solutions to simple and complex computational problems |
| **CO2:** | Apply functions, modules and packages in Python program and use conditionals and loops for solving problems |
| **CO3:** | Analyze conditional branching statements |
| **CO4:** | Evaluate python programs |
| **CO5:** | Develop programs using compound data types and files |

| **TEXT BOOKS** | |
|---|---|
| 1. | Reema Thareja, "Python Programming Using Problem Solving Approach", 13th Edition, Oxford University Press, 2022. |
| 2. | Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016. |

| **REFERENCES** | |
|---|---|
| 1. | Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017. |
| 2. | Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021. |
| 3. | John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021. |
| 4. | Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019. |
| 5. | Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018. |

**Mapping of Course Outcomes to Programme Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | 3 | - | - |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | 3 | - | - |
| CO5 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | 3 | - | - |
| CO | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | 3 | - | - |

3-High, 2- Medium, 1-Low

| **HS22102** | **UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **0** | **2** |

**COURSE OBJECTIVES:**

- To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education

| | | |
|---|---|---|
| • To facilitate the students to understand harmony at all the levels of human living, and live accordingly | | |
| • To create an awareness on Engineering Ethics and Human Values | | |
| • To understand social responsibility of an engineer | | |
| **UNIT I** | **INTRODUCTION TO VALUE EDUCATION** | **6** |
| Value Education - Definition, Concept and Need for Value Education, Basic Guidelines - The Content and Process of Value Education - Basic Guidelines for Value Education - Self exploration as a means of Value Education - Happiness and Prosperity as parts of Value Education. | | |
| **UNIT II** | **HARMONY IN THE HUMAN BEING** | **6** |
| Human Being is more than just the Body- Harmony of the Self ('I') with the Body - Understanding Myself as Co-existence of the Self and the Body - Understanding Needs of the Self and the needs of the Body - Understanding the activities in the Self and the activities in the Body. | | |
| **UNIT III** | **HARMONY IN THE FAMILY, SOCIETY AND HARMONY IN THE NATURE** | **6** |
| Family as a basic unit of Human Interaction and Values in Relationships - The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love - Comprehensive Human Goal: The Five Dimensions of Human Endeavour - Harmony in Nature: The Four Orders in Nature - The Holistic Perception of Harmony in Existence. | | |
| **UNIT IV** | **SOCIAL ETHICS** | **6** |
| The Basics for Ethical Human Conduct - Defects in Ethical Human Conduct - Holistic Alternative and Universal Order - Universal Human Order and Ethical Conduct - Human Rights violation and Social Disparities. | | |
| **UNIT V** | **PROFESSIONAL ETHICS** | **6** |
| Universal Human Values - Value based Life and Profession - Professional Ethics and Right Understanding - Competence in Professional Ethics - Issues in Professional Ethics – The Current Scenario - Vision for Holistic Technologies - Production System and Management Models. | | |
| | | **TOTAL: 30 PERIODS** |
| **COURSE OUTCOMES:** | | |
| **At the end of the course, the students will be able to:** | | |
| **CO1:** | Illustrate the significance of value inputs in a classroom and start applying them in their life and profession. | |
| **CO2:** | Explain the role of a human being in ensuring harmony in society and nature. | |
| **CO3:** | Demonstrate the value of harmonious relationship based on trust and respect in their life and profession. | |
| **CO4:** | Compare values, skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc. | |
| **CO5:** | Classify ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. | |
| **TEXT BOOKS:** | | |
| 1 | R R Gaur, R Sangal, G P Bagaria, "Human Values and Professional Ethics", Excel Books, New Delhi, 2010. | |
| 2 | A.N. Tripathy, "Human Values", New Age International Publishers, New Delhi, | |

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|---|---|
| | 2004. |
| **REFERENCES:** | |
| 1. | Gaur. R.R., Sangal. R, Bagaria. G.P, "A Foundation Course in Value Education", Excel Books, 2009. |
| 2. | Gaur. R.R., Sangal. R, Bagaria. G.P, "Teachers Manual" Excel Books, 2009. |
| 3. | Gaur R R, R Sangal, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2009. |
| 4. | William Lilly, "Introduction to Ethic" Allied Publisher. |
| 5. | Nagarajan, R.S., Professional Ethics and Human values, New Age International Publishers, 2006. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 1 | - | - | - | - | 2 | 2 | 3 | 1 | 1 | - | 1 | - | - | 3 |
| CO2 | 1 | - | - | - | - | 2 | 2 | 3 | 1 | 1 | - | 1 | - | - | 3 |
| CO3 | 1 | - | - | - | - | 2 | 2 | 3 | 1 | 1 | - | 1 | - | - | 3 |
| CO4 | 1 | - | - | - | - | 2 | 2 | 3 | 1 | 1 | - | 1 | - | - | 3 |
| CO5 | 1 | - | - | - | - | 2 | 2 | 3 | 1 | 1 | - | 1 | - | - | 3 |
| CO | 1 | - | - | - | - | 2 | 2 | 3 | 1 | 1 | - | 1 | - | - | 3 |

3-High, 2- Medium, 1-Low

| GE3152 | HERITAGE OF TAMILS | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**COURSE OBJECTIVES:**

- To help students understand the values of Tamil Language, basic language families in India and types of Tamil literature
- To facilitate the students to understand Tamil heritage of rock arts, paintings and musical instruments in their economic life
- To facilitate the students in understanding the harmony existing in Tamils martial arts
- To create an awareness on concept of Thinai Tamils and its values
- To understand the contribution and Influence of Tamils in Indian culture

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

Indian Language Families – Dravidian Languages – Tamil as a Classical Language – Tamil Monographs – Secularity of Sangha Literature – Virtue of Sharing in Sangha Literature – Concepts of Management in Thirukkural – Tamil Copies – Influence of Jain Buddhism in Tamil Nadu – Bhakti Literature – Alvars and Nayanmars – Small Literature – Development of Modern Literature in Tamil – Contribution of Bharatiyar and Bharathidasan to the development of Tamil literature.

| 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 – Leather puppetry– 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** | | |

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| **COURSE OUTCOMES:** | |
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Describe the importance of Tamil Language and types of Tamil literature. |
| **CO2:** | Illustrate their knowledge in rock art paintings to modern art. |
| **CO3:** | Demonstrate a strong foundational knowledge in martial arts. |
| **CO4:** | Explain the concept of Thinai Tamils and its values. |
| **CO5:** | Describe the contribution of Tamils in Indian culture. |

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| **TEXT & REFERENCE BOOKS:** | |
| 1. | *தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை* (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியல் பணிகள் கழகம். |
| 2. | Dr.K.K.Pillay, Social Life of Tamils, A joint publication of TNTB & ESC and RMRL. |
| 3. | Dr.S.Singaravelu, "Social Life of the Tamils – The Classical Period", International Institute of Tamil Studies. |
| 4. | Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu, "Historical Heritage of the Tamils", International Institute of Tamil Studies. |
| 5. | Dr.M.Valarmathi, "The Contributions of the Tamils to Indian Culture", International Institute of Tamil Studies. |
| 6. | Dr.K.K.Pillay, "Studies in the History of India with Special Reference to Tamil Nadu". |

| **GE3152** | ***தமிழர் மரபு*** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **1** | **0** | **0** | **1** |

**COURSE OBJECTIVES:**

- *தமிழ் மொழியின் மதிப்புகள், இந்தியாவில் உள்ள அடிப்படை மொழிக்குடும்பங்கள் மற்றும் தமிழ் இலக்கிய வகைகளை மாணவர்கள் புரிந்துகொள்ள உதவுதல்*
- *மாணவர்கள் பாறை ஓவியங்கள், சிற்பக்கலைகள் மற்றும் இசைக்கருவிகளின் வழி தமிழ் பாரம்பரியத்தைப் புரிந்துகொள்ள வசதி செய்தல்*
- *தமிழர்களின் கலை மற்றும் வீர விளையாட்டுகளைப் புரிந்து கொள்வதற்கு மாணவர்களுக்கு*

| | | |
|---|---|---|
| உதவுதல் | | |
| • தமிழர்களின் திணைக் கருத்துக்கள் மற்றும் அவர்களின் வாழ்க்கை நெறிகளைப் பற்றி மாணவர்களுக்கு விழிப்புணர்வை ஏற்படுத்துதல் | | |
| • இந்திய கலாச்சாரத்தில் தமிழர்களின் பங்களிப்பையும் அதன் தாக்கத்தையும் மாணவர்கள் புரிந்துகொள்ள செய்தல் | | |
| **அலகு I** | **மொழி மற்றும் இலக்கியம்** | **3** |
| இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச்சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு. | | |
| **அலகு II** | **மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை.** | **3** |
| நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு | | |
| **அலகு III** | **நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்** | **3** |
| தெருக்கூத்து கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுக்கள். | | |
| **அலகு IV** | **தமிழர்களின் திணைக் கோட்பாடுகள்.** | **3** |
| தமிழகத்தின் தாவரங்களும் விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும் கல்வியும், சங்ககால நகரங்களும் துறை முகங்களும் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி. | | |
| **அலகு V** | **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்கு தமிழர்களின் பங்களிப்பு** | **3** |
| இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு. | | |
| | | **TOTAL: 15 PERIODS** |
| **COURSE OUTCOMES:** | | |
| **இப்பாடத் திட்டத்தின் மூலம் மாணவர்கள் பெறும் பயன்கள்:** | | |
| **CO1:** | தமிழ் மொழியின் முக்கியத்துவம் மற்றும் இலக்கிய வகைகளை விவரிக்க முடியும். | |
| **CO2:** | பாறை ஓவியங்கள் முதல் நவீன கலைகள் வரை அவர்களின் அறிவை விவரிக்க முடியும். | |
| **CO3:** | தற்காப்புக் கலைளின் வலுவான அடித்தள அறிவை விவரிக்க முடியும். | |
| **CO4:** | தமிழர்களின் திணைக் கருத்துக்கள் மற்றும் அதன் மதிப்புகளை விளக்க முடியும். | |
| **CO5:** | இந்திய கலாச்சாரத்தில் தமிழர்களின் பங்களிப்பை விவரிக்க இயலும். | |
| **TEXT & REFERENCE BOOKS:** | | |

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|---|---|
| 1. | தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியல் பணிகள் கழகம். |
| 2. | Dr.K.K.Pillay, Social Life of Tamils, A joint publication of TNTB & ESC and RMRL. |
| 3. | Dr.S.Singaravelu, "Social Life of the Tamils – The Classical Period", International Institute of Tamil Studies. |
| 4. | Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu, "Historical Heritage of the Tamils", International Institute of Tamil Studies. |
| 5. | Dr.M.Valarmathi, "The Contributions of the Tamils to Indian Culture", International Institute of Tamil Studies. |
| 6. | Dr.K.K.Pillay, "Studies in the History of India with Special Reference to Tamil Nadu". |


**Mapping of Course Outcomes to Programme Outcomes**

| Course Outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | – | – | – | – | – | 1 | – | – | – | – | – | – | – | – | – |
| CO2 | – | – | – | – | – | 1 | – | – | – | – | – | – | – | – | – |
| CO3 | – | – | – | – | – | 1 | – | – | – | – | – | – | – | – | – |
| CO4 | – | – | – | – | – | 1 | – | – | – | – | – | – | – | – | – |
| CO5 | – | – | – | – | – | 1 | – | – | – | – | – | – | – | – | – |
| CO | – | – | – | – | – | 1 | – | – | – | – | – | – | – | – | – |

3–High, 2– Medium, 1–Low

| EN22101 | COMMUNICATIVE ENGLISH | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To guide the learners on the basics of language including vocabulary and grammar
- To develop the receptive skills of the learners: Reading and Listening
- To develop the productive skills of the learners: Writing and Speaking
- To make the learners realize the importance of accuracy and fluency
- To help the learners use the language in real situations

| UNIT I | VOCABULARY AND LANGUAGE STUDY | 6 |
|---|---|---|

**Vocabulary** – Synonyms and Antonyms, Word building – Prefixes and Suffixes – Word formation- Definitions - One word substitutes - Reading for vocabulary and language development- Note making and Summarising - Developing Hints.

| UNIT II | READING AND LANGUAGE DEVELOPMENT | 6 |
|---|---|---|

Parts of speech, Types of sentences – Statement, Interrogative, Imperative, Exclamatory, Wh-questions, **Yes** or **No** questions and tag questions, Formal Letters – Academic, Official, and Business Letters

| | | |
|---|---|---|
| **UNIT III** | **GRAMMAR AND LANGUAGE DEVELOPMENT** | **6** |
| Tense and Voice, Auxiliary verbs (be, do, have), Modal verbs - *Types of Reading* : Intensive Reading and Extensive Reading- *Strategies*: Predicting- Skimming and Scanning -Reading for facts - Understanding the parts of paragraph- Learning the transitional signals used in the passage to classify the text | | |
| **UNIT IV** | **FUNDAMENTALS OF WRITING** | **6** |
| Punctuation and Capitalization- **Sentence formation**: Word order-Completion of sentences-Conjunctions-Transitional signals- sentence and sentence structures- Informal Letters. | | |
| **UNIT V** | **EXTENDED WRITING** | **6** |
| Degrees of Comparison – Reported speech -**Paragraph writing**-Topic sentence, supporting sentences and concluding sentence-Informal and Formal expressions | | |
| | | **TOTAL : 30 PERIODS** |
| **PRACTICAL EXERCISES** | | |
| **Listening (**Receptive skill**)** *Intensive Listening: Effective and Attentive Listening* | | |
| **Exercises** | | |
| 1) Listening for gist from recorded speeches | | |
| 2) Listening for specific information from recorded conversations | | |
| 3) Listening for strengthening vocabulary skills. | | |
| 4) Listening to variety of situations and voices- Listening for language development | | |
| 5) Listening for pronunciation: syllables, stress and intonation. | | |
| **Speaking** (Productive Skill) | | |
| **Exercises** | | |
| 1) Introducing oneself and others | | |
| 2) Asking for / giving personal information | | |
| 3) Practicing dialogues in pairs | | |
| 4) Giving directions-Informal and formal dialogues | | |
| 5) Speaking in connected speech | | |
| 6) Responding to questions | | |
| 7) Short presentations | | |
| 8) Speaking in small and big groups | | |
| 9) Learning and practicing the essential qualities of a good speaker | | |
| | | **TOTAL: 30 PERIODS** |
| | | **TOTAL(T+P): 60 PERIODS** |
| **COURSE OUTCOMES:** | | |
| **At the end of the course, the students will be able to:** | | |
| **CO1:** | Apply and practice the correct usages of language | |
| **CO2:** | Receive the language effectively and meaningfully through receptive skills | |
| **CO3:** | Produce the language appropriate to the needs and situations exercising productive skills | |
| **CO4:** | Transfer or interpret any piece of information with accuracy and fluency | |
| **CO5:** | Apply the language intellectually and confidently | |
| **TEXT BOOKS:** | | |
| 1. | Shobha. K.N, Rayen, Joavani, Lourdes, “Communicative English”, Cambridge University | |

| | |
|---|---|
| | Press, 2018. |
| 2. | Sudharshana.N.P and Saveetha. C, "English for Technical Communication", Cambridge University Press: New Delhi, 2016. |
| **REFERENCES:** | |
| 1. | Kumar, Suresh. E., "Engineering English", Orient Blackswan, Hyderabad, 2015. |
| 2. | Means, L. Thomas and Elaine Langlois, "English & Communication for Colleges", Cengage Learning, USA: 2007. |
| 3. | Greendaum, Sydney and Quirk, Randolph, "A Student's Grammar of the English Language", Pearson Education. |
| 4. | Wood F.T, "Remedial English Grammar", Macmillan, 2007. |
| 5. | Kumar, Sanjay and Pushp Lata, ―Communication Skills: A Workbook‖, New Delhi: OUP, 2018. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | - | - | - | - | - | - | - | - | 1 | 1 | - | 2 | - | - | 1 |
| CO2 | - | - | - | - | - | - | - | - | 2 | 3 | - | 2 | - | - | 1 |
| CO3 | - | - | - | - | - | - | - | - | 1 | 1 | - | 2 | - | - | 1 |
| CO4 | - | - | - | - | - | - | - | - | 2 | 2 | - | 2 | - | - | 1 |
| CO5 | - | - | - | - | - | - | - | - | 2 | 3 | - | 2 | - | - | 1 |
| CO | - | - | - | - | - | - | - | - | 2 | 2 | - | 2 | - | - | 1 |

3-High, 2- Medium, 1-Low

| BS22101 | PHYSICS AND CHEMISTRY LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**PHYSICS LABORATORY**

**OBJECTIVES:**

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student an active participant in each part of all lab exercises.

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1. | Non-uniform bending – Determination of Young's modulus. |
| 2. | SHM of Cantilever – Determination of Young's modulus. |
| 3. | Poiseuille's flow – Coefficient of viscosity of liquid |

| | |
|---|---|
| 4. | Torsional pendulum - Determination of Rigidity modulus. |
| 5. | Newton's ring – Radius of curvature of convex lens. |
| 6. | Lee's Disc – Determination of coefficient of thermal conductivity of bad conductor. |
| | **TOTAL: 30 PERIODS** |

**CHEMISTRY LABORATORY**

**OBJECTIVES**

- To inculcate experimental skills to test basic understanding of water quality parameters such as, acidity, alkalinity and hardness.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1. | Determination of total hardness of water by EDTA method. |
| 2. | Conductometric titration of strong acid and strong base. |
| 3. | Determination of strength of given hydrochloric acid using pH meter. |
| 4. | Conductometric precipitation titration using $BaCl_2$ and $Na_2SO_4$. |
| 5. | Determination of alkalinity in water sample. |
| 6. | Estimation of iron content of the given solution using potentiometer. |
| | **TOTAL: 30 PERIODS** |
| | **TOTAL: 60 PERIODS** |

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Determine different moduli of elasticity used in day to day engineering applications. |
| **CO2:** | Calculate the viscosity of liquids and radius of curvature of convex lens |
| **CO3:** | Estimate the coefficient of thermal conductivity of bad conductors |
| **CO4:** | Determine the water quality parameters of the given water sample. |
| **CO5:** | Analyze quantitatively the metals (Fe, Ni,) in the any sample volumetrically as well as by using spectroanalytical methods. |

**Mapping of Course Outcomes to Programme Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO1** | 3 | 1 | - | - | - | - | - | - | 2 | 1 | - | 1 | 2 | - | - |
| **CO2** | 3 | 1 | - | - | - | - | - | - | 2 | 1 | - | 1 | 2 | - | - |
| **CO3** | 3 | 1 | - | - | - | - | - | - | 2 | 1 | - | 1 | 2 | - | - |
| **CO4** | 3 | 1 | - | - | - | 2 | 2 | - | 1 | - | - | - | 2 | - | - |
| **CO5** | 3 | 1 | - | - | - | 2 | 2 | - | 1 | - | - | - | 2 | - | - |

| CO | 3 | 1 | - | - | - | 2 | 2 | - | 2 | 1 | - | 1 | 2 | - | - |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

3-High, 2- Medium, 1-Low

| CS22102 | PYTHON PROGRAMMING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

- To understand the problem solving approaches
- To learn the basic programming constructs in Python
- To practice various computing strategies for Python-based solutions to real world problems
- To use Python data structures - lists, tuples, dictionaries
- To do input/output with files in Python

**LIST OF EXPERIMENTS**

1. Identification and solving of simple real life or scientific or technical problems, and
2. Python programming using simple statements and expressions
3. Scientific problems using Conditionals and Iterative loops
4. Implementing real-time/technical applications using Lists, Tuples
5. Implementing real-time/technical applications using Sets, Dictionaries
6. Implementing programs using Functions
7. Implementing programs using Strings
8. Implementing real-time/technical applications using File handling
9. Implementing real-time/technical applications using Exception handling
10. Exploring Pygame tool
11. Developing a game activity using Pygame like bouncing ball

**TOTAL PERIODS: 60**

**COURSE OUTCOMES**

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

| | |
|---|---|
| **CO1:** | Develop algorithmic solutions to simple computational problems. |
| **CO2:** | Develop and execute simple Python programs. |
| **CO3:** | Implement programs in Python using conditionals, loops and functions for solving problems. |
| **CO4:** | Process compound data using Python data structures |
| **CO5:** | Utilize Python packages in developing software applications |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | P | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | 3 | - | - |
| CO5 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 1 | 3 | - | - |
| CO | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 1 | 3 | - | - |

3-High, 2- Medium, 1-Low

| HS22101 | HIGHER ORDER THINKING | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**COURSE OBJECTIVES:**

- Teaching the students the sources and dynamics of thinking
- Teaching the students the basics of systematic and scientific thinking
- Initiating the students into critical thinking and to use critical thinking in practical life
- Initiating students into creative thinking

| UNIT I | INTRODUCTION TO COGNITION, KNOWLEDGE AND THINKING | 3 |
|---|---|---|

Cognition - Different Cognitive functions - Cognition and intelligence - Cognitive development: till adolescence and post adolescence - possibility of true knowledge - The sources of Knowledge. Sensation, perception. Reality of perception - Concept formation, abstraction. Memory and retrieving - Introduction to thinking and types of thinking. Systematic thinking

| UNIT II | LOGIC AND REASONING | 3 |
|---|---|---|

Commonsense and scientific knowledge. Pursuit of truth.- Syllogistic Logic. Greek and Indian. -Exercises

| UNIT III | CRITICAL THINKING SKILLS AND DISPOSITIONS | 3 |
|---|---|---|

Critical Thinking Skills & Dispositions. Critical Thinking Exercises

| UNIT IV | ANALYSIS OF ARGUMENTS | 3 |
|---|---|---|

Propositions and fallacies. - Analyzing arguments. - Exercises.

| UNIT V | CREATIVE THINKING AND INNOVATIVE THINKING | 3 |
|---|---|---|

Evolution of Scientific Thinking and Paradigm Shift. - Dynamics of Thoughts: Hegel. - Convergent thinking and divergent thinking (out of the box thinking). - Problem solving and Planning.

**TOTAL: 15 PERIODS**

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Demonstrate the sources of knowledge and the process of thinking |
| **CO2:** | Demonstrate critical thinking skills and dispositions of critical thinking |
| **CO3:** | Confidently engage in creative thinking and problem solving |

**REFERENCES:**


| | |
|---|---|
| 1 | Introduction to Logic, Irving M. Copi, Carl Cohen and Kenneth McMahon, Fourteenth Edition, Pearson Education Limited, 2014. |
| 2 | Teaching Thinking Skills: Theory and Practice, Joan Boykoff Baron and Robert J. Sternberg, W.H. freeman and Company, New York. |
| 3 | Cognitive Psychology, Robert J. Sternberg, Third Edition, Thomson Wadsworth, UK |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 3 | - |
| CO2 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 3 | - |
| CO3 | 3 | 2 | 2 | 1 | - | - | 1 | - | 1 | - | 1 | 1 | - | 3 | - |
| CO | 3 | 2 | 2 | 1 | - | - | 2 | - | 2 | - | 1 | 1 | - | 3 | - |

3-High, 2- Medium, 1-Low

**SEMESTER II**

| MA22201 | STATISTICS AND NUMERICAL METHODS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**COURSE OBJECTIVES:**

- To provide the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various numerical methods of solving ordinary differential equations.

| UNIT I | TESTING OF HYPOTHESIS | 12 |
|---|---|---|

Statistical hypothesis -Type I and Type II errors - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t distribution for single mean and equality of means - Test based on F distribution for equality of variances - Chi square test for single variance and goodness of fit - Independence of attributes - Contingency table : Analysis of r × c tables.

| UNIT II | DESIGN OF EXPERIMENTS | 12 |
|---|---|---|

General principles – Analysis of variance (ANOVA) - One way classification - Completely randomized design (CRD) – Two way classification - Randomized block design (RBD) –

| | | |
|---|---|---|
| Three way classification -Latin square design(LSD) – Two factor experiments: $2^2$ factorial design | | |
| **UNIT III** | **NUMERICAL SOLUTION OF EQUATIONS** | **12** |
| Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel . | | |
| **UNIT IV** | **INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION** | **12** |
| Newton's forward and backward interpolation – Interpolation with unequal intervals - Lagrange's interpolation- Divided differences - Newton's divided difference - Approximation of derivates using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3, 3/8 rules- Numerical double integration: Trapezoidal and Simpson's rules. | | |
| **UNIT V** | **NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS** | **12** |
| Single step methods : Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods : Milne's and Adams - Bash forth predictor corrector methods for solving first order equations. | | |
| | | **TOTAL: 60 PERIODS** |

| | |
|---|---|
| **COURSE OUTCOMES:** | |
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Define the basic concepts of statistical tests, ANOVA, iterative methods, interpolations and ODE. |
| **CO2:** | Discuss the techniques of statistical tests and design of experiments. |
| **CO3:** | Explain the solution of equations, ODE, single and multistep methods, interpolations, differentiation and integration. |
| **CO4:** | Apply the concept of testing of hypothesis and design of experiment in real life. |
| **CO5:** | Apply numerical techniques in system of equations, differential equations, interpolation, differentiation and integration. |
| **TEXT BOOKS:** | |
| 1. | Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi, 2015. |
| 2. | Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016. |
| **REFERENCES:** | |
| 1. | Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016. |
| 2. | Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014. |
| 3. | Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006. |
| 4. | Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics, 4th Edition, Tata McGraw Hill Edition, 2012. |
| 5. | Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for |

| | |
|---|---|
| | Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2012. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |

3-High, 2- Medium, 1-Low

| ES22202 | BASIC ELECTRICAL AND ELECTRONICS ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To introduce the basic circuit components
- To educate on the working principles and applications of electrical machines
- To explain the construction and working of semiconductor devices
- To educate on logic gates, flip flops and registers
- To introduce the functional elements and working of measuring instruments

| UNIT I | INTRODUCTION TO ELECTRICAL ENGINEERING | 9 |
|---|---|---|

Introduction-Conductors, semiconductors and Insulators-Electrostatics – Electric Current-Electromotive Force-Electric Power- Ohm's Law-Basic circuit components-Electromagnetism related laws-Kirchhoff's Laws.

| UNIT II | ELECTRICAL MACHINES | 9 |
|---|---|---|

Construction, working principle and types of DC Generator – Motor- single phase Transformer - single phase and three phase Induction motor -Applications.

| UNIT III | ANALOG ELECTRONICS | 9 |
|---|---|---|

Classification of Semiconductors– Construction, Characteristics and working -PN Junction Diode- Zener Diode - Bipolar Junction Transistor-IGBT- SCR- MOSFET.

| UNIT IV | DIGITAL ELECTRONICS | 9 |
|---|---|---|

Review of number systems, binary codes- Boolean Algebra-Logic gates -Implementation of Boolean expression using K-map –Types of flip flops, Registers.

| UNIT V | MEASUREMENTS AND INSTRUMENTATION | 9 |
|---|---|---|

| | |
|---|---|
| Functional elements of an instrument –Static and dynamic characteristics of instruments, Errors, Principles of electrical indicating instruments- Types of indicating instruments - Moving Coil and Moving Iron instruments- DSO -Transducers-Resistive Transducers. | |
| **TOTAL PERIODS: 45** | |
| **COURSE OUTCOMES** | |
| After completing this course, the students will be able to | |
| **CO1:** | Apply the basic laws to determine circuit parameters. |
| **CO2:** | Explain the construction, working and application of electrical machines. |
| **CO3:** | Explain the construction and working of semiconductor devices. |
| **CO4:** | Interpret the function of combinational and sequential circuits |
| **CO5:** | Interpret the operating principles of measuring instruments. |
| **TEXT BOOKS** | |
| 1 | M .S.Sukhja ,T.K.Nagsarkar "Basic Electrical and Electronics Engineering" Oxford Higher Education First Edition ,2018. |
| 2 | S. Salivahanan, R.Rengaraj "Basic Electrical and Instrumentation Engineering" McGraw Hill Education ,First Edition,2019. |
| **REFERENCES** | |
| 1 | Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw HillEducation, 2019. |
| 2 | H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010. |
| 3 | V. K. Mehta, Rohit Mehta "Basic Electrical Engineering", S.Chand & Company Pvt. Ltd, New Delhi, 2012. |
| 4 | S.K.Sahdev, Basic of Electrical Engineering, Pearson, 2015 |
| 5 | B.L Theraja, Fundamentals of Electrical Engineering and Electronics. Chand & Co, 2008. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 2 | - | - | - | 1 | - | - | - | - | - | 1 | - | 2 | - |
| CO2 | 2 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | 2 | - |
| CO3 | 2 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | 2 | - |
| CO4 | 2 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | 2 | - |
| CO5 | 2 | - | - | - | - | 1 | - | - | - | - | - | 1 | - | 2 | - |
| CO | 2 | 2 | - | - | - | 1 | - | - | - | - | - | 1 | - | 2 | - |

3-High, 2- Medium, 1-Low

| CS22201 | PROGRAMMING IN C | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To develop C Programs using basic programming constructs.
- To develop C programs using arrays and strings.
- To develop applications in C using functions, pointers and structures.
- To do input/output and file handling in C.

| UNIT I | BASICS OF C PROGRAMMING | 9 |
|---|---|---|

Introduction to C programming - Applications of C Language - Structure of C program – C programming: Tokens - Character Set – Keywords – Identifiers - Data Types – Variables – Constants - Storage Classes - Operators and Expressions - Precedence and Associativity – Input / Output statements - Assignment statements - Conditional Branching Statements - Iterative Statements - Nested Loops - Break and Continue Statements- goto Statement

| UNIT II | ARRAYS AND POINTERS | 9 |
|---|---|---|

Introduction to Arrays: One Dimensional Arrays - Declaration of Arrays - Storing Values in Arrays - Accessing the Elements of an Array – Searching Algorithms (Linear Search, Binary Search) - Two Dimensional Arrays - Pointers - Pointer Arithmetic - Array of Pointers - Pointer to Array - Void and Null Pointers.

| UNIT III | STRINGS AND FUNCTIONS | 9 |
|---|---|---|

Functions – Classification of Functions – Strings - String Library Functions – User Defined Functions: Function Declaration/Function Prototype - Function Definition - Function Call - Return Statement - Passing Parameters to Functions (Pass by value, Pass by reference) - Recursion - Sorting Algorithms (Selection Sort, Insertion Sort).

| UNIT IV | STRUCTURES AND UNION | 9 |
|---|---|---|

Structure - Nested Structures - Array of Structures – Structures and Functions - Pointer to Structure - typedef - Dynamic Memory Allocation - Self-referential structures: Singly Linked List - Union.

| UNIT V | FILE PROCESSING | 9 |
|---|---|---|

Files – Types of Files – File Handling Functions - Sequential Access File Processing - Random Access File Processing - Command Line Arguments - Preprocessor Directives.

**TOTAL PERIODS: 45**

**COURSE OUTCOMES**

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

| | |
|---|---|
| **CO1:** | Explore simple applications in C using basic programming constructs. |
| **CO2:** | Develop C programs using arrays and strings. |
| **CO3:** | Develop modular programs in C using functions and pointers. |
| **CO4:** | Build applications in C using structures. |

| CO5: | Demonstrate applications using sequential and random-access file processing. |
|---|---|
| **TEXT BOOKS** | |
| 1. | ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016. |
| 2. | Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013. |
| **REFERENCES** | |
| 1 | Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018. |
| 2 | Yashwant Kanetkar, "Let us C", 17th Edition, BPB Publications, 2020. |
| 3 | Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013. |
| 4 | Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015. |
| 5 | E. Balagurusamy , "Programming in ANSI C", McGraw Hill Education; Eighth edition:2019, ISBN: 978-9351343202 . |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| ME22201 | ENGINEERING GRAPHICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |
| **COURSE OBJECTIVES** | | | | | |
| The main learning objective of this course is to prepare the students for: | | | | | |
| • To draw the engineering curves. | | | | | |
| • To draw orthographic projection of points and lines. | | | | | |

- To draw orthographic projection of solids and section of solids.
- To draw the development of surfaces.
- To draw the isometric projections of simple solids and freehand sketch of simple objects.

**CONCEPTS AND CONVENTIONS (Not for Examination)**

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

| | | |
|---|---|---|
| **UNIT I** | **PLANE CURVES** | **12** |

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

| | | |
|---|---|---|
| **UNIT II** | **PROJECTION OF POINTS, LINES AND PLANES** | **12** |

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces

Projection of planes (polygonal and circular surfaces) inclined to any one principal plane.

| | | |
|---|---|---|
| **UNIT III** | **PROJECTION OF SOLIDS** | **12** |

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to any one of the principal planes by rotating object method.

| | | |
|---|---|---|
| **UNIT IV** | **SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** | **12** |

Sectioning of solids (Prisms, pyramids cylinders and cones) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

| | | |
|---|---|---|
| **UNIT V** | **ISOMETRIC PROJECTIONS AND FREEHAND SKETCHING** | **12** |

Principles of isometric projection — isometric scale - isometric projections of simple solids and truncated solids - Prisms, pyramids & cylinders, in simple vertical positions.

Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Practicing three dimensional modeling of projection of simple objects by CAD Software (Demonstration purpose only).

**TOTAL PERIODS: 60**

**COURSE OUTCOMES**

At the end of the course the students will be able to

| | |
|---|---|
| **CO1:** | Recall the existing national standards and interpret a given three dimensional drawing. |
| **CO2:** | Understand graphics as the basic communication and methodology of the design process. |
| **CO3:** | Acquire visualization skills through the concept of projection. |
| **CO4:** | Develop the sectioned solids and discover its true shape. |
| **CO5:** | Develop imagination of physical objects to be represented on paper for engineering communication. |

| **TEXT BOOKS** | |
|---|---|
| 1. | Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018. |
| 2. | Jeyapoovan T., "ENGINEERING GRAPHICS using AutoCAD", Vikas Publishing House, 7th Edition, 2015. |

| **REFERENCES:** | |
|---|---|
| 1. | Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008. |
| 2. | Julyes Jai Singh S., "Engineering Graphics", SRM tri sea publishers, Nagercoil,7th Edition,2015. |
| 3. | Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019. |
| 4. | Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017. |
| 5. | Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005. |

**Mapping of Course Outcomes to Programme Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 1 | - | - | - | - | - | - | - | 2 | - | - | - | 2 | - |
| CO2 | 3 | 1 | - | - | - | - | - | - | - | 2 | - | - | - | 2 | - |
| CO3 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 | - |
| CO4 | 3 | 1 | - | - | - | - | - | - | - | 2 | - | - | - | 2 | - |
| CO5 | 3 | 1 | - | - | - | - | - | - | - | 2 | - | - | - | 2 | - |
| CO | 3 | 1 | - | - | - | - | - | - | - | 2 | - | - | - | 2 | - |

3-High, 2- Medium, 1-Low

| GE3252 | TAMILS AND TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**COURSE OBJECTIVES:**

- To facilitate the students to understand weaving and ceramic technology of sangam age
- To create an awareness on structural design of Tamils during sangam age
- To help students to distinguish between all the levels of manufacturing technology in ancient period
- To understand the ancient Knowledge of agriculture and irrigation technology
- To enable the students to understand the digitalization of Tamil language

| 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**

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Describe the importance of weaving and ceramic technology of sangam age. |
| **CO2:** | Illustrate the knowledge on structural design of Tamils during sangam age. |
| **CO3:** | Demonstrate a strong foundational knowledge in manufacturing technology of ancient Tamils. |
| **CO4:** | Describe the importance of ancient agriculture and irrigation technology of Tamils. |
| **CO5:** | Explain the concept of digitalization of Tamil language. |

**TEXT & REFERENCE BOOKS:**

1. *கணிணித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்)*

| | |
|---|---|
| 2. | கீழடி – வைகை நதிக்கரயில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு) / Keeladi – 'Sangam City Civilization on the banks of river Vaigai', Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu. |
| 3. | பொருநை – ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு ) / "Porunai Civilization", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu. |
| 4. | Dr.K.K.Pillay, Social Life of Tamils, A joint publication of TNTB & ESC and RMRL. |
| 5. | Dr.S.Singaravelu, "Social Life of the Tamils – The Classical Period", International Institute of Tamil Studies. |
| 6. | R.Balakrishnan, "Journey of Civilization Indus to Vaigai", RMRL. |


| GE3252 | தமிழரும் தொழில்நுட்பமும் | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**COURSE OBJECTIVES:**

- சங்க காலத்தின் நெசவு மற்றும் பீங்கான் தொழில் நுட்பத்தை மாணவர்கள் புரிந்துகொள்ள வசதி செய்தல்
- சங்க காலத் தமிழர்களின் வடிவமைப்பு தொழில்நுட்பம் பற்றிய விழிப்புணர்வை ஏற்படுத்துதல்
- பண்டைய கால உற்பத்தி தொழில்நுட்பத்தின் அனைத்து நிலைகளையும் வேறுபடுத்தி அறிய மாணவர்களுக்கு உதவுதல்
- விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தின் பண்டைய அறிவைப் புரிந்துக் கொள்ள செய்தல்
- தமிழ் மொழியின் டிஜிட்டல் மயமாக்கல் பற்றிப் புரிந்துக் கொள்ள செய்தல்

| அலகு I | நெசவு மற்றும் பானைத் தொழில்நுட்பம் | 3 |
|---|---|---|

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

| அலகு II | வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் | 3 |
|---|---|---|

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்து பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோவில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ்; காலத்தில் சென்னையில் இந்தோ – சாரோசெனிக் கட்டிடக் கலை.

| அலகு III | உற்பத்தித் தொழில் நுட்பம் | 3 |
|---|---|---|

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள்– கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

| அலகு IV | வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம் | 3 |
|---|---|---|

அணை, ஏரி, குளங்கள, மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்கான வடிவமைக்கப்பட்ட கிணறுகள் –

| | | |
|---|---|---|
| வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம். | | |
| **அலகு V** | **அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்** | **3** |
| அறிவியல் தமிழின் வளர்ச்சி – கணினித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம். | | |
| **TOTAL: 15 PERIODS** | | |

| **COURSE OUTCOMES:** | |
|---|---|
| ***இப்பாடத் திட்டத்தின் மூலம் மாணவர்கள் பெறும் பயன்கள்:*** | |
| **CO1:** | சங்க காலத்தின் நெசவு மற்றும் பீங்கான் தொழில் நுட்பத்தின் முக்கியத்துவத்தை விவரிக்க முடியும். |
| **CO2:** | சங்க காலத் தமிழர்களின் வடிவமைப்பு தொழில்நுட்பம் பற்றிய அறிவை விளக்க முடியும். |
| **CO3:** | பண்டைய தமிழர்களின் உற்பத்தி தொழில்நுட்பம் பற்றிய வலுவான அடித்தள அறிவை வெளிப்படுத்த முடியும். |
| **CO4:** | தமிழர்களின் விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தின் பண்டைய அறிவை விவரிக்க முடியும். |
| **CO5:** | தமிழ் மொழியின் டிஜிட்டல் மயமாக்கல் பற்றிய கருத்தை விளக்க முடியும். |

| **TEXT & REFERENCE BOOKS:** | |
|---|---|
| 1. | கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்). |
| 2. | கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு) / Keeladi – 'Sangam City Civilization on the banks of river Vaigai', Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu. |
| 3. | பொருநை – ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு ) / "Porunai Civilization", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu. |
| 4. | Dr.K.K.Pillay, Social Life of Tamils, A joint publication of TNTB & ESC and RMRL. |
| 5. | Dr.S.Singaravelu, "Social Life of the Tamils – The Classical Period", International Institute of Tamil Studies. |
| 6. | R.Balakrishnan, "Journey of Civilization Indus to Vaigai", RMRL. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course Outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | – | – | – | – | – | 1 | 1 | – | – | – | – | – | – | – | – |
| CO2 | – | – | – | – | – | 1 | 1 | – | – | – | – | – | – | – | – |
| CO3 | – | – | – | – | – | 1 | 1 | – | – | – | – | – | – | – | – |
| CO4 | – | – | – | – | – | 1 | 1 | – | – | – | – | – | – | – | – |
| CO5 | – | – | – | – | – | 1 | 1 | – | – | – | – | – | – | – | – |
| CO | – | – | – | – | – | 1 | 1 | – | – | – | – | – | – | – | – |

3–High, 2– Medium, 1–Low

| EN22201 | TECHNICAL ENGLISH | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To widen strategies and skills to augment ability to read and comprehend engineering and technology texts.
- To develop writing skill to make technical presentations.
- To draft convincing job applications and effective reports.
- To strengthen listening skills to comprehend technical lectures and talks in their areas of specialization.
- To cultivate speaking skills both technical and general.

| UNIT I | LANGUAGE STUDY | 12 |
|---|---|---|

Technical Vocabulary- synonyms, antonyms, prefix and suffix, word formation, Homonyms and Homophones - puzzles,- Reading: skimming a reading passage – scanning for specific information- Instruction- Interpreting – Writing: Recommendation- Checklist.

| UNIT II | READING AND STUDY SKILLS | 6 |
|---|---|---|

Active and Passive voice- Extended Definitions- Imperatives- Numerical Adjectives- Purpose Statement – Reading: Critical reading- Newspaper articles- journal reports- editorials and opinion blogs - Report Writing: Fire Accident, Industrial visit, Project report, feasibility report, survey report, business report.

| UNIT III | WRITING SKILLS- INTRODUCTION TO PROFESSIONAL WRITING | 6 |
|---|---|---|

Error Spotting/Common Errors- Concord-Compound words- Abbreviations and Acronyms- Discourse Markers - Finding key information – shifting facts from opinion- interpreting visual material- making inference from the reading passage - Interpretation of charts- - Minutes of the meeting- Paraphrasing- Proposal writing.

| UNIT IV | TECHNICAL WRITING AND GRAMMAR | 6 |
|---|---|---|

If Conditional Clauses- Prepositional Phrases- Fixed and semi fixed expressions- -e-mail communication- reading the attachment files having a poem /joke / proverb/sending their responses through e-mail.- Job application letter and Resume/CV/ Bio-data.

| UNIT V | EXTENDED WRITING AND LANGUAGE STUDY | 6 |
|---|---|---|

Articles- Cause and Effect expressions- Collocations- Sequencing words- Reading longer technical texts and taking down notes- Structure of Essay- Types of Essay: Narrative essay- Descriptive Essay- Analytical Essay- Cause and Effect Essay – Compare and contrast essays.

**TOTAL – 30 PERIODS**

**PRACTICAL EXERCISES**

**Listening Skills – Listening for professional Development**

Listening to UPSC Toppers Mock Interviews- Listening to debates/discussions/different viewpoints /scientific lectures/event narrations/documentaries/telephonic conversations

**Speaking Skills –emphasizing communicative establishment**

Seeking Information -asking and giving directions- narrating personal experiences/ events-

| | |
|---|---|
| answering interview questions- picture description- presenting a product and giving instruction to use a product – mini presentations-role plays- speaking in formal and informal situations- speaking about one's locations - speaking about great personalities –describing a simple process- telephone skills and etiquette | |
| **TOTAL: 30 PERIODS** | |
| **TOTAL (T+P) = 60 PERIODS** | |
| **COURSE OUTCOMES:** | |
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Infer advanced technical texts from varied technical genres to expand engineering knowledge and explore more ideas. |
| **CO2:** | Analyze technical contents written on par with international standards and rewrite contents using the right vocabulary without grammatical errors to make their articles published in reputed journals. |
| **CO3:** | Present reports and job letters utilizing the required format prescribed on par with international standards using the exact vocabulary to make their works worthy to be read . |
| **CO4:** | Employ the language tones and styles appropriately in interviews and Group Discussions effortlessly following the strategies expected by the corporate world |
| **CO5:** | Appraise the need for new products and write feasibility and survey reports following the format prescribed in a way to create awareness. |
| **TEXT BOOKS:** | |
| 1. | Mike Markrl, " Technical Communication", Palgrave Macmillan, London, 2012. |
| 2. | Sumant,S and Joyce Pereira, "Technical English II", Chennai: Vijay Nicole Imprints Private Limited, 2014. |
| **REFERENCES:** | |
| 1. | Raman, Meenakshi & Sangeetha Sharma, "Communication Skills", New Delhi: OUP, 2018. |
| 2. | Rizvi M, Ashraf, " Effective Technical Communication", New Delhi: Tata McGraw-Hill Publishing Company Limited, 2007. |
| 3. | Kumar, Sanjay and Pushp Lata, "Communication Skills: A Workbook", New Delhi: OUP, 2018. |
| 4. | Means, L. Thomas and Elaine Langlois, ―English & Communication for Colleges‖, Cengage Learning, USA: 2007. 5. Greendaum, Sydney and Quirk. |
| 5. | Greendaum, Sydney and Quirk, Randolph, ―A Student's Grammar of the English Language‖, Pearson Education. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | - | - | - | - | - | - | - | - | - | 3 | - | 2 | - | - | 1 |
| CO2 | - | - | - | - | - | - | - | - | 2 | 3 | - | 2 | - | - | 1 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | - | - | - | - | - | - | - | - | 2 | 3 | - | 2 | - | - | 1 |
| CO4 | - | - | - | - | - | - | - | - | 2 | 3 | - | 2 | - | - | 1 |
| CO5 | - | - | - | - | - | - | - | - | 2 | 3 | - | 2 | - | - | 1 |
| CO | - | - | - | - | - | - | - | - | 2 | 3 | - | 2 | - | - | 1 |

3-High, 2- Medium, 1-Low

| PH22203 | PHYSICS FOR INFORMATION SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To understand the concepts of light, electron transport properties and the essential principles of semiconductors.
- To become proficient in magnetic properties of materials and the functioning of optical devices.
- To know the basics of quantum structures and Single electron transistor.
- To induce the students to design new devices that serve humanity by applying the knowledge gained during the course.

| UNIT I | PHOTONICS | 6 |
|---|---|---|

Interference – Air wedge – LASER – population inversion - Einstein coefficient's –NdYAG Laser - CO2 laser – semiconductor laser – Optical fibre – Total internal reflection – propagation of light – Numerical Aperture and Acceptance angle – Fiber optic communication system – Endoscopy.

| UNIT II | ELECTRICAL PROPERTIES OF MATERIALS | 6 |
|---|---|---|

Classical free electron theory - Expression for electrical conductivity and Thermal conductivity, Wiedemann-Franz law – Success and failures - Fermi- Dirac statistics – Density of energy states – Electron in periodic potential – Band theory of solids - Electron effective mass – concept of hole.

| UNIT III | SEMICONDUCTING MATERIALS | 6 |
|---|---|---|

Semiconductors –direct and indirect band gap semiconductors – Intrinsic semiconductors Carrier concentration, band gap in intrinsic semiconductors – extrinsic semiconductors - N-type & P-type semiconductors – Variation of carrier concentration and Fermi level with temperature - Hall effect - measurement of Hall coefficient – applications

| UNIT IV | MAGNETIC PROPERTIES OF MATERIALS | 6 |
|---|---|---|

Magnetic dipole moment – atomic magnetic moment, permeability, susceptibility- Magnetic material classification: diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, ferrimagnetism – Domain Theory- B-H curve – Hard and soft magnetic materials – Magnetic storage devices: Magnetic hard disc with GMR sensor

| UNIT V | OPTOELECTRONIC AND NANODEVICES | 6 |
|---|---|---|

| | |
|---|---|
| Carrier generation and recombination processes - Photo diode – solar cell - Organic LED – Optical data storage - Quantum confinement – Quantum structures - single electron phenomena and single electron transistor - Quantum dot laser | |
| **TOTAL: 30 PERIODS** | |
| **COURSE OUTCOMES:** | |
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Relate the concepts of light, electron transport properties of conductors and basic principles of semiconductors. |
| **CO2:** | Define the magnetic properties of materials and the principles of optoelectronic and nano devices. |
| **CO3:** | Illustrate laser and fiber optics, classical and quantum concepts of conducting materials, physics of semiconducting materials. |
| **CO4:** | Summarize the functioning of various magnetic, optoelectronic and nano devices. |
| **CO5:** | Demonstrate the concepts of optics, fibre optics, moduli of elasticity and thermal energy, behavior of conductors, semiconductors and functioning of magnetic, optical and nano devices in various engineering applications. |
| **TEXT BOOKS:** | |
| 1. | Gaur, R.K & Gupta.S.L, Engineering Physics, Dhanpat Rai Publishers, 2016. |
| 2. | Kasap,S.O. Principles of Electronic Materials and Devices, McGraw-Hill Education, 2017. |
| **REFERENCES:** | |
| 1. | Jasprit Singh, Semiconductor Devices: Basic Principles, Wiley 2012. |
| 2. | Kittel, C. Introduction to Solid State Physics. Wiley, 2017. |
| 3. | Garcia,N. & Damask, A. Physics for Computer Science Students, Springer-Verlag, 2012. |
| 4. | Hanson, G.W. —Fundamentals of Nanoelectronics, Pearson Education, 2009. |
| 5. | Rogers, B., Adams, J. & Pennathur, S. Nanotechnology: Understanding Small Systems, CRC Press, 2014. |
| **LIST OF EXPERIMENTS** | |
| 1. | Uniform bending – Determination of Young's modulus |
| 2. | Air-wedge – Thickness of thin wire |
| 3. | Spectrometer – Grating |
| 4. | LASER – Wavelength and particle size determination |
| 5. | Optical fibre – Acceptance angle and Numerical aperture |
| 6. | Band gap determination |
| | **TOTAL: 30 PERIODS** |
| | **TOTAL (T+P) = 60 PERIODS** |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO5 | 3 | 3 | - | - | - | - | - | - | 2 | 1 | - | 1 | 2 | - | - |
| CO | 2 | 1 | - | - | - | - | - | - | 2 | 1 | - | 1 | 2 | - | - |

3-High, 2- Medium, 1-Low

| **CH22201** | **ENVIRONMENT AND SUSTAINABILITY** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES:**

- To understand the concept of ecosystem and biodiversity.
- To conversant with various types of pollution and its effects.
- To obtain knowledge on natural resources and its exploitation.
- To understand the social issues related to environment and methods to protect.
- To gain knowledge on sustainability and environment.

| **UNIT I** | **ECOSYSTEM AND BIODIVERSITY** | **6** |
|---|---|---|

Environment – Ecosytem – Structure and function of an ecosystem – Energy flow in an ecosystem – Food chain and food web –.Biodiversity – Types – Values, threats and conservation of biodiversity – Endangered and endemic species – Hot spot of biodiversity – Biodiversity at state level, national level and global level.

| **UNIT II** | **NATURAL RESOURCES** | **6** |
|---|---|---|

Introduction – Forest resources – Uses and Overexploitation - Deforestation – causes and consequences – Water resources – effect of over utilisation of water – Food resources – Impacts of modern agriculture (pesticides, fertilizers, water logging, salinity) – Sustainable Energy resources – Wind, Solar, hydroelectric power, geothermal – Land resources – Desertification, soil erosion – Role of an individual in the conservation of natural resources.
Case study – Deforestation, water conflicts, fertilizer and pesticide problem.

| **UNIT III** | **ENVIRONMENTAL POLLUTION AND MANAGEMENT** | **7** |
|---|---|---|

Definition, causes, effects and control measures of air pollution, water pollution, noise pollution, thermal pollution and marine pollution – Waste water treatment - Waste management – solid waste, bio waste, e-waste - Disaster management – Flood, cyclone, earthquake

| **UNIT IV** | **SOCIAL ISSUES AND HUMAN HEALTH** | **6** |
|---|---|---|

Population explosion and its effects on environment — variation of population among nations - Environmental issues and Human health – Food adulteration – Risk of food adulteration – Detection and prevention of food adulteration - COVID-19 – Human rights – Value education

| UNIT V | SUSTAINABLE DEVELOPMENT AND ENVIRONMENT | 5 |
|---|---|---|
| Sustainable development – needs and challenges — Goals – Aspects of sustainable development – Assessment of sustainability - Environmental ethics – Green chemistry – Eco mark, Eco products – EIA – Regional and local environmental issues and possible solutions - Role of engineering in environment and human health | | |
| | | **TOTAL: 30PERIODS** |

| **COURSE OUTCOMES:** | |
|---|---|
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Recall the basic concepts of environment and sustainable development. |
| **CO2:** | Summarize the types of pollution, various natural resources and food adulterants. |
| **CO3:** | Explain the methods for waste management and detection of adulterants. |
| **CO4:** | Apply the gained knowledge to overcome various issues related to health and environment. |
| **CO5:** | Identify suitable methods for local environmental issues and sustainability. |

| **TEXT BOOKS:** | |
|---|---|
| 1. | Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, New Delhi, 2017. |
| 2. | Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2ndEdition, Pearson Education, 2015. |

| **REFERENCES:** | |
|---|---|
| 1. | Erach Bharucha, "Text book of Environmental studies" Universities Press (I) PVT LTD, Hyderabad, 2015. |
| 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, 2014. |
| 4. | Ruth F. Weiner and Robin A. Matthews. Butterworth, —Environmental Engineering‖, Heineman Publications, 4th Edition |
| 5. | Dash M.C, —Concepts of Environmental Management for Sustainable Development‖, Wiley Publications, 2019. |

| **EXPERIMENTS** | |
|---|---|
| 1. | Determination of DO content of waste water sample (Winkler's method). |
| 2. | Determination of chloride content of water sample by Argentometric method |
| 3. | Estimation of copper content in water by Iodometry. |
| 4. | Determination of Ca / Mg in waste water sample |
| 5. | Detection of adulterant in ghee/edible oil/coconut oil. |
| 6. | Detection of adulterant in sugar/honey/chilli powder. |
| | **TOTAL:30 PERIODS** |
| | **TOTAL (T+P) = 60 PERIODS** |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | - | - | - | - | - | 3 | - | 1 | 1 | - | 1 | - | - | 2 |
| CO2 | 3 | - | - | - | - | - | 3 | - | 1 | 1 | - | 1 | - | - | 2 |
| CO3 | 3 | - | - | - | - | - | 3 | - | 1 | 1 | - | 1 | - | - | 2 |
| CO4 | 3 | - | - | - | - | - | 3 | - | 1 | 1 | - | 1 | - | - | 2 |
| CO5 | 3 | - | - | - | - | - | 3 | - | 1 | 1 | - | 1 | - | - | 2 |
| CO | 3 | - | - | - | - | - | 3 | - | 1 | 1 | - | 1 | - | - | 2 |

3-High, 2- Medium, 1-Low

| CS22202 | C PROGRAMMING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

- To familiarize with C programming constructs.
- To develop programs in C using basic constructs.
- To develop programs in C using arrays.
- To develop applications in C using strings, pointers, functions.
- To develop applications in C using structures.
- To develop applications in C using file processing.

**LIST OF EXPERIMENTS**

1. I/O statements – Operators
2. Decision-making constructs.
3. Loops Statements.
4. Arrays: 1-Dimensional and 2 -Dimensional Arrays
5. Strings and its Operations
6. User Defined Functions
7. Recursive Functions.
8. Pointers
9. Structures and Union
10. File Handling and Pre-Processor Directives
11. Command Line Arguments.

**TOTAL PERIODS: 60**

**COURSE OUTCOMES**

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

| | |
|---|---|
| **CO1:** | Demonstrate the knowledge on writing, compiling and debugging the C program. |
| **CO2:** | Develop programs in C using basic constructs. |
| **CO3:** | Develop programs in C using arrays. |
| **CO4:** | Develop applications in C using strings, pointers, functions. |
| **CO5:** | Develop applications in C using structures and file processing. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| ES22203 | ENGINEERING PRACTICES LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

The main learning objective of this course is to prepare the students for

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in commonhousehold wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipment; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

**GROUP - A (CIVIL & MECHANICAL)**

| PART I | CIVIL ENGINEERING PRACTICES | 15 |
|---|---|---|

| | | |
|---|---|---|
| **PLUMBING WORK** | ❖ Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household. | |
| | ❖ Preparing plumbing line sketches. | |
| | ❖ Laying pipe connection to the suction side of a pump | |
| | ❖ Laying pipe connection to the delivery side of a pump. | |
| | ❖ Connecting pipes of different materials: Metal, plastic and flexible pipes used inhousehold appliances. | |
| **WOOD WORK** | ❖ Sawing | |
| | ❖ Planning and | |
| | ❖ Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint. | |
| **PART II** | **MECHANICAL ENGINEERING PRACTICES** | **15** |
| **WELDING WORK** | ❖ Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding. | |
| | ❖ Practicing gas welding. | |
| **BASIC MACHINING WORK** | ❖ Perform turning operation in the given work piece. | |
| | ❖ Perform drilling operation in the given work piece. | |
| | ❖ Performing tapping operation in the given work piece. | |
| **ASSEMBLY WORK** | ❖ Assembling a centrifugal pump. | |
| | ❖ Assembling a household mixer. | |
| **SHEET METAL WORK** | ❖ Making of a square tray | |
| **GROUP - B (ELECTRICAL AND ELECTRONICS)** | | |
| **PART-I** | **ELECTRICAL ENGINEERING PRACTICES** | **15** |
| ❖ One lamp controlled by one switch. | | |
| ❖ Series and parallel wiring. | | |
| ❖ Staircase wiring. | | |
| ❖ Fluorescent Lamp wiring. | | |
| ❖ Residential wiring | | |
| ❖ Iron Box wiring and assembly. | | |
| **PART-II** | **ELECTRONIC ENGINEERING PRACTICES** | **15** |
| ❖ Introduction to electronic components and equipment's | | |
| ❖ Calculation of resistance using colour coding | | |

| | |
|---|---|
| ❖ Verify the logic gates AND, OR, EX-OR and NOT. | |
| ❖ Measurement of AC signal parameters using CRO | |
| ❖ Soldering simple electronic circuits on a small PCB and checking continuity. | |
| **TOTAL PERIOD: 60** | |
| **COURSE OUTCOMES** | |
| At the end of the course the students will be able to | |
| **CO1:** | Prepare various pipe and furniture fittings used in common household. |
| **CO2:** | Perform the given metal joining and metal removal operation in the given work piece as per the dimensions. |
| **CO3:** | Apply the fundamental concepts involved in Electrical Engineering. |
| **CO4:** | Explain the basic electrical wiring procedures. |
| **CO5:** | Assemble basic electronic components. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | - | - | - | - | - | - | - | 3 | 1 | - | 1 | - | - | 1 |
| CO2 | 3 | - | - | - | - | - | - | - | 3 | 1 | - | 1 | - | - | 1 |
| CO3 | 3 | - | - | - | - | - | - | - | 3 | 1 | - | 1 | - | - | 1 |
| CO4 | 2 | - | - | - | - | - | - | - | 3 | 1 | - | 1 | - | - | 1 |
| CO5 | 3 | - | - | - | - | - | - | - | 3 | 1 | - | 1 | - | - | 1 |
| CO | 3 | - | - | - | - | - | - | - | 3 | 1 | - | 1 | - | - | 1 |

3-High, 2- Medium, 1-Low

**SEMESTER III**

| MA22302 | DISCRETE MATHEMATICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |
| **COURSE OBJECTIVES:** | | | | | |
| • To introduce Propositional Logic and their rules for validity of statements. | | | | | |
| • To introduce Predicates Calculus for validating arguments and programs. | | | | | |
| • To give the counting principles for solving combinatorial problems. | | | | | |
| • To introduce abstract notion of Algebraic structures for studying cryptography and its related areas. | | | | | |
| • To introduce Boolean algebra as a special algebraic structure for understanding logical circuit problems. | | | | | |
| **UNIT I** | **PROPOSITIONAL CALCULUS** | | | | 12 |

| | | |
|---|---|---|
| Propositions and notations- Propositional logic – Propositions and truth tables – Propositional equivalences – Conditional propositions – Converse, Contrapositive and Inverse-Tautologies and Contradictions –Normal Forms - Theory of Inference for the statement calculus (Validity using Truth Tables). | | |
| **UNIT II** | **PREDICATE CALCULUS** | 12 |
| Predicates –Statement function - Variables and Quantifiers – Nested quantifiers – Predicate formulae –Valid formulas and equivalences –Theory of Inference for the Predicate Calculus - Introduction to proofs – Proof methods and strategy. | | |
| **UNIT III** | **COMBINATORICS** | 12 |
| Mathematical induction – The pigeonhole principle - Permutations and Combinations – Recurrence relations – Solving linear recurrence relations - Inclusion and exclusion principle(without proof) and its applications. | | |
| **UNIT IV** | **ALGEBRAIC STRUCTURES** | 12 |
| Algebraic systems – Semi groups and Monoids – Groups – Subgroups – Cosets – Lagrange's theorem – Definition: Rings and Fields – Problems on integer modulo *n*. | | |
| **UNIT V** | **LATTICES AND BOOLEAN ALGEBRA** | 12 |
| Relations - Equivalence Relation and Partition - Partial order Relations – Partially Ordered Sets – Representation for Partially Ordered Sets - Hasse diagram - Lattices as Partially Ordered Sets (Definition and Examples)– Boolean algebra ( Definition and Examples). | | |
| | | **TOTAL: 60 PERIODS** |

| **COURSE OUTCOMES:** | |
|---|---|
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Construct truth tables and their rules for validity of statements. |
| **CO2:** | Apply the rules for validating arguments and programs. |
| **CO3:** | Establish the counting principles and recurrence relations. |
| **CO4:** | Apply the concepts and properties of groups and rings in the area of coding theory. |
| **CO5:** | Develop the significance of relations and boolean algebra. |

| **TEXT BOOKS:** | |
|---|---|
| 1. | Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011. |
| 2. | Kenneth H.Rosen, "Discrete Mathematics and its Applications", Seventh Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2018. |

| **REFERENCES:** | |
|---|---|
| 1. | Swapan Kumar Sarkar, "Discrete Mathematics", S.Chand & Company Ltd.,New Delhi, 2008. |
| 2. | David Makinson, "Sets, Logics and Maths for Computing", Springer Indian Reprint, 2011. |
| 3. | Ralph.P.Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007. |
| 4. | Seymour Lipschutz and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Third Edition, 2010. |
| 5. | Sengadir.T. "Discrete Mathematics and Combinatorics", Pearson Education, New Delhi, 2009. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| IT22301 | COMPUTER ARCHITECTURE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To learn the basic structure and operations of a computer.
- To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.
- To learn the basics of pipelined execution.
- To understand parallelism and multi-core processors.
- To understand the memory hierarchies, cache memories and virtual memories and to learn the different ways of communication with I/O devices.

| UNIT I | BASIC STRUCTURE OF A COMPUTER SYSTEM | 9 |
|---|---|---|

Functional Units – Basic Operational Concepts – Performance – Instructions and Instruction sequencing – Logical operations – decision making – MIPS Addressing.

| UNIT II | ARITHMETIC FOR COMPUTERS | 9 |
|---|---|---|

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism.

| UNIT III | PROCESSOR AND CONTROL UNIT | 9 |
|---|---|---|

Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

| UNIT IV | PARALLELISIM | 9 |
|---|---|---|

Parallel processing challenges – Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

| UNIT V | MEMORY & I/O SYSTEMS | 9 |
|---|---|---|

Memory Hierarchy - memory technologies – Cache memories – Performance Considerations – virtual memories– Accessing I/O Devices – Interrupts – Direct Memory Access – Buses – Standard I/O Interfaces –Interface circuits

| | |
|---|---|
| | **TOTAL PERIODS: 45** |
| **COURSE OUTCOMES** | |
| Upon completion of the course, students will be able to | |
| **CO1:** | Explain the functional units of digital computer, instruction formats and the operation of a digital computer |
| **CO2:** | Solve the fixed point and floating-point arithmetic for ALU operation. |
| **CO3:** | Demonstrate the working of processor and control units with and without pipeline. |
| **CO4:** | Apply multithreading, multiprocessing and parallel processing architectures. |
| **CO5:** | Illustrate the organization of different memory systems, parallel processing architectures, I/O processors and its communication. |
| **TEXT BOOKS** | |
| 1. | David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014. |
| 2. | Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012. |
| **REFERENCE BOOKS** | |
| 1. | William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, Pearson Education, 2010. |
| 2. | John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012. |
| 3. | John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012. |
| 4. | Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications",Second edition, McGraw-Hill Education India Pvt Ltd, 2014. |
| 5. | Miles J. Murdocca and Vincent P. Heuring, "Computer Architecture and Organization: An Integrated approach", Second edition, Wiley India Pvt Ltd, 2015. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| IT22302 | DIGITAL SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To apply the fundamentals of the number system, binary codes, logic gates, Karnaugh, Map and memory system.
- To design combinational logic circuits.
- To design synchronous sequential logic circuits.
- To design asynchronous sequential logic circuits.
- To understand the memory and programmable logic.

| UNIT I | BOOLEAN ALGEBRA AND LOGIC GATES | 9 |
|---|---|---|

Number Systems – Arithmetic Operations – Binary Codes- Boolean Algebra and Logic Gates – Theorems and Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms – Simplification of Boolean Functions using Karnaugh Map – Logic Gates – NAND and NOR Implementations.

| UNIT II | COMBINATIONAL LOGIC | 9 |
|---|---|---|

Combinational Circuits – Analysis and Design Procedures – Binary Adder-Subtractor – Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders – Encoders – Multiplexers.

| UNIT III | SYNCHRONOUS SEQUENTIAL LOGIC | 9 |
|---|---|---|

Sequential Circuits – Storage Elements: Flip-Flops – Analysis of Clocked Sequential Circuits – State Reduction and Assignment – Design Procedure – Registers and Counters.

| UNIT IV | ASYNCHRONOUS SEQUENTIAL LOGIC | 9 |
|---|---|---|

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

| UNIT V | MEMORY AND PROGRAMMABLE LOGIC | 9 |
|---|---|---|

RAM – Memory Decoding – Error Detection and Correction – ROM – Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices.

**TOTAL PERIODS: 45**

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Apply the fundamentals of number system, binary codes, logic gates, Karnaugh Map and memory system. |
| **CO2:** | Design combinational logic circuits. |
| **CO3:** | Design synchronous sequential logic circuits. |
| **CO4:** | Design asynchronous sequential logic circuits. |
| **CO5:** | Design memory arrays using programmable logic devices. |

**TEXT BOOKS**

| | |
|---|---|
| 1. | M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL and System Verilog", 6th Edition, |

| | |
|---|---|
| | Pearson Education, 2018. |
| 2. | John M. Yarbrough, "Digital logic applications and design", Thomson publications, 2nd Edition, 2006. |
| **REFERENCES:** | |
| 1. | G. K. Kharate, "Digital Electronics", Oxford University Press, 2010. |
| 2. | John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017. |
| 3. | Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013. |
| 4. | Donald D. Givone, Digital Principles and Design, Tata Mc Graw Hill, 2003 |
| 5. | Digital Systems, Principles and Applications Twelfth Edition, Neal S Widmer, Greg Moss, Ronald J. Toccy, Publisher(s): Pearson, 2022. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| CS22301 | OBJECT ORIENTED PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To understand Object Oriented Programming concepts and basic characteristics of
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads
- To design and build simple Graphical User Interfaces

| UNIT I | INTRODUCTION TO OOP AND JAVA FUNDAMENTALS | 9 |
|---|---|---|

Object Oriented Programming concepts - Characteristics of Java –Java Source File - Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – Access specifiers - Comments, Data Types, Variables, Operators, Control Flow, Methods, Static members - Arrays-Strings- JavaDoc comments.

| UNIT II | INHERITANCE AND INTERFACES | 9 |
|---|---|---|
| Constructors in java - Packages - Inheritance – Super classes- Sub classes –Protected members – Constructors in sub classes- the Object class – Abstract classes and methods- Final methods and classes – Interfaces – Defining an interface, Implementing interface, Differences between classes and interfaces and extending interfaces | | |
| **UNIT III** | **EXCEPTION HANDLING AND I/O** | 9 |
| Exceptions - Exception hierarchy - Throwing and catching exceptions – Built-in exceptions, Creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files. | | |
| **UNIT IV** | **COLLECTIONS, MULTITHREADING AND GENERICS** | 9 |
| The Collections Framework: Collections Overview - The Collection Interface: The List Interface - The Set Interface- The Collection Classes: The ArrayList Class - The LinkedList Class - Accessing a Collection via an Iterator – The For-Each Alternative to Iterators. Multithreading: Differences between multi-threading and multitasking, Thread life cycle, Creating threads, Synchronizing threads, Inter-thread communication, Daemon threads, Thread groups. Generic Programming: Generic classes – Generic Methods. | | |
| **UNIT V** | **JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS** | 9 |
| JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem | | |
| **TOTAL: 45 PERIODS** | | |

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Describe the basic concepts of OOP and fundamentals in Java. |
| **CO2:** | Implement the principles of packages, inheritance and interfaces |
| **CO3:** | Develop Java applications using exception handling techniques and I/O operations. |
| **CO4:** | Write Java applications using multithreading, collections and generics concepts. |
| **CO5:** | Design interactive GUI based applications using the concepts of event handling and JavaFX components. |

**TEXT BOOKS:**


| | |
|---|---|
| 1. | Herbert Schildt, “Java The Complete Reference”, Tenth Edition, McGraw Hill Education, 2019. |
| 2. | Herbert Schildt, “Introducing JavaFX 8 Programming”, First Edition, McGraw Hill Education, New Delhi, 2015 |


**REFERENCES:**


| | |
|---|---|
| 1. | Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, Ninth Edition, Prentice Hall, 2013. |
| 2. | Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, Third Edition, Pearson, 2015. |
| 3. | Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011. |
| 4. | Timothy Budd, “Understanding Object-oriented programming with Java”, Updated |

| | |
|---|---|
| | Edition, Pearson Education, 2000. |
| 5. | E Balagurusamy, “Programming with Java”, McGraw Hill Education, 2019. |

**Mapping of Course Outcomes to Programme Outcomes**

| ourse outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| CS22302 | DATA STRUCTURES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To understand the concepts of ADTs.
- To learn linear data structures – lists, stacks, and queues.
- To understand non-linear data structures – trees and graphs.
- To understand sorting, searching and hashing algorithms.
- To apply Tree and Graph structures.

| UNIT I | LISTS | 9 |
|---|---|---|

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 ADT – Radix Sort – Multi lists.

| UNIT II | STACKS AND QUEUES | 9 |
|---|---|---|

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.

| UNIT III | TREES | 9 |
|---|---|---|

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Threaded Trees -Priority Queue (Heaps) – Binary Heap - B-Tree.

| UNIT IV | GRAPHS | 9 |
|---|---|---|

Graph Definition – Representation of Graphs – Types of Graph - Breadth-first traversal – Depth-first traversal – Topological Sort – Shortest path algorithms - Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm

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

| |
|---|
| Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort –. Merge Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing –Rehashing – Extendible Hashing. |
| **TOTAL: 45 PERIODS** |

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Explain the linear data structure List. |
| **CO2:** | Implement stack and queue data structures. |
| **CO3:** | Use appropriate non–linear data structure operations for solving a given problem. |
| **CO4:** | Apply appropriate graph algorithms for graph applications. |
| **CO5:** | Apply different searching, sorting and hashing techniques. |

**TEXT BOOKS:**

| | |
|---|---|
| 1. | Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005. |
| 2. | Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007. |

**REFERENCES:**

| | |
|---|---|
| 1. | Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015. |
| 2. | Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022. |
| 3. | Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002. |
| 4. | Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006. |
| 5. | Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd Edition, Universities Press, 2008. |

**Mapping of Course Outcomes to Programme Outcomes**

| **ourse outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 1 | 3 | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | - | - |

3-High, 2- Medium, 1-Low

| CS22305 | OBJECT ORIENTED PROGRAMMING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
- To develop applications using event handling.

**LIST OF EXPERIMENTS**

1. Write simple java applications using if-else, switch -case, loops, array
2. Develop a java application to implement packages.
3. Develop a java application to implement inheritance.
4. Develop a java application to implement an interface.
5. Develop a java application to implement abstract classes.
6. Write a Java program to implement user defined exception handling.
7. Write a Java program that performs file operations.
8. Write a java program that implements a multi-threaded application.
9. Design a simple calculator using event-driven programming paradigm of Java.
10. Develop a mini project for any application using Java concepts.

**TOTAL PERIODS: 60**

**Lab Requirements**: for a batch of 30 students
Operating Systems: Linux / Windows
Front End Tools: Eclipse IDE / Netbeans IDE

**COURSE OUTCOMES**

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

| | |
|---|---|
| **CO1:** | Develop Java programs for simple applications that make use of classes, packages and interfaces. |
| **CO2:** | Develop Java programs to implement inheritance, exception handling and multithreading concepts. |
| **CO3:** | Design applications using file operations. |
| **CO4:** | Design applications using JAVAFX and event handling. |
| **CO5:** | Develop a mini project for any application. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course Outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| **CS22306** | **DATA STRUCTURES LABORATORY** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **0** | **0** | **4** | **2** |

**COURSE OBJECTIVES:**

- To implement linear and non-linear data structures
- To apply the different operations of search trees
- To implement graph traversal algorithms
- To apply sorting and searching algorithms

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1. | Linked list implementation of List ADT, Stack ADT and Queue ADT. |
| 2. | Implementation of Doubly Linked List and Circularly Linked List. |
| 3. | Polynomial Addition, Subtraction and Multiplication using Linked List. |
| 4. | Balancing Symbols, Evaluation of Postfix Expression and Infix to Postfix conversion. |
| 5. | Implementation of Double Ended Queue. |
| 6. | Implementation of binary tree and its operations with relevant traversals. |
| 7. | Implementation of binary search tree. |
| 8. | Graph representations, Implementation of BFS & DFS. |
| 9. | Shortest path using Dijkstra's algorithm. |
| 10. | Minimum spanning tree using Prim's algorithm. |
| 11. | Implementation of Sorting Algorithms and Searching Algorithms |
| 12. | Hashing using separate chaining & open addressing. |

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Write functions to implement linked list. |
| **CO2:** | Use appropriate linear / non-linear data structure operations for solving a given problem. |
| **CO3:** | Use graph traversal algorithms. |
| **CO4:** | Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval. |
| **CO5:** | Write functions to implement searching and sorting algorithms. |

**Mapping of Course Outcomes to Programme Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 1 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | - | 3 | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | 3 | 3 | 1 | 1 | 2 | - | - | - | - | - | - | 3 | - | 3 | - |
| CO3 | 2 | 1 | 3 | 2 | 2 | - | - | - | - | - | - | 3 | - | 3 | - |
| CO4 | 3 | 2 | 1 | 2 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO5 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | - | 3 | - |
| CO | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | - | 3 | - |

3-High, 2- Medium, 1-Low

| **SD22301** | **CODING SKILLS AND SOFT SKILLS TRAINING – PHASE II** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **0** | **0** | **4** | **2** |

**COURSE OBJECTIVES**

- To make the students to solve basic programming logics.
- To help the students develop logics using decision control statements.
- To make them develop logics using looping statements and arrays.
- To train the students for effective communication and identify the common errors in formal writings.
- To guide and motivate the students for setting their goals with positive thinking.

| **UNIT I** | **FUNDAMENTALS IN PROGRAMMING** | **8** |
|---|---|---|

Output of Programs: I/O Functions, Data types, Constants, Operators – Mathematical Problems – Debugging – Puzzles - Company Specific Programming Examples.

| **UNIT II** | **DECISION CONTROL STATEMENTS** | **8** |
|---|---|---|

Logic Building Using Conditional Control Statements – Output of Programs – Mathematical Problems - Puzzles – Company Specific Programming Examples

| **UNIT III** | **LOOPING STATEMENTS AND ARRAYS** | **14** |
|---|---|---|

Logic Building Using Looping Statements – Number Programs – Programs on Patterns – Array Programs – Programs on Sorting and Searching - Matrix Programs – Puzzles - Output of Programs - Company Specific Programming Examples

| **UNIT IV** | **COMMUNICATION IN GENERAL** | **15** |
|---|---|---|

Introduction to communication-Types of communication – Effective Communication-Barriers to communication. Language Study: Vocabulary-Formation of sentences-Sentence and sentence structures-Common errors – Writing paragraphs & essays. Professional writing: Job application & Resume writing

| **UNIT V** | **PERSONALITY DEVELOPMENT** | **15** |
|---|---|---|

Study of personality & ways to improve. Soft Skills: Self-evaluation / self-awareness – Goal setting and positive thinking – Self-esteem and confidence – Public speaking – Extempore – Body language and Observation skills

**SUGGESTIVE ASSESSMENT METHODS:**

1) Pre Assessment Test – To check the student's previous knowledge in Programming skills.

| | |
|---|---|
| 2) Internal Assessment I for coding skills will be conducted for 100 marks which are then calculated to 20. | |
| 3) Internal Assessment II for coding skills will be conducted for 100 marks which are then calculated to 20. | |
| 4) Model Exam for coding skills will be conducted for 100 marks which are then calculated to 20. | |
| 5) A test for Communication skills will be conducted for 100 marks which will be then calculated to 40. | |
| 6) For assignments, students should attend all the practice tests conducted online on HackerRank. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks. | |
| 7) The total of 100 marks obtained from the tests will be then calculated to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100. | |
| **TOTAL PERIODS: 60** | |
| **COURSE OUTCOMES** | |
| Upon completion of the course, the students will be able to. | |
| **CO1:** | Solve problems on basic I/O constructs. |
| **CO2:** | Develop problem solving skills using decision control statements. |
| **CO3:** | Develop logics using looping statements and arrays. |
| **CO4:** | Avoid / fix the common errors they commit in academic and professional writings and prepare standard resumes and update the same for future career. |
| **CO5:** | Recognize the value of self-evaluation and grow with self-confidence. |
| **TEXT BOOKS** | |
| 1. | Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016. |
| 2. | Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015. |
| **REFERENCE BOOKS** | |
| 1. | Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013. |
| 2. | Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018. |
| 3. | E Balagurusamy, “Programming in ANSI C”, Eighth edition, Mc GrawHill Publications, 2019. |
| 4. | S.Sobana, R.Manivannan, G.Immanuel,‘Communication and Soft Skills’ VK Publications’, 2016. |

| | |
|---|---|
| 5. | Zed Shaw, " Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding", Zed Shaw's Hardway Series, 2015. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 2 | - | 1 | 1 | 1 | - | - | - | 1 | 2 | 2 | 1 | 2 |
| CO2 | 3 | 2 | 2 | - | 1 | 1 | 1 | - | - | - | 1 | 2 | 2 | 1 | 2 |
| CO3 | 3 | 2 | 2 | - | 1 | 1 | 1 | - | - | - | 1 | 2 | 2 | 1 | 2 |
| CO4 | - | - | - | - | - | - | - | 1 | 2 | 3 | - | 2 | 3 | - | - |
| CO5 | - | - | - | - | - | - | - | 1 | 2 | 3 | - | 2 | 3 | - | - |
| CO | 3 | 2 | 2 | - | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 2 | 2 | 1 | 2 |

3-High, 2- Medium, 1-Low

| AC22301 | CONSTITUTION OF INDIA | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 |

**COURSE OBJECTIVES**

- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

| UNIT I | INTRODUCTION | 6 |
|---|---|---|

History of Making of the Indian Constitution - Drafting Committee - Philosophy of the Indian Constitution - Preamble - Salient Features.

| UNIT II | CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES | 6 |
|---|---|---|

Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and Educational Rights - Fundamental Duties.

| UNIT III | ORGANISATIONS OF GOVERNANCE | 7 |
|---|---|---|

Parliament - Composition - Qualifications and Disqualifications - Powers and Functions - Executive President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges - Qualifications, Powers and Functions.

| UNIT IV | EMERGENCY PROVISIONS | 4 |
|---|---|---|

Emergency Provisions - National Emergency, President Rule, Financial Emergency.

| UNIT V | LOCAL ADMINISTRATION | 7 |
|---|---|---|

District's Administration head - Role and Importance -Municipalities - Introduction- Mayor and role of Elected Representative - CEO of Municipal Corporation -Pachayati raj -

| | |
|---|---|
| Introduction - PRI- Zila Pachayat-Elected officials and their roles. | |
| **TOTAL PERIODS: 30** | |
| **COURSE OUTCOMES** | |
| Upon completion of the course, the students will be able to | |
| **CO1:** | Understand history and philosophy of Indian Constitution. |
| **CO2:** | Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. |
| **CO3:** | Understand powers and functions of Indian government. |
| **CO4:** | Understand emergency rule. |
| **CO5:** | Understand structure and functions of local administration. |
| **TEXT BOOKS** | |
| 1. | Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015. |
| 2. | Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015. |
| 3. | Jain M P, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014. |
| 4. | The Constitution of India (Bare Act), Government Publication,1950. |
| **REFERENCES:** | |
| 1 | M.V.Pylee, "Introduction to the Constitution of India",4th Edition, Vikas publication,2005. |
| 2. | Durga Das Basu (DD Basu), "Introduction to the constitution of India", (Student Edition),19th Edition, Prentice-Hall EEE, 2008. |
| 3. | Merunandan, "Multiple Choice Questions on Constitution of India", 2nd Edition, Meraga publication, 2007. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | - | 1 | - | - | 1 | 1 | - | 1 | - | - | - | 1 | - | - | 2 |
| CO2 | - | 1 | - | - | - | 1 | - | 1 | - | 1 | - | - | - | - | 2 |
| CO3 | - | 1 | 1 | - | - | 1 | - | 1 | - | 1 | - | - | - | - | 2 |
| CO4 | - | - | - | 1 | - | - | 1 | - | 1 | 1 | 1 | 1 | - | - | 2 |
| CO5 | - | - | - | - | - | - | 1 | - | - | 1 | - | 1 | - | - | 2 |
| CO | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - | - | 2 |

3-High, 2- Medium, 1-Low

| HS22301 | VALUE EDUCATION – I | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 0 |
| **COURSE OBJECTIVES** | | | | | |
| • To give the students a deeper understanding about the purpose of life. | | | | | |
| • To animate the students to have a noble vision and a right value system for their life. | | | | | |
| • To help the students to set short term and long-term goals in their life. | | | | | |
| **UNIT I** | **MY LIFE AND MY PLACE IN THE UNIVERSE** | **4** | | | |

| | | |
|---|---|---|
| Value of my life – My Uniqueness, strengths and weakness – My self-esteem and confidence – My identity in the universe. | | |
| **UNIT II** | **MY LIFE AND THE OTHER** | **4** |
| Realising the need to relate with other persons and nature – My refined manners and conduct in relationships – Basic communication and relationship skills – Mature relationship attitudes. | | |
| **UNIT III** | **MY LIFE IS MY RESPONSIBILITY** | **3** |
| Personal autonomy – developing a value system and moral reasoning skills – setting goals for life. | | |
| **UNIT IV** | **UNDERSTANDING MY EDUCATION AND DEVELOPING MATURITY** | **4** |
| Importance of my Engineering education – Managing emotions - personal problem solving skills. | | |
| | | **TOTAL PERIODS: 15** |

| | |
|---|---|
| **COURSE OUTCOMES** | |
| Upon completion of the course, the students will be able to: | |
| **CO1:** | Explain the importance of value-based living. |
| **CO2:** | Set realistic goals and start working towards them. |
| **CO3:** | Apply the interpersonal skills in their personal and professional life. |
| **CO4:** | Emerge as responsible citizens with a clear conviction to be a role model in the society. |
| **REFERENCE BOOKS** | |
| 1. | David Brooks. The Social Animal: The Hidden Sources of Love, Character, and Achievement. Random House, 2011. |
| 2. | Mani Jacob. Resource Book for Value Education. Institute of Value Education, 2002. |
| 3. | Eddie de Jong. Goal Setting for Success. CreateSpace Independent Publishing, 2014. |
| 4. | Dr.Abdul kalam. My Journey-Transforming Dreams into Actions. Rupa Publications, 2013. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |
| CO2 | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |
| CO3 | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |
| CO4 | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |
| CO | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |

3-High, 2- Medium, 1-Low

**SEMESTER IV**

| IT22401 | FUNDAMENTALS OF ALGORITHM ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To understand and apply the algorithm analysis techniques and critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To understand Brute Force and Divide and Conquer algorithm design techniques
- To understand dynamic programming and greedy algorithm design techniques
- To make the students understand and solve problems using iterative method
- To understand the limitations of Algorithmic power

| UNIT I | INRODUCTION | 9 |
|---|---|---|

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

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

Brute Force –String Matching – Closest-Pair and Convex-Hull Problems – Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem. Divide and Conquer Methodology –Merge sort – Quick sort – Binary Search.

| UNIT III | DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE | 9 |
|---|---|---|

Dynamic programming – Computing a Binomial Coefficient –Optimal Binary Search Trees – Warshall's and Floyd's algorithm. Greedy Technique – Prim's algorithm, Dijkstra's Algorithm and Kruskal's Algorithm – Huffman Trees.

| UNIT IV | BACKTRACKING AND BRANCH-AND-BOUND | 9 |
|---|---|---|

Backtracking – n-Queen problem – Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – Assignment problem – Knapsack Problem – Travelling Salesman Problem.

| UNIT V | ITERATIVE IMPROVEMENT & LIMITATIONS OF ALGORITHMIC POWER | 9 |
|---|---|---|
| The Simplex Method – The Maximum-Flow Problem – Bipartite Graphs - Stable marriage Problem. Lower – Bound Arguments – P, NP NP- Complete and NP Hard Problems. Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem. | | |
| | | **TOTAL PERIODS: 45** |

| **COURSE OUTCOMES**<br>Upon completion of the course, the students will be able to | |
|---|---|
| **CO1:**<br>. | Describe the algorithm design and analytical principles for various computing problems |
| **CO2:** | Implement the problems using brute force and divide and conquer techniques |
| **CO3:** | Solve problems using dynamic programming and greedy technique |
| **CO4:** | Compute the limitations of algorithmic power and solve the problems using backtracking and branch and bound techniques |
| **CO5:** | Modify the problems using iterative improvement techniques for optimization |

| **TEXT BOOKS** | |
|---|---|
| 1. | Anany Levitin, ―Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012. |
| 2. | Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/C++, Second Edition, Universities Press, 2007. |

| **REFERENCE BOOKS** | |
|---|---|
| 1. | Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012. |
| 2. | Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006. |
| 3. | Harsh Bhasin, "Algorithms Design and Analysis", Oxford university press, 2016. |
| 4. | S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014. |
| 5. | http://nptel.ac.in/ |

**Mapping of Course Outcomes to Programme Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 3 | - | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO4 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| CS22402 | DATABASE MANAGEMENT SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To learn the fundamental concepts of database, data models, relational algebra and SQL.
- To represent a database system using ER diagrams and to learn normalization techniques.
- To understand the fundamental concepts of transaction, concurrency and recovery processing.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To have an introductory knowledge about the Distributed databases, NOSQL and database security

| UNIT I | RELATIONAL DATABASES | 10 |
|---|---|---|

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

| UNIT II | DATABASE DESIGN | 8 |
|---|---|---|

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

| UNIT III | TRANSACTIONS | 9 |
|---|---|---|

Transaction Concepts – ACID Properties – Schedules – Serializability – Need for Concurrency – Concurrency control –Two Phase Locking- Deadlock Handling -Timestamp based Protocols – Recovery Concepts – Recovery based on deferred and immediate update – ARIES Algorithm

| UNIT IV | IMPLEMENTATION TECHNIQUES | 9 |
|---|---|---|

RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations – Query optimization using Heuristics - Cost Estimation.

| UNIT V | ADVANCED TOPICS | 9 |
|---|---|---|
| NoSQL Databases - Evolution of NoSQL databases. Different types of NoSQL databases. CAP Theorem, Consistency levels. Advantages of NoSQL databases, Scalability and performance.Introducing MongoDB: History, MongoDB Design Philosophy, Speed, Scalability, and Agility, Non-Relational Approach, JSON-Based Document Store, Performance vs. Features. | | |
| | | **TOTAL PERIODS: 45** |

| **COURSE OUTCOMES** | |
|---|---|
| Upon completion of this course, the students will be able to | |
| **CO1:** | Outline the basic concepts of Relational databases |
| **CO2:** | Illustrate database using ER model and normalize the database |
| **CO3:** | Summarize transaction concepts and locking mechanisms. |
| **CO4:** | Identify the various indexing and hashing strategies to tune the performance of the database |
| **CO5:** | Examine how does advanced databases differ from relational databases and find a suitable database for the given requirement |
| **TEXT BOOKS** | |
| 1. | Abraham Silberschatz, Henry F. Korth, S. Sudharshan, -Database System Concepts, Seventh Edition, McGraw Hill, 2020. |
| 2. | Ramez Elmasri, Shamkant B. Navathe, -Fundamentals of Database Systems, Seventh Edition, Pearson Education, 2017. |
| **REFERENCES:** | |
| 1. | C.J.Date, A.Kannan, S.Swamynathan, -An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006. |
| 2. | Anirudha Kolpyakwar , Pallavi Chaudhari “, Database Management System with NoSQL”Lampert Academic Publishing,2018. |
| 3. | Saeed K. Rahimi, Frank S. Haug, “Distributed database management system. A Practical approach” John Wiley & Sons, 2010. |
| 4. | B. Prabhakaran ,”Multimedia Database Management Systems” The Springer International Series , 2012. |
| 5. | Akmal Chaudhri, Awais Rashid , Roberto Zicari, “XML Data Management: Native XML and XML-Enabled Database Systems”, Addison-Wesley Professional, First Edition, 2003. |

**Mapping of Course Outcomes to Programme Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| CS22403 | OPERATING SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.
- To analyze Scheduling algorithms.

| UNIT I | OPERATING SYSTEM OVERVIEW | 7 |
|---|---|---|

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview- Objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

| UNIT II | PROCESS MANAGEMENT | 10 |
|---|---|---|

Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors;

| UNIT III | PROCESS SYNCHRONISATION | 10 |
|---|---|---|

CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

| UNIT IV | STORAGE MANAGEMENT | `9 |
|---|---|---|

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, Disk structure- Disk scheduling- swap space management- Directory and disk structure, Directory implementation, Allocation Methods.

| UNIT V | VIRTUAL MACHINES | 9 |
|---|---|---|

Virtual machines – Distributed systems – Types of network based operating system - Linux System – Design Principles, Kernel Modules - Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Describe the basic concepts, services and structure of operating systems. |
| **CO2:** | Interpret process management, process synchronization and multithreading concepts. |
| **CO3:** | Apply CPU scheduling algorithms and deadlock detection and avoidance algorithms. |
| **CO4:** | Apply various storage management schemes. |
| **CO5:** | Compare different types of operating systems. |

**TEXT BOOKS:**

| | |
|---|---|
| 1. | Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Tenth Edition, John Wiley and Sons Inc., 2018. |
| 2. | Andrew. Tanenbaum, "Modern Operating Systems", Adison Wesley, Fourth Edition, 2014. |

**REFERENCES:**

| | |
|---|---|
| 1. | Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010. |
| 2. | Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016. |
| 3. | D M Dhamdhere, "Operating Systems: A Concept-Based Approach, Third Edition, Tata McGraw Hill 2017. |
| 4. | William Stallings, "Operating Systems: Internals and Design Principles", Seventh Edition, Prentice-Hall, 2013. |
| 5. | Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill, 2012. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO3 | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO4 | 3 | 1 | 2 | 2 | - | - | - | - | - | - | - | 1 | 2 | - | - |
| CO5 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | - | 1 | 3 | - | - |
| CO | 3 | 1 | 1 | 2 | - | - | - | - | - | - | - | 1 | 2 | - | - |

3-High, 2- Medium, 1-Low

| IT22402 | PROBABILITY AND MACHINE LEARNING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To introduce the fundamentals of probability and random variables.
- To introduce the fundamentals of two-dimensional random variables.
- To provide a basic understanding on machine learning concepts.
- To provide an in-depth introduction to supervised learning algorithms.
- To provide an in-depth introduction to unsupervised learning algorithms.

| UNIT I | PROBABILITY AND RANDOM VARIABLES | 6 |
|---|---|---|
| Probability – Axioms of probability – Conditional probability – Baye‘s theorem - Discrete and continuous random variables – Moments –Probability distributions: Binomial, Poisson and Normal distributions. | | |
| **UNIT II** | **TWO - DIMENSIONAL RANDOM VARIABLES** | **6** |
| Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem. | | |
| **UNIT III** | **MACHINE LEARNING AND DATA PREPROCESSING** | **6** |
| Definitions, goals and history of Machine Learning, Taxonomy of Machine Learning, Data preprocessing, standardization, dimension reduction, feature selection, Train-Test splitting, loss function, optimization, model selection, cross validation. | | |
| **UNIT IV** | **SUPERVISED LEARNING** | **6** |
| Supervised Learning: Parametric/Non-parametric learning, Naive Bayes classifier, support vector machine, Regularization, Classification errors, Decision Tree, K-Nearest Neighbors, Neural Networks. | | |
| **UNIT V** | **UNSUPERVISED AND REINFORCED LEARNING** | **6** |
| Clustering: K-means, K-medoids, hierarchical clustering algorithms, Dimensionality reduction, kernel methods, Learning theory: bias/variance trade-offs, VC theory, large margins. Introduction to reinforcement learning. Applications of machine learning. | | |
| | | **TOTAL PERIODS: 30** |

| **PRACTICAL EXERCISES** | |
|---|---|
| 1. | Implementation of Data Pre-processing techniques. |
| 2. | Build Linear Regression models. |
| 3. | Implement Naïve Bayes models. |
| 4. | Build decision trees. |
| 5. | Build SVM models. |
| 6. | Implement K-Means clustering algorithms. |
| 7. | Build simple NN models. |
| | **TOTAL PERIODS: 30** |

**COURSE OUTCOMES**

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

| | |
|---|---|
| **CO1:** | Solve the problems using the concepts of probability and standard distributions. |
| **CO2:** | Apply the concepts of two-dimensional random variables. |
| **CO3:** | Explore the concepts of machine learning and data preprocessing techniques. |
| **CO4:** | Apply supervised learning algorithms for real world problems. |
| **CO5:** | Apply unsupervised learning techniques. |

**TEXT BOOKS**

| | |
|---|---|
| 1 | Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015. |
| 2 | Mitchell, Tom. Machine Learning. New York, NY: McGraw-Hill, 1997. |

| REFERENCES: | |
|---|---|
| 1. | Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007. |
| 2. | Bishop, C. M., Pattern Recognition and Machine Learning, Springer, 2006. |
| 3. | Hastie, T., R. Tibshirani, and J. H. Friedman. The Elements of Statistical Learning: Data Mining, Inference and Prediction, Second Edition, Springer, 2009 . |
| 4. | Devore. J.L., "Probability and Statistics for Engineering and the Sciences‖, Cengage Learning, New Delhi, 8th Edition, 2014. |
| 5. | Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 1 | - | 3 | - |
| CO2 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 1 | - | 3 | - |
| CO3 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO5 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |

3-High, 2- Medium, 1-Low

| IT22403 | WEB ESSENTIALS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To comprehend and analyze the basic concepts of web programming and internet protocols.
- To describe how the client-server model of Internet programming works.
- To demonstrate the uses of scripting languages
- To write simple scripts for the creation of web sites
- To create database applications

| UNIT I | WEBSITE BASICS | 6 |
|---|---|---|

Internet Overview - Fundamental computer network concepts - Web Protocols - URL – Domain Name- Web Browsers and Web Servers- Working principle of a Website – Creating a Website - Client-side and server-side scripting.

| UNIT II | WEB DESIGNING | 6 |
|---|---|---|
| HTML – Form Elements - Input types and Media elements - CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface. | | |
| **UNIT III** | **CLIENT-SIDE PROCESSING AND SCRIPTING** | **6** |
| JavaScript Introduction – Variables and Data Types-Statements – Operators - Literals-Functions- Objects-Arrays-Built-in Objects- Regular Expression, Exceptions, Event handling, Validation. | | |
| **UNIT IV** | **SERVER-SIDE PROCESSING AND SCRIPTING** | **6** |
| PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - File Uploading – Email Basics - Email with attachments - PHP and HTML - Simple PHP scripts - Databases with PHP. | | |
| **UNIT V** | **SERVLETS AND DATABASE CONNECTIVITY** | **6** |
| Servlets: Java Servlet Architecture – Servlet Life cycle- Form GET and POST actions - Sessions – Cookies – Database connectivity - JDBC Creation of simple interactive applications - Simple database applications. | | |
| | | **TOTAL PERIODS: 30** |

| **PRACTICAL EXERCISES** | |
|---|---|
| 1. | Creation of interactive web sites - Design using HTML and authoring tools |
| 2. | Form validation using JavaScript |
| 3. | Creation of simple PHP scripts |
| 4. | Handling multimedia content in web sites |
| 5. | Write programs using Servlets to invoke servlets from HTML forms |
| 6. | Creation of information retrieval system using web, PHP and MySQL |
| 7. | Creation of personal Information System |
| | **TOTAL PERIODS: 30** |

| **COURSE OUTCOMES** | |
|---|---|
| Upon completion of the course, students will be able to | |
| **CO1:** | Explain the basic concepts of web programming and internet protocols. |
| **CO2:** | Demonstrate simple web-applications |
| **CO3:** | Apply JavaScript, HTML and CSS effectively to create interactive and dynamic websites. |
| **CO4:** | Construct simple PHP scripts. |
| **CO5:** | Construct multimedia components and database applications. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'Reilly publishers, 2014. |
| **2.** | Paul Deitel, Harvey Deitel, Abbey Deitel, “Internet & World Wide Web - How to Program”, 5th edition, Pearson Education, 2012. |

| **REFERENCE BOOKS** | |
|---|---|
| **1.** | Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006. |
| **2.** | James F. Kurose, “Computer Networking: A Top-Down Approach”, Sixth Edition, Pearson Education, 2012 |

| | |
|---|---|
| **3.** | Steven Holzener , “PHP – The Complete Reference”, 1st Edition, Mc-Graw Hill, 2017 |
| **4.** | Fritz Schneider, Thomas Powell , “JavaScript – The Complete Reference”, 3rd Edition, Mc- Graw Hill Publishers, 2017 |
| **5.** | Bates, “Developing Web Applications”, Wiley Publishers, 2006 |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| CO5 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - |
| CO | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - |

3-High, 2- Medium, 1-Low

| CS22405 | DATABASE MANAGEMENT SYSTEMS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES:**

- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions, procedures and procedural extensions of databases.
- To understand design and implementation of typical database applications.
- To be familiar with the use of a front-end tool for GUI based application development.

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1. | Create a database table, add constraints (primary key, unique, check, not null), insert rows, update and delete rows using SQL DDL and DML commands. |
| 2. | Create a set of tables, add foreign key constraints and incorporate referential integrity. |
| 3. | Query the database tables using different ‘where’ clause conditions and also implement aggregate functions. |
| 4. | Query the database tables and explore sub queries and simple join operations. |

| | |
|---|---|
| 5. | Query the database tables and explore natural, equi and outer joins. |
| 6. | Write user defined functions and stored procedures in SQL. |
| 7. | Execute complex transactions and realize DCL and TCL commands. |
| 8. | Write SQL Triggers for insert, delete, and update operations in a database table. |
| 9. | Create View and index for database tables with a large number of records. |
| 10. | Create an XML database and validate it using XML schema. |
| 11. | Create Document, column and graph based data using NOSQL database tools. |
| 12. | Data manipulation using MongoDB. |
| | **TOTAL: 60 PERIODS** |

**List of Equipment: (30 Students per Batch)**

MYSQL / SQL: 30 Users

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Construct databases with different types of key constraints. |
| **CO2:** | Develop simple and complex SQL queries using DML and DCL commands. |
| **CO3:** | Experiment with advanced features such as stored procedures and triggers and incorporate in GUI based application development. |
| **CO4:** | Build an XML database and validate with meta-data (XML schema). |
| **CO5:** | Model and manipulate data using NOSQL database. |

**Mapping of Course Outcomes to Programme Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| **IT22404** | **OPERATING SYSTEMS LABORATORY** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|

| | | 0 | 0 | 4 | 2 |
|---|---|---|---|---|---|

**COURSE OBJECTIVES**

- To learn Unix commands and shell programming.
- To implement various CPU Scheduling Algorithms.
- To implement Process Creation and Inter-Process Communication.
- To implement Deadlock Avoidance Algorithms.
- To implement Page Replacement Algorithms.
- To implement File Allocation Strategies.

**LIST OF EXPERIMENTS**

1. Basics of UNIX commands.
2. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
3. Shell Programming.
4. Write C programs to implement the various CPU Scheduling Algorithms.
5. Implementation of Semaphores.
6. Implementation of Shared memory and IPC.
7. Bankers Algorithm for Deadlock Avoidance.
8. Write C program to implement Threading & Synchronization Applications.
9. Implementation of the following Memory Allocation Methods for fixed partition
   a) First Fit b) Worst Fit c) Best Fit
10. Implementation of Paging Technique of Memory Management.
11. Implementation of the following Page Replacement Algorithms
    a) FIFO b) LRU c) LFU
12. Implementation of the following File Allocation Strategies
    a) Sequential b) Indexed c) Linked

**LAB REQUIREMENTS:**

For a batch of 30 students Operating Systems: Linux / Windows
Compiler: C/C++/JAVA

**TOTAL PERIODS: 60**

**COURSE OUTCOMES**

At the end of the course, the student should be able to

| | |
|---|---|
| **CO1:** | Implement UNIX commands and shell programming. |
| **CO2:** | Implement the various CPU Scheduling Algorithms. |
| **CO3:** | Implement Process Creation and Inter Process Communications. |
| **CO4:** | Implement Deadlock Avoidance and Deadlock Detection Algorithms. |
| **CO5:** | Implement Page Replacement Algorithms, File organization and File allocation Strategies. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO4 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO5 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - | - |

3-High, 2- Medium, 1-Low

| SD22401 | CODING SKILLS AND SOFT SKILLS TRAINING – PHASE II | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

- To help students on developing modular applications using functions.
- To train them on building logics using strings and pointers.
- To make them develop applications using user defined data types.
- To train the students on speaking skills for group discussions.
- To set them correctly on the track of presentation skills and management skills.

| UNIT I | FUNCTIONS | 12 |
|---|---|---|

Logic Building Using Functions – Programs on Recursion – Puzzles - Output of Programs - Company Specific Programming Examples.

| UNIT II | STRINGS AND POINTERS | 12 |
|---|---|---|

Logic Building Using Strings – Programs on Strings - Logic Building Using Pointers – Puzzles - Output of Programs - Company Specific Examples.

| UNIT III | USER DEFINED DATATYPES | 6 |
|---|---|---|

Logic Building Using Looping Statements – Number Programs – Programs on Patterns – Array Programs – Programs on Sorting and Searching - Matrix Programs – Puzzles - Output of Programs - Company Specific Programming Examples

| UNIT IV | COMMUNICATION SKILLS / LANGUAGE SKILLS | 15 |
|---|---|---|

Receptive Skills and productive skills - Skills together - Integration of skills - Input and output Receptive Skills: Listening and Reading - Lead-in - Pre-existent knowledge - General understanding of the audio or the written text - Discussion in pairs or small groups – feedback - Text-related task in detail - Focus on aspects of language in the text. Productive Skills: Speaking and Writing - lead-in - engaging students with the topic - setting the task - role-play - Monitoring the task - Giving the feedback-positive- task-related follow up - repetition / re-setting of task. Activities: Pronunciation: syllable, stress, intonation - Writing memos, e-mails and formal letters - Oral presentations / seminars - Written and Oral Descriptions Group discussions.

| UNIT V | SOFT SKILLS: SEARCH AND FIND FOR CAREER DEVELOPMENTS | 15 |
|---|---|---|

Self-motivation: Interpersonal relationship - Attitudes and interpersonal integrity – Time management – prioritizing - Leadership quality – In the team: Team building and Team work - Memory technique Problem solving: – emotional intelligence – positive attitude towards life – taking up initiatives – developing mind set –openness to feed back – adaptability – active listening – work ethics. Presentation of skills: creative thinking – critical thinking – logical

| | |
|---|---|
| thinking - decision making. Management ability: empathy – selflessness – humility – cultural respectfulness – versatility – generosity – trustworthiness – planning and executing – target achievement – listening to others' views – friendliness - active participation – empowering healthy atmosphere – exchange of ideas – mediation – negotiation – qualities – updating the knowledge – pre-work for performance – respect for 4 rules and regulations. | |
| **SUGGESTIVE ASSESSMENT METHODS:** | |
| 1) Pre Assessment Test – To check the student's previous knowledge in Programming skills. | |
| 2) Internal Assessment I for coding skills will be conducted for 100 marks which are then calculated to 20. | |
| 3) Internal Assessment II for coding skills will be conducted for 100 marks which are then calculated to 20. | |
| 4) Model Exam for coding skills will be conducted for 100 marks which are then calculated to 20. | |
| 5) A test for Communication skills will be conducted for 100 marks which will be then calculated to 40. | |
| 6) For assignments, students should attend all the practice tests conducted online on HackerRank. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks. | |
| 8) The total of 100 marks obtained from the tests will be then calculated to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100. | |
| **TOTAL PERIODS: 60** | |
| **COURSE OUTCOMES** | |
| Upon completion of the course, the students will be able to. | |
| **CO1:** | Develop and implement modular applications using functions. |
| **CO2:** | Develop logics using strings and pointers. |
| **CO3:** | Develop applications in C using user defined datatypes. |
| **CO4:** | Practice both receptive skills (listening and reading) and productive skills (writing and speaking) and speak English with standard pronunciation using correct stress and intonation. |
| **CO5:** | Practice team building and team work procedures and develop memory techniques and manage abilities like empathy, selflessness, cultural respectfulness and trustworthiness preparing themselves for target achievement. |
| **TEXT BOOKS** | |
| 1. | Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016. |

| | |
|---|---|
| 2. | Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015. |
| **REFERENCE BOOKS** | |
| 1. | Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013. |
| 2. | Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018. |
| 3. | E Balagurusamy, "Programming in ANSI C", Eighth edition, Mc GrawHill Publications, 2019. |
| 4. | S.Sobana, R.Manivannan, G.Immanuel,'Communication and Soft Skills' VK Publications', 2016. |
| 5. | Zed Shaw, " Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding", Zed Shaw's Hardway Series, 2015. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 2 | - | 1 | 1 | 1 | - | - | - | 1 | 2 | 2 | 1 | 2 |
| CO2 | 3 | 2 | 2 | - | 1 | 1 | 1 | - | - | - | 1 | 2 | 2 | 1 | 2 |
| CO3 | 3 | 2 | 2 | - | 1 | 1 | 1 | - | - | - | 1 | 2 | 2 | 1 | 2 |
| CO4 | - | - | - | - | - | - | - | 1 | 2 | 3 | - | 2 | - | - | - |
| CO5 | - | - | - | - | - | - | - | 1 | 2 | 3 | - | 2 | - | - | - |
| CO | 3 | 2 | 2 | - | 1 | 1 | 1 | 1 | 2 | 3 | 1 | 2 | 2 | 1 | 2 |

3-High, 2- Medium, 1-Low

| AC22401 | INDUSTRIAL SAFETY ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 |

**COURSE OBJECTIVES**

- To explain the fundamental concept and principles of industrial safety.
- To apply the principles of maintenance engineering.
- To analyse the wear and its reduction.
- To evaluate faults in various tools, equipment and machines.
- To apply periodic maintenance procedures in preventive maintenance.

| UNIT I | INDUSTRIAL SAFETY | 6 |
|---|---|---|

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

| UNIT II | MAINTENANCE ENGINEERING | 6 |
|---|---|---|

| | | |
|---|---|---|
| Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment. | | |
| **UNIT III** | **WEAR AND CORROSION AND THEIR PREVENTION** | **6** |
| Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods. | | |
| **UNIT IV** | **FAULT TRACING** | **6** |
| Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,vi. Electrical motors, Types of faults in machine tools and their general causes. | | |
| **UNIT V** | **PERIODIC AND PREVENTIVE MAINTENANCE** | **6** |
| Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, Advantages of preventive maintenance. Repair cycle concept and importance. | | |
| | | **TOTAL PERIODS: 30** |

| **COURSE OUTCOMES** | |
|---|---|
| At the end of the course, the students would be able to | |
| **CO1:** | Explain the fundamental concept and principles of industrial safety. |
| **CO2:** | Apply the principles of maintenance engineering. |
| **CO3:** | Analyze the wear and its reduction. |
| **CO4:** | Evaluate faults in various tools, equipment and machines. |
| **CO5:** | Apply periodic maintenance procedures in preventive maintenance. |

| **TEXT BOOKS** | |
|---|---|
| 1. | L M Deshmukh, Industrial Safety Management, Tata McGraw-Hill Education, 2005. |
| 2. | Charles D. Reese, Occupational Health and Safety Management: A Practical Approach, CRC Press, 2003. |

| **REFERENCES:** | |
|---|---|
| 1. | Edward Ghali, V. S. Sastri, M. Elboujdaini, Corrosion Prevention and Protection: Practical Solutions, John Wiley & Sons, 2007. |
| 2. | Garg, HP, Maintenance Engineering, S. Chand Publishing. |
| 3. | J Maiti, Pradip Kumar Ray, Industrial Safety Management: 21st Century Perspectives of Asia, Springer, 2017. |

| | |
|---|---|
| 4. | R. Keith Mobley, Maintenance Fundamentals, Elsevier, 2011. |
| 5. | W. E. Vesely, F. F. Goldberg, Fault Tree Handbook, Create space Independent Pub, 2014. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 1 | 2 | - | - | 2 | 1 | - | - | - | - | 1 | - | - | 2 |
| CO2 | 2 | 1 | 2 | - | - | 2 | 1 | - | - | - | - | 1 | - | - | 2 |
| CO3 | 2 | 1 | 2 | - | - | 2 | 1 | - | - | - | - | 1 | - | - | 2 |
| CO4 | 2 | 1 | 2 | - | - | 2 | 1 | - | - | - | - | 1 | - | - | 2 |
| CO5 | 2 | 1 | 2 | - | - | 2 | 1 | - | - | - | - | 1 | - | - | 2 |
| CO | 2 | 1 | 2 | - | - | 2 | 1 | - | - | - | - | 1 | - | - | 2 |

3-High, 2- Medium, 1-Low

**SEMESTER V**

| IT22501 | DATA COMMUNICATION AND NETWORKING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To understand the protocol layering.
- To analyse the performance of the Networks.
- To understand the various components required to build different networks.
- To learn function of a network layer.
- To familiarize the functions and protocols of the transport layer.

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

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media : Guided media-Unguided media: Wireless– Switching.

| UNIT II | DATALINK LAYER | 6 |
|---|---|---|

Introduction-nodes and link-Two types of links-Two sublayers -Data link control: Framing-Error control-Two DLC protocols – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC.

| UNIT III | NETWORK LAYER | 6 |
|---|---|---|

Network Layer Services: Packetizing-Routing-Error Control-Flow Control-Congestion Control-quality of service-Network layer performance: Delay-Throughput-packet loss – Packet

| | | |
|---|---|---|
| switching – Performance – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4. | | |
| **UNIT IV** | **TRANSPORT LAYER** | **6** |
| Introduction – Transport Layer Protocols: Services – Port Numbers – User Datagram Protocol: UDP services-UDP applications-Transmission control protocol: TCP services-TCP features-Segment-A TCP connection-State Transition Diagram-SCTP: SCTP services-SCTP features. | | |
| **UNIT V** | **APPLICATION LAYER** | **6** |
| WWW and HTTP – FTP – Email –Telnet-Secure Shell (SSH)-Domain Name System(DNS). | | |
| | | **TOTAL PERIODS: 30** |

| **PRACTICAL EXERCISES** | |
|---|---|
| 1 | Study of network commands. |
| 2 | Write a HTTP web client program to download a web page using TCP sockets. |
| 3 | Applications using TCP sockets - chat, file transfer. |
| 4 | Simulation of DNS using UDP sockets. |
| 5 | Write a code simulating ARP /RARP protocols. |
| 6 | TCP and UDP performance using network simulation tools. |
| 7 | Simulation of Error Correction Code(like CRC), Distance Vector Routing/Link State Routing Protocol. |
| | **TOTAL PERIODS: 30** |

| **COURSE OUTCOMES** | |
|---|---|
| Upon completion of the course, students will be able to | |
| **CO1:** | Explain the concepts of Data Communication, basic layers and its function in computer networks. |
| **CO2:** | Infer the concepts of datalink layer. |
| **CO3:** | Apply routing algorithms and their functionality. |
| **CO4:** | Apply the working of transport and application layer protocol. |
| **CO5:** | Analyse the performance of TCP and UDP. |

| **TEXT BOOKS** | |
|---|---|
| 1. | Behrouz A. Forouzen, “Data Communications and Networking with TCP/IP Protocol Suite”, Sixth Edition, TMH,2022. |
| 2. | William Stallings, “Data and Computer Communications”, Eighth Edition, Pearson Education, 2023. |

| REFERENCE BOOKS | |
|---|---|
| 1. | Larry Peterson, Bruce S. Davie, "Computer Networks: A system Approach", Fifth Edition, Morgan Kaufmann Publishers Inc , 2012. |
| 2. | Doug Lowe, "Networking all-in one Dummies", Seventh Edition, Wiley Publication, 2018. |
| 3. | Nader F. Mir, "Computer and Communication Networks", Second Edition, Prentice hall, 2015. |
| 4. | Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An open Source Approach", McGraw Hill Publishers, 2011. |
| 5. | James F. Kurose, Keith W.Ross, "Computer Networking, A top-Down Approach Featuring the Internet", Sixth Edition, Pearson Education, 2013. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 2 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| IT22502 | SOFTWARE ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To understand the fundamentals of software engineering
- To understand software requirements and UML diagrams
- To understand the software design concepts
- To apply the various software testing methodologies
- To learn various project estimation methods

| UNIT I | INTRODUCTION TO SOFTWARE ENGINEERING | 6 |
|---|---|---|

Introduction to Software Engineering: The evolving role of software, changing nature of software, a layered technology. Software Process, Process Models: The waterfall model, incremental process models, evolutionary process models, Agility: Agile process, Extreme programming.

| UNIT II | SOFTWARE REQUIREMENTS AND OBJECT MODELLING | 6 |
|---|---|---|

| | | |
|---|---|---|
| Software Requirements: Functional and non-functional requirements, user requirements, system requirements. Requirements engineering process, Object modelling with UML: Use case diagram, Class diagram, Sequence diagram, Collaboration diagram. | | |
| **UNIT III** | **DESIGN ENGINEERING** | **6** |
| Design process: design concepts, design model, design heuristic. Architectural Design: architectural styles, architectural Design, architectural mapping using data flow, Component level Design: designing class-based components. | | |
| **UNIT IV** | **SOFTWARE TESTING** | **6** |
| Testing Strategies: A strategic approach to software testing, black-box and white-box testing. Regression testing, unit testing, integration testing, validation testing, system testing, and the art of debugging. | | |
| **UNIT V** | **PROJECT ESTIMATION** | **6** |
| Software Project Estimation — LOC, FP Based Estimation, Make/Buy Decision, COCOMO I model, COCOMO II model, Risk management. | | |
| | | **TOTAL PERIODS: 30** |

| | |
|---|---|
| **PRACTICAL EXERCISES** | |
| 1 | Identify a software system that needs to be developed. |
| 2 | Document the Software Requirements Specification (SRS) for the identified system. |
| 3 | Identify use cases and develop the Use Case model. |
| 4 | Identify the conceptual classes, derive a Class Diagram and generate code. |
| 5 | Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams |
| 6 | Draw relevant State Chart and Activity Diagrams for the system. |
| 7 | Implement the system as per the detailed design. |
| | **TOTAL PERIODS: 30** |

| | |
|---|---|
| **COURSE OUTCOMES** | |
| Upon completion of the course, students will be able to | |
| **CO1:** | Describe the basics of software process models. |
| **CO2:** | Express the requirements of a system with UML diagrams. |
| **CO3:** | Explain software design concepts. |

| | |
|---|---|
| **CO4:** | Apply various testing strategies. |
| **CO5:** | Analyze project estimation techniques. |
| **TEXT BOOKS** | |
| **1.** | Larman Craig, “Applying UML and Patterns”, Third Edition, Pearson, 2015. |
| **2.** | Roger S. Pressman, “Software Engineering - A Practitioner‟s Approach”, Seventh Edition, McGraw-Hill International Edition, 2010. |
| **REFERENCE BOOKS** | |
| **1.** | Ali Bahrami, “Object Oriented Systems Development”, McGraw Hill International Edition,2012. |
| **2.** | Hessam Ashrafi and Noushin Ashrafi, "Object Oriented Systems Analysis and Design: Pearson New International Edition", Pearson Education Limited, 2013. |
| **3.** | Simon Bennett, Ray Farmer and Steve McRobb, ”Object-Oriented Systems Analysis and Design Using UML", McGraw-Hill Europe, 2010. |
| **4.** | Ian Sommerville, “Software Engineering”, Ninth Edition, Pearson Education Asia, 2011. |
| **5.** | Rajib Mall, “Fundamentals of Software Engineering”, Fourth Edition, PHI Learning Private Limited, 2014. |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 3 | 3 | - | 2 | - | - | - | - | - | - | - | 2 | - | - |
| CO2 | 3 | 3 | 3 | - | 2 | - | - | - | - | - | - | - | 2 | - | - |
| CO3 | 3 | 3 | 3 | - | 2 | - | - | - | - | - | - | - | 2 | - | - |
| CO4 | 3 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - | 2 | - | - |
| CO5 | 3 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - | 2 | - | - |
| CO | 3 | 3 | 3 | 1 | 3 | - | - | - | - | - | - | - | 2 | - | - |

3-High, 2- Medium, 1-Low

| **IT22503** | **MOBILE APPLICATION DEVELOPMENT LABORATORY** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **1** | **0** | **2** | **2** |

| COURSE OBJECTIVES: | | |
|---|---|---|
| • Use Flutter/Kotlin multi-platform environment for building cross-platform mobile applications. | | |
| • Demonstrate the knowledge of different programming techniques and patterns for mobile application development. | | |
| • Identify the components and structure of mobile application development frameworks. | | |
| • Understand the capabilities and limitations of different platforms. | | |
| • Design and develop real-time mobile applications. | | |
| **UNIT I** | **INTRODUCTION TO MOBILE APPLICATION** | **3** |
| Mobile Application Development - Mobile Applications and Device Platforms - Alternatives for Building Mobile Apps. | | |
| **UNIT II** | **INTRODUCTION TO FLUTTER** | **3** |
| What is Flutter? , Why Flutter? , The other options, Native Solutions, What is Dart? | | |
| **UNIT III** | **BASICS OF DART** | **3** |
| Keywords, Built-in types, Functions, Operators, Control Flow statements, Exceptions, Classes, generics, Libraries and visibility. | | |
| **UNIT IV** | **BASICS OF WRITING FLUTTER CODE** | **3** |
| Basic Widgets such as Appbar, Column, Row, Container, Image, Icon, Buttons and Text. | | |
| **UNIT V** | **FLUTTER UI** | **3** |
| Important widgets, Theme and Layout. User interaction: Forms and Gestures. | | |
| **TOTAL: 15 PERIODS** | | |

| LIST OF EXPERIMENTS | |
|---|---|
| 1. | Installation of Flutter multi-platform environment |
| 2. | Develop an application that uses Widgets, GUI components, Fonts, and Colors. |
| 3. | Develop a native calculator application. |
| 4. | Develop a gaming application that uses 2-D animations and gestures. |
| 5. | Develop a movie rating application |
| 6. | Develop an application to connect to a web service and to retrieve data with HTTP. |
| 7. | Develop a simple shopping application002E. |
| 8. | Design a web server supporting push notifications. |
| 9. | Develop an application by integrating Google maps. |
| **TOTAL: 30 PERIODS** | |

| COURSE OUTCOMES: | |
|---|---|
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Explain the various mobile application development environments with its features. |
| **CO2:** | Apply various programming techniques and patterns to build mobile applications. |
| **CO3:** | Build real-time mobile applications for society/environment. |

| | |
|---|---|
| **CO4:** | Build gaming and multimedia based mobile applications. |
| **CO5:** | Build AI based mobile applications for society/environment following ethical practices. |

**REFERENCES:**


| | |
|---|---|
| 1 | Simone Alessandria, "Flutter Projects: A practical project-based guide to building real-world cross-platform mobile applications and games", Packt publishing, 2020. |
| 2 | Eric Windmill ,"Flutter in Action", Manning Publications, 2020. |
| 3 | Rap Payne, "Beginning App development with Flutter: Create Cross Platform Mobile Apps", APress, 2019. |
| 4 | Carmine Zaccagnino, "Programming Flutter: Native, Cross-Platform Apps the Easy Way (The Pragmatic Programmers)", Packt publishing, 2020. |


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

30 Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development Tools with appropriate emulators and debuggers.

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 1 | 1 | 3 | - | - | - | - | - | - | 1 | 3 | - | - |
| CO2 | 3 | 2 | 1 | 2 | 3 | - | - | - | - | - | - | 1 | 3 | - | - |
| CO3 | 3 | 2 | 1 | 1 | 3 | - | - | - | - | - | - | 1 | 3 | - | - |
| CO4 | 3 | 3 | 2 | 1 | 3 | - | - | - | - | - | - | 1 | 3 | - | - |
| CO5 | 3 | 3 | 1 | 1 | 3 | - | - | - | - | - | - | 1 | 3 | - | - |
| CO | 3 | 2 | 1 | 1 | 3 | - | - | - | - | - | - | 1 | 3 | - | - |

3-High, 2- Medium, 1-Low

| IT22504 | TECHNICAL SEMINAR | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

- To encourage the students to study advanced engineering developments.
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

**METHOD OF EVALUATION**

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session maximum of 12 students are expected to present the seminar. Each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

**TOTAL PERIODS: 30**

**COURSE OUTCOMES**

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

| | |
|---|---|
| **CO1:** | Review, prepare and present technological developments. |
| **CO2:** | Face the placement interviews. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 2 | - | - | - | - | - | - | 2 | 2 | 1 | 2 | - | 2 | 3 |
| CO2 | 2 | 2 | - | - | - | - | - | - | 2 | 2 | - | 2 | - | 2 | 3 |
| CO | 2 | 2 | - | - | - | - | - | - | 2 | 2 | 1 | 2 | - | 2 | 3 |

3-High, 2- Medium, 1-Low

| IT22505 | INPLANT/INDUSTRIAL TRAINING | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 0 | 1 |

**COURSE OBJECTIVES:**

- To Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required
- To apply the Technical knowledge in real industrial situations.
- To gain experience in writing Technical reports/projects.
- To expose the students to experience the engineer's responsibilities and ethics.
- To promote academic, professional and/or personal development.

**Inplant/Industrial Training Duration**

The students may undergo Industrial training for a period as specified in the Curriculum during the summer / winter vacation. In this case, the training has to be undergone continuously for a period of at least two weeks in an organization.

**METHOD OF EVALUATION**

The student will bring the training report and will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

| | |
|---|---|
| | ○ Quality of content presented.<br>○ Proper planning for presentation.<br>○ Effectiveness of presentation.<br>○ Depth of knowledge and skills.<br>○ Innovation the content |
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Interpret how the theoretical aspects learned in classes are integrated into the practical world. |
| **CO2:** | Make use of the opportunity to learn new skills and supplement knowledge. |
| **CO3:** | Develop communication and teamwork skills |
| **CO4:** | Motive the student for higher education. |
| **CO5:** | Formulate to learn strategies like time management, multi-tasking etc in an industrial setup |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 2 | 1 | 1 | 3 | 3 | - | - | 2 | 2 | 1 | 2 | 2 | 2 | 3 |
| CO2 | 2 | 2 | 1 | 2 | 3 | - | - | - | 2 | 2 | - | 2 | 2 | 2 | 3 |
| CO3 | - | - | - | - | - | - | - | - | 2 | 2 | - | 2 | 2 | 2 | 3 |
| CO4 | - | - | - | - | - | - | - | - | 2 | 2 | - | 2 | 2 | 2 | 3 |
| CO5 | - | - | - | - | - | 3 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 3 |
| CO | 2 | 2 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 3 |

3-High, 2- Medium, 1-Low

| SD22501 | CODING SKILLS AND SOFT SKILLS TRAINING – PHASE III | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |
| **COURSE OBJECTIVES** | | | | | |
| ● To make the students develop logics using basic Programming Logics, Decisional Statements, Arrays and Strings. | | | | | |
| ● To help the students know how to use classes and objects. | | | | | |
| ● To enable the students to implement programs using OOPs Concepts. | | | | | |
| ● To train the students on interview skills with mock interviews and updated / enhanced resumes | | | | | |
| ● To prepare students for taking initiatives and decision making with critical thinking | | | | | |
| **UNIT I** | **BASIC PROGRAMMING CONSTRUCTS & SOFT SKILLS: TIME MANAGEMENT** | **12** | | | |
| Structured vs Object oriented programming language – Output of programs on basic I/O functions – Logic building using Decisional Statements – Programs on Patterns and Numbers - Debugging – Puzzles - Company specific programming examples. | | | | | |

| | | |
|---|---|---|
| **Soft Skills: Time management:** Prioritizing – Delegation - Decision-making - Goal setting – Multitasking - Problem solving - Strategic thinking - Scheduling – Planning - to-do lists and checklists - Evaluating urgent tasks - Auditing and improving workflows - Filtering notifications - Setting thoughtful deadlines – Evaluating the work done schedules – Grouping similar tasks – Learn to say 'no'. | | |
| **UNIT II** | **PROGRAMMING USING FUNCTIONS AND ARRAYS & SOFT SKILLS: STRESS MANAGEMENT AND EMOTIONAL QUOTIENT** | **12** |
| Logic building using modular approach – Programming using Friend Function – Programs on Matrices and strings – Puzzles – Output of programs - Company specific programming examples.<br><br>**Soft Skills: Stress management:** Using guided meditation - Maintain physical exercise and good nutrition - Manage social media time - Connect with others – read and relax. **Emotional Quotient**: Overcoming challenges – defusing conflict - Self-awareness - Self-regulation - Professional etiquette – Avoiding doubt – Introducing others – Courteousness – Non-interruption – Avoiding gossip. | | |
| **UNIT III** | **IMPLEMENTING OOPS CONCEPTS & SOFT SKILLS: VALUES OF LIFE AND BEHAVIOURAL ATTITUDES** | **12** |
| Discussion on basics of OOPs Concepts – Solving problems based on Data Members and Member Functions – Programs based on Construction and Destruction of Objects - Puzzles - Output of Programs – Understanding Access Specifiers – Company specific programming examples.<br><br>**Soft Skills: Values of life**: Loyalty to others and responsibilities – Living with Spirituality – Maintaining humility – Possessing compassion – Proving being honest – developing kindness – Learning to have integrity – Embracing responsibility. **Behavioural attitudes:** Behaving with sportive attitude – Respecting the freedom of the others – Being bold – Enhancing fun and joy. | | |
| **UNIT IV** | **LOGIC BUILDING USING INHERITANCE AND ABSTRACTION & SOFT SKILLS: EMPLOYERS EXPECTATIONS AND RESUME ENHANCEMENT** | **12** |
| Understanding Super class and Derived Class – Logic building based on inheritance – Programming using Pure Virtual Function and Abstract Classes- The Final Keyword – Puzzles - Output of Programs – Company specific programming examples.<br><br>**Soft Skills: Employers expectations:** Contributing to the team – Being with stability – Developing the ability to grow - Improving the productivity. **Resume enhancement:** Select the best template for your skills, experience, and goals Adding skills to be an expert - Robusting and compelling objective – Displaying online presence - Quantifying accomplishments various roles. | | |
| **UNIT V** | **PROGRAMMING USING ENCAPSULATION AND POLYMORPHISM & SOFT SKILLS: INTERVIEW SKILLS** | **12** |
| Understanding how Encapsulation works – Understanding the term Polymorphism – Programming using Function Overloading and Overriding – Puzzles – Output of programs | | |

| | |
|---|---|
| – Company specific programming examples.<br>**Soft Skills: Interview Skills**: Clarifying interview questions - Communicate nonverbally - Knowing the resume thoroughly - Leveraging knowledge of the company and interviewer - Mock interviews – Getting rehearsed before moving for interviews. | |
| **TOTAL PERIODS:60** | |
| **Suggestive Assessment Methods:** | |
| 1 | Pre Assessment Test – To check the student's previous knowledge in Programming skills. |
| 2 | Internal Assessment I for coding skills will be conducted for 100 marks which are then calculated to 20. |
| 3 | Internal Assessment II for coding skills will be conducted for 100 marks which are then reduced to 20. |
| 4 | Model Exam for coding skills will be conducted for 100 marks which are then calculated to 20. |
| 5 | A test for Soft Skills will be conducted for 100 marks which will be then calculated to 40. |
| 6 | For assignments, students should attend all the practice tests conducted online on HackerRank. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks. |
| 7 | The total of 100 marks obtained from the tests will be then calculated to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100. |
| **COURSE OUTCOMES** | |
| On completion of this course, the students will be able to: | |
| **CO1:** | Develop programs using Functions, Strings and Arrays. |
| **CO2:** | Write programs using Classes and Objects. |
| **CO3:** | Develop applications using OOPs Concepts. |
| **CO4:** | Apply all the interview skills learned with updated resumes and language skills balancing technical skills and interpersonal skills. |
| **CO5:** | Attend different job interviews with emotional balance and achieve the target with right planning and unique solutions. |
| **TEXT BOOKS** | |
| 1. | Balagurusamy E, "Object Oriented Programing with C++", Eighth Edition, Tata McGraw Hill Education Pvt.Ltd, 2020. |
| 2. | Anthony Williams, "C++ Concurrency in Action", Second Edition, Manning Publications, 2019. |

| REFERENCES | |
|---|---|
| 1. | Bjarne Stroustrup, “A Tour of C++”, Second Edition, Pearson Education, 2018. |
| 2. | Scott Meyers, “Effective Modern C++”, O’Reilly Publication, December 2014. |
| 3. | Stanely Lippman, Josee Lajoie, Barbara Moo, “C++ Primer”, Fifth Edition, Pearson Education, 2012. |
| 4. | Bjarne Stroustrup, “The C++ Programming Language”, Fourth Edition, Pearson Education, 2013. |
| 5. | S.Sobana, R.Manivannan and G.Immanuel, “Communication and Soft Skills”, VK Publications, 2016. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 2 | 2 | - | 1 | 1 | 1 | - | - | - | 1 | 2 | 2 | 1 | 2 |
| CO2 | 2 | 2 | 2 | - | 1 | 1 | 1 | - | - | - | 1 | 2 | 2 | 1 | 2 |
| CO3 | 2 | 2 | 2 | - | 1 | 1 | 1 | - | - | - | 1 | 2 | 2 | 1 | 2 |
| CO4 | - | - | - | - | - | - | - | 1 | 2 | 2 | - | 2 | - | - | - |
| CO5 | - | - | - | - | - | - | - | 1 | 2 | 2 | - | 2 | - | - | - |
| CO | 2 | 2 | 2 | - | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 |

3-High, 2- Medium, 1-Low

| AC22501 | ENTREPRENEURSHIP DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 0 |

**COURSE OBJECTIVES**

The main learning objective of this course is to prepare the students for:

- Explaining the types, characteristics of entrepreneurship and its role in economic development.
- Applying the theories of achievement motivation and the principles of entrepreneurship development program to enterprise.
- Selecting the appropriate form of business ownership in setting up an enterprise.

| | | |
|---|---|---|
| • Applying the fundamental concepts of finance and accounting to enterprise. | | |
| • Identifying sickness in industry, selecting the appropriate corrective measures, and identifying the growth strategies in enterprise. | | |
| **UNIT I** | **ENTREPRENEURSHIP** | **6** |
| Entrepreneur - Characteristics - Types of Entrepreneurs - Difference between Entrepreneur and Intrapreneur, Entrepreneurial Competencies - Role of Entrepreneurship in Economic Development - Factors Affecting Entrepreneurial Growth. | | |
| **UNIT II** | **BUSINESS PLAN** | **6** |
| Sources of business ideas and tests of feasibility: Significance of writing the business plan/ project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation; Project Appraisal, preparation of project report. | | |
| **UNIT III** | **SMALL SCALE INDUSTRIES** | **6** |
| Legal formalities in setting up of SSIs, Business Laws, Governmental Setup in promoting small industries, Status of Small Scale Industrial Undertakings, Steps in starting a small industry, Ownership Structures. | | |
| **UNIT IV** | **FINANCING AND ACCOUNTING** | **6** |
| Finance: Need, Sources, Capital Structure, Term Loans - Accounting: Need, Objectives, Process, Journal, Ledger, Trial Balance, Final Accounts - Working Capital Management. | | |
| **UNIT V** | **SUPPORT TO ENTREPRENEURS** | **6** |
| Government Policy for Small Scale Enterprises - Institutional Support to Entrepreneurs: Need and Support - Taxation Benefits to Small Scale Industry, Social Responsibility of Business. | | |
| | | **TOTAL PERIODS: 30** |
| **COURSE OUTCOMES** | | |
| Upon completion of this course, the students will be able to: | | |
| **CO1:** | Explain the types, characteristics of entrepreneurship and its role in economic Development | |
| **CO2:** | Apply the theories of achievement motivation and the principles of entrepreneurship development program. | |
| **CO3:** | Select the appropriate form of business ownership in setting up an enterprise. | |
| **CO4:** | Apply the fundamental concepts of finance and accounting to enterprise. | |
| **CO5:** | Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise. | |
| **TEXT BOOKS** | | |

| | |
|---|---|
| 1. | S.S.Khanka, “Entrepreneurial Development”, S.Chand & Co. Ltd, 2007. |
| 2. | Kurahko & Hodgetts, “Entrepreneurship – Theory, process and practices”, Sixth Edition, Thomson learning, 2010. |
| **REFERENCE BOOKS** | |
| 1. | Charantimath P. M., “Entrepreneurship Development and Small Business Enterprises”, Pearson Education, 2006. |
| 2. | Hisrich R D and Peters M P, “Entrepreneurship”, Fifth Edition, Tata McGraw-Hill, 2002. |
| 3. | Mathew J Manimala, “Entrepreneurship theory at cross roads: paradigms and praxis”, Second Edition, Dream tech, 2006. |
| 4. | Rabindra N. Kanungo, “Entrepreneurship and innovation”, Sage Publications, 1998. |
| 5. | Singh, A. K., “Entrepreneurship Development and Management”, University Science Press, 2009. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | - | 1 | - | - | 1 | - | 1 | 2 | 1 | 2 | - | 1 | - | - | 1 |
| CO2 | - | - | 1 | - | 1 | 1 | 1 | 2 | 2 | 2 | - | 1 | - | - | 1 |
| CO3 | - | - | 1 | - | - | 2 | 1 | 1 | 1 | 1 | - | 1 | - | - | 1 |
| CO4 | 1 | - | 1 | - | - | 2 | 1 | - | 1 | 1 | 1 | - | - | - | 1 |
| CO5 | - | 1 | - | 1 | - | 1 | 1 | - | 1 | 1 | - | 1 | - | - | 1 |
| CO | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | - | - | 1 |

3-High, 2- Medium, 1-Low

| HS22501 | VALUE EDUCATION – II | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 0 |

**Course objectives**

- To impart knowledge on essential qualities to become a good leader.
- To prepare them to have the ability to relate with others and contribute to industrial and human development.
- To teach the significance of being responsible citizens of the society.

| | | |
|---|---|---|
| **UNIT I** | **UNDERSTANDING THE SOCIETY AND BECOMING A LEADER** | **3** |
| Problems of our society and their causes – styles of leadership – qualities and skills of leadership. | | |
| **UNIT II** | **PRACTICING LEADERSHIP FOR SOCIAL CHANGE** | **4** |
| Possible areas of changes in the society with education – Utilising Engineering education to create social changes – strategies and people movement for the change. | | |
| **UNIT III** | **BALANCING PROFESSIONAL, PERSONAL, FAMILY FOR FULLNESS OF LIFE** | **4** |
| Healthy adult as an individual and family – stages of life – strategies to balance life. | | |
| **UNIT IV** | **INNOVATIVE SOCIAL COMMITMENT, SPIRITUALITY AND SOCIAL NETWORKING** | **4** |
| Social commitment as a healthy spirituality – systematic contribution to society and industry – Networking professionals for growth and change. | | |
| | | **TOTAL PERIODS: 15** |
| **COURSE OUTCOMES** | | |
| **Upon completion of the course, the students will be able to** | | |
| **CO1:** | Demonstrate the essential steps to become good leaders. | |
| **CO2:** | Identify the various societal problems and also the solution. | |
| **CO3:** | Realise their role and contribution to nation building. | |
| **CO4:** | Apply the essential steps to become value based professionals. | |
| **TEXT BOOKS:** | | |
| 1. | Warren G.Bennis. “On Becoming a Leader. Basic Books”, 2009. | |
| 2. | Suresh Agarwal, “Social Problems in India”, Rajat Publications, 2015. | |
| **REFERENCES:** | | |
| 1. | Biswaranjan Mohanty, “Constitution, Government and Politics in India”, New Century Publication, 2009. | |
| 2. | Myles Munroe, “Releasing Your Potential”, Destiny Image, 2007. | |
| 3. | Kelsang Gyatso, “How to Solve Our Human Problems: The Four Noble Truths”, Tharpa Publications, 2005. | |
| 4. | Ifeanyi Enoch Onuoha , “Overcoming the challenges of life”, Author house, 2011. | |

| | |
|---|---|
| 5. | John C Maxwell, "Five Levels of Leadership, the Proven Steps to Maximize Your Potential", Center Street, 2011. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | **1** | **2** | **3** |
| CO1 | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |
| CO2 | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |
| CO3 | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |
| CO4 | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |
| CO | - | - | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 | - | - | 1 |

3-High, 2- Medium, 1-Low

| **HS22601** | **PROFESSIONAL ETHICS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES:**

- To identify and analyze ethical issues in engineering
- To recognize the code of ethics with appropriate perspective as per industrial standards
- To understand the ethical situations in risky situation
- To provide services in their areas of expertise
- To be aware of the role of engineers in solving global issues

| **UNIT I** | **ENGINEERING ETHICS, MORAL REASONING AND ETHICAL THEORIES** | **10** |
|---|---|---|

Senses of 'Engineering Ethics' – Variety of Moral Issues – Types of Inquiry – Social Ethics vs Scientific Ethics vs Experiential Ethics – Moral Dilemmas – Moral Autonomy – Kohlberg's Theory – Gilligan's Theory – Professions and Professionalism – Professional Ideals and Virtues – Theories about Right Action – Uses of Ethical Theories.

| **UNIT II** | **ENGINEERING AS SOCIAL EXPERIMENTATION** | **8** |
|---|---|---|

Role of Professional Ethics in Engineering Based Product Development – Engineering as Experimentation – Engineers as Responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – Case Study.

| **UNIT III** | **ENGINEERS' RESPONSIBILITY FOR SAFETY AND RISK** | **8** |
|---|---|---|

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analyses and Reducing Risk – Case Studies.

| **UNIT IV** | **RESPONSIBILITIES AND RIGHTS** | **9** |
|---|---|---|

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Whistle Blowing – Employee Rights – Discrimination – Intellectual Property Rights (IPR).

| **UNIT V** | **GLOBAL ISSUES AND ROLE OF ENGINEERS** | **10** |
|---|---|---|

Multinational Corporations – Environmental Ethics – Computer Ethics – Ethics of AI – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Corporate Social Responsibility – Ethics in Engineering Practice and Research – Ethical Audit.

**TOTAL: 45 PERIODS**

| COURSE OUTCOMES: | |
|---|---|
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Visualize the scope of engineering ethics and ethical decision making. |
| **CO2:** | Develop a perspective on engineering as an experiment. |
| **CO3:** | Detail the importance of assessing safety and risk and reducing the risk. |
| **CO4:** | Realize the responsibilities and rights of engineers, employees, employers and public. |
| **CO5:** | Recognize the role of ethics related to MNC, Environment, Computer, Weapons, and while acting as manager, consultant, and experts. |
| **TEXT BOOKS:** | |
| 1. | Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill Education, 2017. |
| 2. | Govindarajan M, Natarajan S, Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India Pvt. Ltd., 2015. |
| **REFERENCES:** | |
| 1. | Robert McGinn R., "The Ethical Engineer: Contemporary Concepts & Cases", Princeton University Press, February 2018. |
| 2. | Mark Coeckelbergh, "AI Ethics", The MIT Press, April 2020. |
| 3. | Qin Zhu, Mike Martin and Roland Schinzinger, "Ethics in Engineering", Fifth Edition , McGraw Hill, , 2022. |
| 4. | Deborah C. Poff and Alex C. Michalos, "Encyclopedia of Business and Professional Ethics", Springer Nature, Switzerland AG, May 2023. |
| 5. | Frederic G. Reamer, "Social Work Values and Ethics", Sixth Edition, Columbia University Press, New York, , May 2024. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course Outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | - | - | - | - | - | - | - | 3 | - | - | - | - | - | - | 2 |
| CO2 | - | - | - | - | - | 2 | - | 3 | - | - | - | - | - | - | 2 |
| CO3 | - | - | - | - | - | 1 | - | 3 | - | - | - | - | - | - | 2 |
| CO4 | - | - | - | - | - | - | - | 3 | - | - | - | - | - | - | 2 |
| CO5 | - | - | - | - | - | 2 | 2 | 3 | 2 | 1 | - | 2 | - | - | 2 |
| CO | - | - | - | - | - | 2 | 2 | 3 | 2 | 1 | - | 2 | - | - | 2 |

3-High, 2- Medium, 1-Low

| CS22601 | COMPILER DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

| COURSEOBJECTIVES: |
|---|
| • To learn the various phases of compiler. |
| • To learn the various parsing techniques. |
| • To understand intermediate code generation and run-time environment. |

- To learn to implement front-end of the compiler.
- To learn to implement code generator.

| UNIT I | INTRODUCTION TO COMPILERS AND LEXICAL ANALYSIS | 9 |
|---|---|---|

Introduction - Language Processors- The Structure of a Compiler- Compiler-Construction Tools- Lexical Analysis- The Role of the Lexical Analyzer- Tokens, Patterns, and Lexemes- Specification of Tokens - The Lexical-Analyzer Generator Lex - Finite Automata - Construction of an NFA from a Regular Expression - Conversion of an NFA to a DFA - Minimizing the Number of States of a DFA

| UNIT II | SYNTAX ANALYSIS | 9 |
|---|---|---|

Syntax Analysis - The Role of the Parser- Syntax Error Handling- Error-Recovery Strategies- Context-Free Grammars – Derivations - Parse Trees – Ambiguity - Top-down parsing - Recursive descent parser - Predictive parser - bottom-up parsing - shift reduce parser - LR parsers - Construction of SLR parsing table –YACC

| UNIT III | SYNTAX-DIRECTED TRANSLATION AND INTERMEDIATE-CODE GENERATION | 9 |
|---|---|---|

Syntax-Directed Definitions - Evaluation Orders for SDD's - Construction of Syntax tree - Directed Acyclic Graphs for Expressions - Three-Address Code - Types and Declarations - Translation of Expressions - Type Checking

| UNIT IV | RUN-TIME ENVIRONMENTS AND CODE GENERATION | 9 |
|---|---|---|

Storage Organization - Static Versus Dynamic Storage Allocation - Stack Allocation of Space - Heap Management - Issues in the Design of a Code Generator - A simple code Generator- Optimal Code Generation for Expressions

| UNIT V | CODE OPTIMIZATION | 9 |
|---|---|---|

Basic Blocks and Flow Graphs- DAG -The Principal Sources of Optimization –Optimization of Basic Blocks – Peep-hole optimization- Data-Flow Analysis - Reaching Definitions- Live-Variable Analysis - Available Expressions.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Describe different phases of the compiler and design a lexical analyzer for a sample language. |
| **CO2:** | Explain semantics rules (SDT) and intermediate code generation. |
| **CO3:** | Summarize various storage allocation strategies and machine code generation for simple language constructs. |
| **CO4:** | Develop parsers using different parsing algorithms for a given grammar. |
| **CO5:** | Implement various optimization techniques to improve the performance of the compiler. |

**TEXT BOOKS:**


| | |
|---|---|
| 1. | Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, Updated Second Edition, Pearson Education, 2023. |

| | |
|---|---|
| 2. | Douglas Thain, “Introduction to Compilers and Language Design”, Second Edition, Independently Published, 2020. |
| **REFERENCES:** | |
| 1. | K. Muneeswaran, “Compiler Design”, Oxford University Press, 2013. |
| 2. | Keith D Cooper and Linda Torczon, “Engineering a Compiler”, Third Edition, Morgan Kaufmann Publishers Elsevier Science, 2022. |
| 3. | Santanu Chattopadhyay, “Compiler Design”, PHI Learning Pvt. Ltd., 2015. |
| 4. | John I Moore,” Introduction to Compiler Design - An Object-Oriented Approach Using Java”, Third Edition, Softmoore Consulting, 2019. |
| 5. | V. Raghavan, “Principles of Compiler Design”, Tata McGraw Hill Education Publishers, 2017. |

**Mapping of Course Outcomes to Programe Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | 3 |

3-High, 2- Medium, 1-Low

| IT22601 | DATA SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python.

| UNIT I | INTRODUCTION | 6 |
|---|---|---|

Data Science: Benefits and uses - facets of data - Data Science Process: Overview - Defining research goals - Retrieving data - Data preparation - Exploratory Data analysis - build the model- presenting findings and building applications.

| UNIT II | DESCRIBING DATA | 6 |
|---|---|---|

Types of Data - Types of Variables -Describing Data with Tables and Graphs -Describing

| | | |
|---|---|---|
| Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores. | | |
| **UNIT III** | **DESCRIBING RELATIONSHIPS** | **6** |
| Correlation -Scatter plots -correlation coefficient for quantitative data -computational formula for correlation coefficient - Regression -regression line -least squares regression line - Standard error of estimate. | | |
| **UNIT IV** | **PYTHON LIBRARIES FOR DATA WRANGLING** | **6** |
| Basics of Numpy arrays -aggregations -computations on arrays -comparisons, masks, boolean logic - fancy indexing - structured arrays - Data manipulation with Pandas - operating on data - missing data - aggregation and grouping. | | |
| **UNIT V** | **DATA VISUALIZATION** | **6** |
| Importing Matplotlib - Line plots - Scatter plots - density and contour plots - Histograms - legends - colors - subplots - text and annotation – three-dimensional plotting. | | |
| | | **TOTAL PERIODS: 30** |
| **PRACTICAL EXERCISES** | | |
| 1. | Working with Numpy arrays. | |
| 2. | Working with Pandas data frames. | |
| 3. | Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set. | |
| 4. | Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:<br>a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis<br>b. Bivariate analysis: Linear and logistic regression modeling | |
| 5. | Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:<br>a. Multiple Regression analysis<br>b. Also compare the results of the above analysis for the two data sets | |
| 6. | Apply and explore the below plotting functions on UCI data sets<br>a. Normal curves<br>b. Density and contour plots<br>c. Correlation and scatter plots<br>d. Three-dimensional plotting Visualizing Geographic Data with Base map | |
| 7. | Case Study- Use machine learning models to predict the likelihood of diseases such as diabetes, cancer or heart disease based on patient data. | |
| | | **TOTAL PERIODS: 30** |
| **COURSE OUTCOMES** | | |

| Upon completion of the course, students will be able to | |
|---|---|
| **CO1:** | Describe the data science process. |
| **CO2:** | Explore different types of data description for data science process. |
| **CO3:** | Build knowledge on relationships between data. |
| **CO4:** | Use the Python Libraries for Data Wrangling. |
| **CO5:** | Apply visualization Libraries in Python to interpret and explore data |
| **CO6:** | Infer different visualization tools and techniques to leverage the visualization ofdata set. |
| **TEXT BOOKS** | |
| 1. | Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. |
| 2. | Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media Inc., 2022. |
| **REFERENCES:** | |
| 1. | David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. |
| 2. | Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press,2014. |
| 3. | Peter Bruce and Andrew Bruce, "Practical Statistics for Data Scientists", O'Reilly Media Inc., 2020. |
| 4. | Wes McKinney, "Python for Data Analytics", Third Edition, O'Reilly Media Inc., 2022. |
| 5. | Roger D. Peng and Elizabeth Matsui, "The Art of Data Science — A Guide for Anyone Who Works With Data", Lulu.com, 2016. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 2 | - | 2 | - | - | - | - | 1 | - | - | - | 2 | - |
| CO2 | 3 | 2 | 2 | - | 2 | - | - | - | - | 1 | - | - | - | 2 | - |
| CO3 | 3 | 2 | 2 | - | 2 | - | - | - | - | 1 | - | - | - | 2 | - |
| CO4 | 3 | 2 | 2 | - | 2 | - | - | - | - | 1 | - | - | - | 2 | - |
| CO5 | 3 | 2 | 2 | - | 2 | - | - | - | - | 1 | - | - | - | 2 | - |
| CO6 | 3 | 2 | 2 | - | 2 | - | - | - | - | 1 | - | - | - | 2 | - |
| CO | 3 | 2 | 2 | - | 2 | - | - | - | - | 1 | - | - | - | 2 | - |

3-High, 2- Medium, 1-Low

| SD22601 | CODING SKILLS AND QUANTITATIVE APTITUDE – PHASE I | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

- To create a simple, React Application using React Components.
- To implement Routing and API Integration in React Applications.
- To gain hands-on experience with real-world React Applications.
- To improve aptitude, problem solving skills and reasoning ability of the students.
- To demonstrate the use of mathematical reasoning by justifying through numerical skills.

| UNIT I | FRONT END ENGINEERING WITH REACT&QA & LR | 12 |
|---|---|---|

Basic HTML and JavaScript – JSX- Introduction to React- Setting up the environment – Creating first React Component.
**Quants: Numbers** – Number Systems, Types of Numbers, Series (Arithmetic Progression, Geometric Progression), HCF & LCM, Decimal Fractions, Simplification (Including Expression & Evaluation).
**Logical Reasoning -** Analogy - Blood Relations/Family Tree.

| UNIT II | WORKING WITH REACT COMPONENTS & QA & LR | 12 |
|---|---|---|

React Components: Component properties – Component State – Handling Events- Life Cycle Methods and Hooks- Conditional Rendering- List and Keys - Forms and User Input.
**Quants: Average**-Problem on Ages.
**Logical Reasoning:** Coding-Decoding.

| UNIT III | STYLING IN REACT & ROUTING & QA & LR | 12 |
|---|---|---|

Styling React Components – Routing: Introduction to React Router- Nested Routes – Redirects and Navigation.
**Quants: Ratio & Proportions** - Partnership-Mixtures and Alligations.
**Logical Reasoning:** Cryptarithmetic Problems, Syllogisms.

| UNIT IV | STATE MANAGEMENT & QA & LR | 12 |
|---|---|---|

Context API Basics – Context Provider and Consumer – useContext hook
**Quants: Time & Work-Chain Rule-Pipes and Cisterns**
**Logical Reasoning -** Calendar – Clocks - Images (Mirror & Water).

| UNIT V | WORKING WITH APIS & QA & LR | 12 |
|---|---|---|

Fetching Data – Displaying Fetched Data – Updating Data – Project Work.
**Quants: Time,Speed & Distance -** Problems on Trains,Boats & Streams.
**Logical Reasoning:** Cubes and Dices - Data Sufficiency.

**SUGGESTIVE ASSESSMENT METHODS**

| | |
|---|---|
| 1 | Pre-Assessment Test – To check the student's previous knowledge in Programming skills and quantitative aptitude and logical reasoning. |

| | |
|---|---|
| 2 | Internal Assessment I for coding skills and quantitative aptitude will be conducted for 100 marks whichare then calculated to 30. |
| 3 | Internal Assessment II for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30. |
| 4 | For assignments, students should attend all the practice tests conducted online on HackerRank and google form. Each assignment will be for 100 marks and finally the total marks obtained by a student in all assignments will be reduced to 40 marks. |
| 5 | Thus 60 marks from internal and 40 marks from assignments will make it a total of 100. |
| | **TOTAL PERIODS: 60** |
| **COURSE OUTCOMES** | |
| Upon completion of the course, the students will be able to: | |
| **CO1:** | Construct a basic React application. |
| **CO2:** | Apply Routing and API Integration in web applications. |
| **CO3:** | Construct a real-world React application |
| **CO4:** | Apply quantitative techniques to solve a variety of problems and can enhance their employability quotient and to establish a stronger connection with the technical environment in which they operate. |
| **CO5:** | Interpret solutions for problems within short duration and can also think critically and apply basic mathematics skills to interpret data, draw conclusions and solve problems. |
| **TEXT BOOKS** | |
| 1. | Robin Wieruch," The Road to React: with React18 and React Hooks", CreateSpace Independent Publishing Platform, 2024. |
| 2. | Stoyan Stefanov, "React: Up & Running: Building Web Applications", Second Edition, O' Reilly Publications, 2021. |
| 3. | Agarwal R.S, "Quantitative Aptitude," S.Chand and Company Pvt. Ltd., New Delhi, 2023. |
| 4. | Agarwal R.S, "A Modern Approach to Verbal and Non-Verbal Reasoning," S.Chand and Company Pvt. Ltd.,New Delhi, 2016. |
| **REFERENCES** | |
| 1 | Zac Gordan, Mikall Angela Hill and RobbieAddair, "React Explained: Your Step-By-Step Guide to React", OSTraining Publishers, 2020. |
| 2 | Alex Banks and Eve Porcello, "Learning React: Functional Web Development with React and Redux", O' Reilly Publications, 2017. |

| | |
|---|---|
| 3 | Anand P A, “Quantitative Aptitude,” Wiley India Pvt. Ltd., New Delhi, 2016. |
| 4 | Arun Sharma, “How to Prepare for Logical Reasoning,” Tata-McGraw Hill Education Series. New Delhi, 2016. |
| 5 | Sharon Weiner Green and Ira K Wolf, “Barron’s GRE,” Barron Publishers, 2016. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | 2 | 2 | - | - |
| CO2 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | 2 | 2 | - | - |
| CO3 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | 2 | 2 | - | - |
| CO4 | 1 | 1 | 1 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - |
| CO5 | 1 | 1 | 1 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - |
| CO | 2 | 2 | 2 | - | 2 | - | - | - | 1 | - | - | 2 | 2 | - | - |

3-High, 2- Medium, 1-Low

## SEMESTER VII

| MS22701 | PRINCIPLES OF MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To explain the evolution of Management and its principles.
- To discuss the functions of Management and their importance in business.
- Learn the application of the principles in an organization like planning, organizing, directing and controlling.
- Analyze the position of self and company goals towards business.

| UNIT I | INTRODUCTION TO MANAGEMENT | 9 |
|---|---|---|

Definition of Management – Role of Managers in the Workplace – Management Functions, Levels, Roles and Skills – Evolution of Management – Influence of the External Environment and the Organization’s Culture – Diversity, Equity, and Inclusion – Types of Business organizations – Managing in a Global Environment – Managing Corporate Social Responsibility and Ethics – Current trends and issues.

| UNIT II | PLANNING | 9 |
|---|---|---|

Foundations of planning – Planning process – Types of planning – Objectives – Setting objectives – MBO – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making process –Entrepreneurial Ventures – Business Plan Development in Entrepreneurship – Contemporary issues in planning.

| UNIT III | ORGANIZING AND STAFFING | 9 |
|---|---|---|

Nature and purpose – Organization structure design – Departmentalization – Delegation of authority – Centralization and decentralization – Managing Human Resources – HR Planning –

| | | |
|---|---|---|
| Recruitment and Decruitment – Selection, Orientation, Training and Development, Performance Management – Career planning, development and management – Managing change and innovation – Recent issues in HRM. | | |
| **UNIT IV** | **DIRECTING AND LEADING** | 9 |
| Understanding and managing individual behavior –Perception, Personality, Attitude, and Learning – Motivating Employees – Motivation theories – Managing Groups and Teams – Team Dynamics – Effective Leadership – quality, styles, skills and theories of leadership – Communication management – Process and Forms of communication – Barrier in communication – Effective communication styles and Negotiation skills. | | |
| **UNIT V** | **MANAGEMENT CONTROL** | 9 |
| Management control – Use of computers and IT in Management control – System and process of controlling – Planning and Control Techniques- PERT- CPM-Productivity problems and management – Control and performance – Direct and preventive control – Levers of control framework – Reporting – Managing Operations – Modern issues in control. | | |
| **TOTAL: 45 PERIODS** | | |

| **COURSE OUTCOMES:** | |
|---|---|
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Outline the fundamentals of Managerial functions and Business Environment. |
| **CO2:** | Explain the various planning processes and become competent when involved in team to achieve success. |
| **CO3:** | Demonstrate the concept of organizing for the effective functioning of a management. |
| **CO4:** | Practice and develop managerial styles to anticipate the consequences of each leadership style. |
| **CO5:** | Apply the controlling techniques to the practical situations concerning the management of people and organizations in real business life. |

| **TEXT BOOKS:** | |
|---|---|
| 1. | Stephen P. Robbins, Mary A. Coulter and Lori Long, "Management", 16th Edition Pearson Education, 2024. |
| 2. | P C Tripathi, P N Reddy, Ashish Bajpai, "Principles of Management", Tata McGraw Hill, 2021. |

| **REFERENCES:** | |
|---|---|
| 1 | Almas Sabir, "Principles of Management", Partridge Publishing Singapore, 2019. |
| 2 | Harold Koontz, Heinz Weihrich and Mark V. Cannice, "Essentials of Management", Tata McGraw Hill, 2020. |
| 3 | Chandran J S, " Principles of Management- Text & Cases", Third Edition, Sultan & Chand publications, 2024. |
| 4 | Oliver Laasch, "Principles of Management: Practicing Ethics, Responsibility, Sustainability", Second Edition, SAGE Publications Ltd, 2021. |
| 5 | David Bright, "Principles of Management", 2023. |

**Mapping of Course Outcomes to Programme Outcomes**

| **Course Outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 2 |
| CO2 | - | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO3 | 1 | - | - | 2 | - | - | 1 | - | 2 | - | 1 | 1 | - | - | 2 |
| CO4 | - | 1 | 1 | 1 | 2 | - | - | 1 | 2 | - | - | - | - | - | 1 |
| CO5 | 1 | - | - | - | 1 | 1 | - | - | - | 3 | - | 1 | - | - | 1 |
| CO | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 3 | 1 | 1 | - | - | 2 |

3-High, 2- Medium, 1-Low

| IT22701 | CRYPTOGRAPHY AND NETWORK SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To understand OSI security architecture, Algorithms and Systems.
- To acquire fundamental knowledge on the concepts of classical, modern conventional encryption and Finite fields of number theory.
- To describe the principles of public key cryptosystems and key management.
- To gain the knowledge on security practices of hash functions, digital signature and system security.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

| UNIT I | INTRODUCTION & NUMBER THEORY | 9 |
|---|---|---|

Computer security concepts-OSI security architecture -Security Services, Mechanisms and Attacks -Fundamental security design principles-Network security model-Introduction to Number Theory

| UNIT II | SYMMETRIC CIPHERS | 9 |
|---|---|---|

Classical Encryption techniques -Block ciphers and Data Encryption Standards-Finite Fields-Advanced Encryption Standard (AES) -Block cipher operations-Random bit generation and stream ciphers.

| UNIT III | ASYMMETRIC CIPHERS | 9 |
|---|---|---|

Public key cryptography and RSA - Key Management and Distribution - Diffie Hellman Key Exchange - ElGamal Cryptosystem - Elliptic Curve Arithmetic-Elliptic Curve Cryptography, Cryptanalysis.

| UNIT IV | CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS AND MUTUAL TRUST | 9 |
|---|---|---|

Cryptographic Hash Functions-Message Authentication Codes**:** Authentication requirement - Authentication function -Security of MAC-SHA-HMAC- DSS-User Authentication: Kerberos.

| UNIT V | SECURITY PRACTICE AND SYSTEM SECURITY | 9 |
|---|---|---|

| | |
|---|---|
| Electronic Mail security - PGP, S/MIME - IP security -- System Security: Intruders - Malicious software - viruses - Firewalls. | |
| **TOTAL PERIODS: 45** | |
| **COURSE OUTCOMES** | |
| Upon completion of the course, students will be able to | |
| **CO1:** | Illustrate the fundamentals of networks security, security architecture, threats and vulnerabilities. |
| **CO2:** | Apply the different cryptographic operations of symmetric cryptographic algorithms. |
| **CO3:** | Apply the different cryptographic operations of public key cryptography. |
| **CO4:** | Apply the various authentication schemes to simulate different applications. |
| **CO5:** | Demonstrate various security practices and system security standards. |
| **TEXT BOOKS** | |
| **1.** | William Stallings, "Cryptography and Network Security: Principles and Practice", Eighth Edition, Tata McGraw Hill Education, 2023. |
| **2.** | Behrouz A Foruzan, Debdeep Mukhopadhyay, "Cryptography and Network Security",Third Edition, Tata McGraw Hill Education,2015. |
| **REFERENCE BOOKS** | |
| **1.** | C K Shyamala, N Harini and Dr. T R Padmanabhan, "Cryptography and Network Security", Second Edition, Wiley India Pvt.Ltd ,2012. |
| **2.** | Charlie Kaufman, Radia Perlman, and Mike Speciner, "Network Security: PRIVATE Communication in a PUBLIC World", Third Edition, Pearson Education,2024. |
| 3. | Bruce Scheneier, "Applied Cryptography", Second Edition, John Wiley & Sons, 2008. |
| 4. | David M. Durton, "Elementary Number Theory", Seventh Edition, Tata Mcgraw Hill, 2023. |
| 5. | William Stallings "Network Security Essentials: Applications and Standards", Sixth Edition, Pearson Education, 2018. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO4 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO5 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 2 | 3 | - | - |

3-High, 2- Medium, 1-Low

| IT22702 | SECURITY LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

- To learn different cipher techniques.
- To implement the algorithms DES, RSA,MD5,SHA-1.
- To use network security tools and vulnerability assessment tools.

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1. | Perform encryption, decryption using the following substitution techniques<br>(i) Ceaser cipher, ii) Playfair cipher iii) Hill Cipher iv) Vigenere cipher |
| 2. | Perform encryption and decryption using following transposition techniques<br>(i)Rail fence ii) Row & Column Transformation. |
| 3. | Apply DES algorithm for practical applications. |
| 4. | Apply AES algorithm for practical applications. |
| 5. | Implement RSA Algorithm using HTML and JavaScript. |
| 6. | Implement the Diffie-Hellman Key Exchange algorithm for a given problem |
| 7. | Calculate the message digest of a text using the SHA-1 algorithm |
| 8. | Implement the SIGNATURE SCHEME - Digital Signature Standard |
| 9. | Demonstrate intrusion detection system (IDS) using any tool eg. Snort or any other s/w. |
| 10. | Automated Attack and Penetration Tools<br>Exploring N-Stalker, a Vulnerability Assessment Tool |
| 11. | Defeating Malware<br>i) Building Trojans ii) Rootkit Hunter |

**TOTAL PERIODS: 60**

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Develop code for classical Encryption Techniques to solve the problems. |
| **CO2:** | Build cryptosystems by applying symmetric and public key encryption algorithms. |
| **CO3:** | Construct code for authentication algorithms. |
| **CO4:** | Develop a signature scheme using Digital signature standard. |
| **CO5:** | Demonstrate the network security system using open source tools. |

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

| |
|---|
| SOFTWARE: C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker or Equivalent<br>HARDWARE: Standalone desktops - 30 Nos. (or) Server supporting 30 terminals or more. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO2 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 3 | 3 | - | - |
| CO3 | 3 | 3 | 3 | 1 | - | - | - | - | 3 | - | - | 2 | 3 | - | - |
| CO4 | 3 | 3 | 3 | 2 | 3 | - | - | - | 3 | - | - | 3 | - | - | - |
| CO5 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | - | - |
| CO | 3 | 3 | 3 | 2 | 3 | - | - | - | 3 | - | - | 3 | 3 | - | - |

3-High, 2- Medium, 1-Low

| IT22703 | MINI PROJECT | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 6 | 3 |

**COURSE OBJECTIVES**

- To determine a particular issue pertaining to the needs of sustainable growth of the society and gather data on it by conducting a thorough investigation.
- To develop the methodology to solve the identified problem.
- To implement a project using the identified methodology with modern tools.
- To prepare students to write project reports and to take viva-voce exams and reviews.

**SYLLABUS**

The group of students works on a specific topic approved by a faculty member who is familiar with this area of interest. The batch can identify any problem that is relevant to his/her specialization of the program. The batch should do the detailed investigation related to the area of work, and they should identify methodology/algorithm for carrying out the work. At the end of the semester, the final product and a detailed report on the work done should be submitted. The students will be evaluated through a viva-voce examination by a panel of examiners, including one external examiner.

**TOTAL: 90 PERIODS**

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Identify any real-world problem and find the optimal solution by applying gathered knowledge and skills. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

3-High, 2- Medium, 1-Low

| SD22701 | CODING SKILLS AND QUANTITATIVE APTITUDE TRAINING – PHASE II | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

- To help students to work with Database
- To help them create a simple Spring Boot application and gain foundational skills in Spring Boot by exploring Spring Boot Starters, RESTful web services, Dependency Injection, and handling HTTP methods effectively.
- To make them to learn to create and use repositories, perform basic CRUD operations with JPA Repository, and apply these skills in a hands-on project.
- To improve aptitude, problem solving skills and reasoning ability of the students.
- Demonstrate the use of mathematical reasoning by justifying through numerical skills.

| UNIT I | DATABASE BASICS & QUANTS – TIME, SPEED AND DISTANCE | 12 |
|---|---|---|

Introduction to Database- Database Design Principles – SQL Basics – Querying a Database

**Quants: Time, Speed and Distance -** Time, Speed & Distance - Problems on Trains- Boats & Stream

| UNIT II | DEVELOPING BACK END USING SPRING BOOT & QUANTS – PERCENTAGE & INTEREST | 12 |
|---|---|---|

Introduction to Spring Boot – Creating a simple Spring Boot Application- Bean Scopes and Life Cycle

**Quants: Percentage & Interest -** Percentage-Interest (Simple Interest, Compound Interest)-Profit & Loss

| UNIT III | BUILDING RESTFUL WEB SERVICES & QUANTS – PROBABILITY | 12 |
|---|---|---|

Spring Boot Starters – Introduction to REST - Dependency Injection – Handling HTTP Methods

**Quants: Probability -** Probability-Permutations & Combinations

| UNIT IV | DATA PERSISTENCE WITH SPRING DATA JPA & LOGICAL REASONING | 12 |
|---|---|---|

| | | |
|---|---|---|
| Path Variables and Request Parameters – Overview of JPA and Hibernate – Setting up Spring Data JPA in a Spring Boot project.<br>**Logical Reasoning:** Data Interpretation (Tabulation, Bar Chart, Pie Chart, Line Graphs)- Direction sense test - Linear/Seating Arrangements - Series completion | | |
| **UNIT V** | **CREATING AND USING REPOSITORIES & LOGICAL REASONING** | **12** |
| Creating and using Repositories – Basic CRUD operations with JPA Repository – Project Work.<br>**Logical Reasoning:** Logical Venn Diagram/Syllogisms - Odd man out/Finding missing elements - Crypt arithmetic Questions – Puzzles | | |
| | | **TOTAL PERIODS:60** |
| **Suggestive Assessment Methods:** | | |
| 1 | Pre-Assessment Test - To check the student's previous knowledge in Programming skills and quantitative aptitude and logical reasoning. | |
| 2 | Internal Assessment I for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30. | |
| 3 | Internal Assessment II for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30. | |
| 4 | Post-Assessment - Evaluating students' knowledge gained from the Coding Skill and Quantitative Aptitude – Phase I Skill Development Course. | |
| 5 | For assignments, students should attend all the practice tests conducted online on HackerRank and google form. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks. | |
| 6 | The total of 100 marks obtained from the tests will be then reduced to 60 marks and additional of 40marks will be given for assignments which will make it a total of 100. | |
| **COURSE OUTCOMES** | | |
| On completion of this course, the students will be able to: | | |
| **CO1:** | Design and Query a Database. | |
| **CO2:** | Utilize Spring Boot Starters, develop RESTful web services, implement Dependency Injection, and effectively handle various HTTP methods. | |
| **CO3:** | Implement a hands-on project using Spring Boot. | |
| **CO4:** | Apply quantitative techniques to solve variety of problems and can enhance their employability quotient and to establish a stronger connect with the technical environment in which they operate. | |
| **CO5:** | Find solutions for problems within short duration and can also think critically and apply basic mathematics skills to interpret data, draw conclusions and solve problems. | |
| **TEXT BOOKS** | | |

| | |
|---|---|
| 1 | Craig Walls, “Spring Boot in Action”, Sixth Edition, Manning Publishers, March 2022. |
| 2 | Agarwal R.S, “Quantitative Aptitude,” S.Chand and Company Pvt. Ltd., New Delhi, 2016. |
| **REFERENCES** | |
| 1 | Alex Antonov, “Spring Boot 2.0 Cookbook”, Second Edition, Packt Publishers, 2018. |
| 2 | Felipe Gutierrez, “Pro Spring Boot 2: An authorative Guide to Building Microservices, Web and Enterprise Applications, and Best Practices”, Second Edition, ApressPublishers,2018. |
| 3 | Anand P A, “Quantitative Aptitude,” Wiley India Pvt. Ltd., New Delhi,2016. |
| 4 | Agarwal R.S, “A Modern Approach to Verbal and Non-Verbal Reasoning,” S.Chand and Company Pvt. Ltd.,New Delhi,2016. |
| 4 | Arun Sharma, “How to Prepare for Logical Reasoning,” Tata-McGraw Hill Education Series.New Delhi,2016. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | 2 | 2 | - | - |
| CO2 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | 2 | 2 | - | - |
| CO3 | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | 2 | 2 | - | - |
| CO4 | 1 | 1 | 1 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - |
| CO5 | 1 | 1 | 1 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - |
| CO | 2 | 2 | 2 | - | 2 | - | - | - | 1 | - | - | 2 | 2 | - | - |

3-High, 2- Medium, 1-Low

## SEMESTER VIII

| IT22801 | PROJECT WORK | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 16 | 8 |

**COURSE OBJECTIVES**

- To train the students for gaining domain knowledge, and technical skills to solve potential business / research problems.
- To gather requirements and design suitable software solutions and evaluate all the possible alternatives.
- To work in teams and understand the processes and practices in the industry.
- To implement, test and deploy solutions for target platforms
- To prepare project reports ethically and communicate to the technical society

| SYLLABUS |
|---|
| The students shall individually / or as group work on business/research domains and related problems approved by the department / organization that offered the project. The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, defend on the results and finally conclude with citations and references as per the format prescribed by the institution and submit to the Head of the Department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the regulations. |
| **TOTAL: 240 PERIODS** |

| COURSE OUTCOMES | |
|---|---|
| Upon completion of the course, students will be able to | |
| **CO1:** | Develop the ability to design, implement, and evaluate innovative IT solutions to real-world problems while demonstrating technical proficiency, teamwork, ethical practices, and effective communication. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

3-High, 2- Medium, 1-Low

## PROFESSIONAL ELECTIVES

## VERTICAL I: INTERNET TECHNOLOGIES

| IT22511 | FULL STACK WEB DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

| COURSE OBJECTIVES |
|---|
| • To understand the various components of full stack development |
| • To learn Node.js features and applications |
| • To develop applications with MongoDB |
| • To understand the role of Angular and Express in web applications |

- To develop simple web applications with React

| | | |
|---|---|---|
| **UNIT I** | **BASICS OF FULL STACK** | **6** |
| Understanding the Basic Web Development Framework – User – Browser – Webserver – Backend Services – MVC Architecture – Understanding the different stacks –The role of Express–Angular – Node – Mongo DB – React | | |
| **UNIT II** | **NODE JS** | **6** |
| Basics of Node JS – Installation – Working with Node packages – Using Node package manager,Creating a simple Node.js application – Using Events. | | |
| **UNIT III** | **MONGO DB** | **6** |
| Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections-Database Connectivity. | | |
| **UNIT IV** | **EXPRESS AND ANGULAR** | **6** |
| Implementing Express in Node.js – Configuring routes – Using Request and Response objects–Angular – Typescript - Implementing Classes, Modules, Functions – Angular Components | | |
| **UNIT V** | **REACT** | **6** |
| MERN STACK – Basic React applications – React Components — React State – Event Handling, Stateless Components, Designing Components – Express REST APIs . | | |
| | | **TOTAL PERIODS: 30** |

**PRACTICAL EXERCISES**

| | |
|---|---|
| 1 | Develop a portfolio website for yourself which gives details about yourself for a potential recruiter. |
| 2 | Create a web application to manage the TO-DO list of users, where users can login and manage their to-do items. |
| 3 | Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them. |
| 4 | Create a grocery delivery website where users can order from a particular shop listed in the website. |
| 5 | Develop a simple dashboard for project management where the statuses of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, InProgress or Completed. |

**TOTAL PERIODS: 30**

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Explain the various stacks available for web application development. |
| **CO2:** | Use Node.js for application development. |
| **CO3:** | Develop applications with MongoDB. |
| **CO4:** | Use the features of Angular and Express. |
| **CO5:** | Develop React applications. |
| **TEXT BOOKS** | |
| 1 | Brad Dayley, Brendan Dayley and Caleb Dayley, "Node.js, MongoDB and Angular Web Development", Second Edition, Addison-Wesley, 2018. |
| 2 | Vasan Subramanian, "Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node", Second Edition, Apress, 2019. |
| **REFERENCE BOOKS** | |
| 1 | Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2012. |
| 2 | Chris Northwood, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", Apress, 2018. |
| 3 | Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", Second Edition, Addison-Wesley Professional, 2018. |
| 4 | Jon Duckett, "HTML and CSS-Design and Build Websites", John Wiley Sons, 2011. |
| 5 | Kyle Banker, Peter Bakkum, Shaun Verch, Douglas Garrett and Tim Hawkins, "MongoDB in Action", Second Edition, Manning Publication, 2016. |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 2 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | - | - | - | 2 |
| CO2 | 2 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | - | - | - | 2 |
| CO3 | 2 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | - | - | - | 2 |
| CO4 | 2 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | - | - | - | 2 |
| CO5 | 2 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | - | - | - | 2 |
| CO | 2 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | - | - | - | 2 |

3-High, 2- Medium, 1-Low

| IT22512 | CLOUD COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

| UNIT I | INTRODUCTION | 6 |
|---|---|---|

Introduction to Cloud Computing - Underlying Principles of Parallel and Distributed Computing - Cloud Characteristics - Elasticity in Cloud - On demand Provisioning.

| UNIT II | VIRTUALIZATION AND DOCKER BASICS | 6 |
|---|---|---|

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization of CPU, Memory, I/O Devices. Introduction to Docker, Docker Components.

| UNIT III | CLOUD ARCHITECTURE AND SERVICES | 6 |
|---|---|---|

NIST Cloud Computing Reference Architecture - Public, Private and Hybrid Clouds - laaS - PaaS - SaaS - Architectural Design Challenges - Cloud Storage - Storage-as-a-Service.

| UNIT IV | CLOUD DEPLOYMENT ENVIRONMENT | 7 |
|---|---|---|

Google App Engine – Amazon AWS – Microsoft Azure; Emerging Cloud Software Environments – Open Nebula, Sector/Sphere, OpenStack.

| UNIT V | CLOUD SECURITY | 5 |
|---|---|---|

IAM - Introduction, Challenges, Architecture and practice - Standards and Protocols for cloud services and consumers - IAM practices – Cloud Authorization Management.

**TOTAL PERIODS: 30**

**PRACTICAL EXERCISES**

| | |
|---|---|
| 1 | Install Virtualbox/VMware/ Equivalent open-source cloud workstation with different flavours of Linux or Windows OS on top of windows 8 and above. |
| 2 | Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs. |
| 3 | Install Google App Engine. Create a hello world app and other simple web applications using python/java. |
| 4 | Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim. |
| 5 | Deploy a microservices architecture using a container orchestration tool Docker Swarm. |
| 6 | Deploy a containerized application on a virtual machine using Docker. |

**TOTAL PERIODS: 30**

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Explain the main concepts, key technologies, strengths and limitations of cloud computing. |
| **CO2:** | Apply the concepts of virtualization and docker. |
| **CO3:** | Explore the architecture of cloud, service and deployment models. |
| **CO4:** | Implement the cloud deployment services. |
| **CO5:** | Explain Identity and Access management in the cloud. |
| **CO6:** | Analyse and choose the appropriate technologies, services for implementation and use of cloud. |
| **TEXT BOOKS** | |
| 1. | Kai Hwang, Geoffrey C. Fox and Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012. |
| 2. | Rajkumar Buyya, Christian Vecchiola and S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013. |
| **REFERENCES** | |
| 1. | Tim Mather, Subra Kumaraswamy and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2010. |
| 2. | James Turnbull, "The Docker Book", O'Reilly Publishers, 2014. |
| 3. | Kumar Saurabh," Cloud Computing: Architecting Next-Gen Transformation Paradigms", Fourth Edition, Wiley, 2017. |
| 4. | George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2010. |
| 5. | John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO2 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO4 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | - | - |
| CO5 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | - | - |
| CO6 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | - | - |
| CO | 3 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | - | - |

3-High, 2- Medium, 1-Low

| CS22641 | UI/UX DESIGN | L | T | P | C |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES:**

- To understand the basics concepts of Design Thinking process.
- To learn the fundamental concepts of User Interface Design process.
- To introduce the basic concepts of User Experience Design process.
- To induce the students to create a wireframe and prototype.
- To understand the various Research Methods used in Design

| | | |
|---|---|---|
| **UNIT I** | **FUNDAMENTALS OF DESIGN** | **6** |

Introduction to User Interface (UI) and User Experience (UX) – Evolution of Design – Need of Good design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming – Observational Empathy.

| | | |
|---|---|---|
| **UNIT II** | **FUNDAMENTALS OF UI DESIGN** | **6** |

UI Design Principles - UI Elements and Patterns - Responsive Grids and Breakpoints – Typography– Color Schemes – Branding - Style Guides.

| | | |
|---|---|---|
| **UNIT III** | **FUNDAMENTALS OF UX DESIGN** | **6** |

UX Design Process and its Methodology – Research in User Experience Design - Tools and Methods used for Research – Usability Testing – Information architecture – Sitemaps.

| | | |
|---|---|---|
| **UNIT IV** | **WIREFRAMING AND PROTOTYPING** | **6** |

Sketching Principles - Sketching Red Routes - Tools used for UI and UX Design – Wireframing - Creating Wireflows - Building a Prototype - Create interaction – Share Prototypes – Comment on Prototype – Incorporate feedback – Export designs. - Prototype Iteration.

| | | |
|---|---|---|
| **UNIT V** | **USER RESEARCH AND IDEATION** | **6** |

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping – Journey Map.

**30 PERIODS**

**PRACTICAL EXERCISES**

| | |
|---|---|
| 1 | Use the design thinking process to create the ideal user interface design for a societal application. Also include different UI interaction patterns and discuss them. |
| 2 | Develop an interface for responsive home page of hotel management system using Icons, Primary and Secondary Buttons. |
| 3 | Developing an interface for a shopping application with proper UI Style Guides. |
| 4 | Make a wire flow diagram for a banking application using open-source software. |
| 5 | Develop an interface for a bus ticket booking application by conducting the end-to-end user research. |
| 6 | Identify the customer problem that users of an agriculture information system are having, then create an interface design to overcome that issue. |
| 7 | Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements. |

**30 PERIODS**

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Explain the basic user interface and user experience design concepts. |
| **CO2:** | Describe user interface design for real time applications. |
| **CO3:** | Summarize user experience design process and its methodology. |
| **CO4:** | Sketch Wireframe and Prototype for a new project. |
| **CO5:** | Illustrate various User Experience Research methods in Design. |

**TEXT BOOKS:**

| | |
|---|---|
| 1. | Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services", O'Reilly, 2021. |
| 2. | Joel Marsh, "UX for Beginners", O'Reilly, 2022. |

**REFERENCES:**

| | |
|---|---|
| 1. | David Platt, "The Joy of UX: User Experience and Interactive Design for Developers", Addison-Wesley Professional, 2016. |
| 2. | Elisa Paduraru, "Fundamentals of Creating a Great UI/UX", Creative Tim, 2022. |
| 3. | Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interfaces", Third Edition, O'Reilly Media, 2020. |
| 4. | Garrett JJ, "The elements of user experience: user-centered design for the Web", Berkeley: New Riders, 2011. |
| 5. | https://www.interaction-design.org/literature. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 1 | 1 | 3 | 1 | - | - | - | 3 | 3 | 2 | 1 | 2 | - | - |
| CO2 | 2 | 3 | 1 | 3 | 2 | - | - | - | 1 | 2 | 2 | 2 | 1 | - | - |
| CO3 | 1 | 3 | 3 | 2 | 2 | - | - | - | 2 | 3 | 1 | 2 | 1 | - | - |
| CO4 | 1 | 2 | 3 | 2 | 1 | - | - | - | 2 | 1 | 1 | 1 | 3 | - | - |
| CO5 | 1 | 3 | 3 | 2 | 2 | - | - | - | 2 | 3 | 1 | 2 | 3 | - | - |
| CO | 2 | 2 | 2 | 2 | 2 | - | - | - | 2 | 2 | 1 | 2 | 2 | - | - |

3-High, 2- Medium, 1-Low

| **IT22611** | **DEVOPS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES:**

- To describe the agile relationship between development and IT operations.
- To understand the different Version control tools like Git
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment
- To understand Configuration management using Ansible

- Illustrate the benefits and drive the adoption of cloud-based DevOps tools to solve real world problems

| UNIT I | INTRODUCTION TO DEVOPS | 6 |
|---|---|---|

Introduction, Agile development model, DevOps Essentials, Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

| UNIT II | DEVOPS BUILD TOOLS | 6 |
|---|---|---|

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle.

| UNIT III | CONTINUOUS INTEGRATION USING JENKINS | 6 |
|---|---|---|

Integrating the system: Build systems, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

| UNIT IV | TESTING AND CONFIGURATION MANAGEMENT | 6 |
|---|---|---|

Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible.

| UNIT V | BUILDING DEVOPS PIPELINES USING AZURE | 6 |
|---|---|---|

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

**TOTAL: 30 PERIODS**

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1. | Create Maven Build pipeline in Azure |
| 2. | Run regression tests using Maven Build pipeline in Azure |
| 3. | Build a simple application using Gradle |
| 4. | Create CI pipeline using Jenkins |
| 5. | Create a CD pipeline in Jenkins and deploy in Cloud |
| 6. | Create an Ansible playbook for a simple web application infrastructure |
| 7. | Configure ansible roles and to write playbooks |

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Explain the terminology and concepts of DevOps and version control tools. |
| **CO2:** | Perform Continuous Integration and Building using Maven and Gradle. |
| **CO3:** | Apply Jenkins to automate continuous deployment. |
| **CO4:** | Perform testing and configuration management using Ansible. |
| **CO5:** | Demonstrate Cloud-based DevOps tools using Azure DevOps |

| TEXT BOOKS: | |
|---|---|
| 1 | Joakim Verona, “Practical Devops”, Second Edition. Ingram short title,2018. |
| 2 | Deepak Gaikwad and Viral Thakkar, “ DevOps Tools from Practitioner's Viewpoint”, Wiley publications, 2020. |
| **REFERENCES:** | |
| 1 | Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, 2016. |
| 2 | Len Bass, Ingo Weber, Liming Zhu, “DevOps: A Software Architect's Perspective”, Addison Wesley, 2018. |
| 3 | Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, LeanPub, 2015. |
| 4 | Mitesh Soni, “Hands-On Azure Devops: CICD Implementation for Mobile, Hybrid, and Web Applications Using Azure Devops and Microsoft Azure”, 2020. |
| 5 | Mariot Tsitoara, “Ansible Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, Apress, 2019. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 1 | 3 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | 1 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 1 | 2 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 1 | 3 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 1 | 2 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| IT22711 | ADVANCED WED APPLICATION DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To design and implement interactive web forms using HTML
- To use JavaScript to interact with HTML forms, access and manipulate DOM elements.
- To utilize JavaScript objects to organize and encapsulate data and functionality.

| | | |
|---|---|---|
| • To use appropriate colors and integrate multimedia files into web pages. | | |
| • To develop advanced web page layouts using CSS animations. | | |
| **UNIT I** | **WEB-BASED FORMS** | **6** |
| How HTML Forms Work - Creating a Form - Accepting Text Input - Grouping Form Elements - Exploring Form Input Controls - Using HTML5 Form Validation. | | |
| **UNIT II** | **JAVA SCRIPT AND DOCUMENT OBJECT MODEL (DOM)** | **6** |
| Submitting Form Data - Accessing Form Elements with JavaScript -Understanding the Document Object Model - Using window Objects - Working with the document Object - Accessing Browser History - Modifying Text in a Page - Adding Text to a Page. | | |
| **UNIT III** | **USING OBJECTS** | **6** |
| Introducing Objects - Using Objects to Simplify Scripting - Extending Built-in Objects - Using the Math Object - Working with Math Methods - Working with Dates. | | |
| **UNIT IV** | **COLORS, IMAGES, AND MULTIMEDIA** | **6** |
| Best Practices for Choosing Colors - Understanding Web Colors - Preparing Photographic Images - Creating Banners and Buttons - Placing Images on a Web Page - Describing Images with Text - Linking to Multimedia Files - Embedding Multimedia Files. | | |
| **UNIT V** | **ADVANCED CSS** | **6** |
| Advanced web page design with CSS : CSS box model and positioning– How the CSS Box Model affects List – Creating layout using modern CSS techniques – Using CSS transformation and transition - Animation with CSS and the canvas. | | |
| | | **TOTAL: 30 PERIODS** |
| **LIST OF EXPERIMENTS** | | |
| 1. | Design a Web Application for an Organization with Registration forms and advanced controls. | |
| 2. | Use CSS to apply different styles such as borders, margins, padding, and backgrounds to each element. | |
| 3. | Experiment with CSS animations to create engaging visual effects such as fading, sliding, rotating, and scaling elements. | |
| 4. | Apply CSS transformations (e.g., translate, rotate, scale) to HTML elements to create visual effects such as animations and transitions. | |
| 5. | Write JavaScript functions to access form elements by their IDs or names. | |
| 6. | Use CSS to style HTML elements as banners and buttons, applying background images, gradients, and hover effects. | |
| 7. | Create Date objects to represent specific dates and times in JavaScript. | |
| | | **TOTAL: 30 PERIODS** |
| **COURSE OUTCOMES:** | | |
| **At the end of the course, the students will be able to:** | | |
| **CO1:** | Design and implement interactive web forms using HTML | |
| **CO2:** | Use JavaScript to interact with HTML forms, access and manipulate DOM elements. | |

| | |
|---|---|
| **CO3:** | Utilize JavaScript objects to organize and encapsulate data and functionality. |
| **CO4:** | Use appropriate colors and integrate multimedia files into web pages. |
| **CO5:** | Develop advanced web page layouts using CSS animations. |
| **TEXT BOOKS:** | |
| **1** | Julie C. Meloni, Jennifer and Kyrnin, "HTML, CSS, and JavaScript All in One: Covering HTML5, CSS3, and ES6", Sams Teach Yourself, 2020. |
| **2** | DT Editorial Services , "HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery", Second Edition, DreamTech,2020. |
| **REFERENCES:** | |
| **1** | Andy Harris , "HTML5 and CSS3 All-in-One", Third Edition, For Dummies, 2014. |
| **2** | David Sawyer McFarland, "CSS: The Missing Manual", Second Edition, O'Reilly,2010. |
| **3** | Magige Robi," HTML 5 Made Easy: A beginner's Handbook to easily Learn HTML 5", 2021. |
| **4** | Christopher Schmitt , " HTML 5 Cookbook: Solutions & Examples for HTML5 Developers", O'Reilly,2011. |
| **5** | Ivan Bayross, "HTML 5 & CSS Made Simple", BPB Publications,2011. |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 2 | 1 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | 3 |
| CO2 | 2 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | 2 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | 3 |
| CO4 | 2 | 1 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | 3 |
| CO5 | 2 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | 3 |
| CO | 2 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | 3 |

3-High, 2- Medium, 1-Low

| **IT22712** | **DIGITAL MARKETING** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES**

- To explore the role of digital marketing in the business environment.
- To make a clear understanding of how to formulate a SEO technique.

| | | |
|---|---|---|
| • To know the key elements of email and mobile marketing. | | |
| • To utilize social media effectively for marketing. | | |
| **UNIT I** | **INTRODUCTION TO DIGITAL MARKETING** | **6** |
| Introduction of Digital Marketing – Digital Marketing vs Traditional Marketing - Digital Marketing Strategy- Components - Opportunities for building Brand Website - Content Marketing. | | |
| **UNIT II** | **SEARCH ENGINE OPTIMISATION** | **6** |
| Search Engine optimisation - Keyword Strategy- SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement. | | |
| **UNIT III** | **EMAIL MARKETING** | **6** |
| E- Mail Marketing – Types of E- Mail Marketing – Email Automation – Lead Generation – Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Integrating Email with social media and Mobile - Mobile Commerce, SMS Campaigns- Profiling and targeting. | | |
| **UNIT IV** | **SOCIAL MEDIA MARKETING** | **6** |
| Social Media Marketing – Social Media Channels- Leveraging social media for brand conversations and buzz. Successful /benchmark social media campaigns. Engagement Marketing- Building Customer relationships – Creating Loyalty drivers – Influencer Marketing. | | |
| **UNIT V** | **DIGITAL TRANSFORMATION** | **6** |
| Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, social media, Web Analytics – Changing your strategy based on analysis- Recent trends in Digital marketing. | | |
| | | **TOTAL PERIODS: 30** |
| **PRACTICAL EXERCISES** | | |
| 1 | Subscribe to a weekly/quarterly newsletter and analyze how its content and structure aid with the branding of the company and how it aids its potential customer segments. | |
| 2 | Discuss an interesting case study regarding how an insurance company/ banking sector manages leads. | |
| 3 | Discuss negative and positive impacts and ethical implications of using the trending social media apps for political advertising. | |
| 4 | Perform keyword search for a skincare hospital website based on search volume and competition using Google keyword planner tool. | |

| | |
|---|---|
| 5 | Demonstrate how to use the Google Web Masters Indexing API. |
| 6 | Discuss how Predictive analytics is impacting marketing automation. |
| | **TOTAL PERIODS: 30** |

| **COURSE OUTCOMES** | |
|---|---|
| Upon completion of the course, students will be able to | |
| **CO1:** | Explain the need of digital marketing strategies for today's business trends. |
| **CO2:** | Explore the different SEO techniques used in digital marketing. |
| **CO3:** | Apply email and mobile marketing effectively for advertising the product or service. |
| **CO4:** | Apply social media marketing strategies to engage customer effectively in business. |
| **CO5:** | Apply various analytical methods to measure the impact of various marketing strategies. |
| **TEXT BOOKS** | |
| 1. | Seema Gupta, "Digital Marketing", Third Edition, Mc Graw Hill, 2022. |
| 2. | Kailash Chandra Upadhyay, "Digital Marketing: Complete Digital Marketing Tutorial", Notion Press, 2021. |
| **REFERENCE BOOKS** | |
| 1. | Puneet Singh Bhatia, "Fundamentals of Digital Marketing", Pearson Education, 2017. |
| 2. | Vandana Ahuja, "Digital Marketing", Oxford University Press, 2015. |
| 3. | Philip Kotler, "Marketing 4.0: Moving from Traditional to Digital", Wiley, 2017. |
| 4. | Barker, Barker, Bormann and Neher, "Social Media Marketing: A Strategic Approach", Second Edition, South-Western Cengage Learning, 2017. |
| 5. | Pulizzi,J, "Beginner's Guide to Digital Marketing", Mcgraw Hill Education, 2015. |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | - | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| CS22753 | SALESFORCE ADMINISTRATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSEOBJECTIVES:**

- To understand Salesforce architecture and features.
- To know the customization process in Salesforce.
- To understand the security model.
- To understand the business process automation features
- To understand the reports and dashboard

| UNIT I | SALESFORCE FUNDAMENTALS | 6 |
|---|---|---|

Introduction to CRM- CRM Use Cases - Why Salesforce? - Overview of Salesforce platform and its Architecture - Advantage of Salesforce, Salesforce editions and licenses - Salesforce user interface and navigation - Salesforce Mobile App and Salesforce Lightning Experience -Signing up Developer Edition - Standard Objects - Creating Custom Objects - Fields and data types - Apps Creation.

| UNIT II | SALESFORCE DATA MANAGEMENT AND CUSTOMIZATION ESSENTIALS | 6 |
|---|---|---|

Relationships and junction objects, Roll-up Summary- Creating Formula Fields, Schema Builder. Data Validation - Validation rules. Working with Record Types and Page Layouts - Compact Layout- Lightning Record Pages – Home Page Customization -Path Settings. - List Views - Data import and data management tools.

| UNIT III | SECURITY AND DATA ACCESS | 6 |
|---|---|---|

Public groups and Queues - Organization Security Controls - Passwords, IP restrictions, Network Settings. User Setup and Security - User Creation- Security Model: Profiles - Permission Set - Permission Set Group - Salesforce Sharing model - Organization Wide Defaults (OWD) - Role Hierarchy - Sharing Rules - Manual Sharing.

| UNIT IV | BUSINESS PROCESS AUTOMATION | 6 |
|---|---|---|

Introduction to Workflow and Process Builder - Work flow rules – Workflow action - Email Alerts and Field Updates. Flows: Types of Flow Screen Flow- Record Triggered Flow- Scheduled Trigger Flow- Auto Launched Flow. uses cases of Process Automation. - Approval Processes.

| UNIT V | REPORTS, DASHBOARDS, AND ANALYTICS | 6 |
|---|---|---|

Creating or customizing a Report –Types of Reports - Summary Report- Tabular Report - Matrix Report - Joined Report. Row Level Formula – Summary Level Formula. Various charts in Reports. Creating and modifying Dashboards – Filters – Various Charts - Standard Dashboards & Dynamic Dashboards. Folder Creation and Sharing.

**30 PERIODS**

**PRACTICAL EXERCISES**

| | |
|---|---|
| **1** | Create Objects, Fields and App |
| **2** | Explore Data Types |

| | |
|---|---|
| **3** | Create Fields and Relationships |
| **4** | Create Record Types (create), Page Layout (adding section, field property settings), Page Layout Assignment (assign page layout based on Record types) |
| **5** | Create Lightning Record Page, List View, Path Settings |
| **6** | Validation Rule |
| **7** | Automation I<br>a.Screen Flow<br>b.Auto Launched Flow |
| **8** | Automation II<br>a. Record Trigger Flow<br>b. Scheduled Trigger Flow<br>c. Approval Process |
| **9** | Security<br>a.Profiles and Permission Set<br>b.Org Wide Default<br>c.Roles<br>d.Sharing Rules<br>e.Manual Sharing |
| **10** | Reports and Dashboards<br>a.Custom Report Types<br>b.Dynamic Dashboards<br>c. Report and Dashboards Sharing |
| | **30 PERIODS** |
| | **TOTAL: 60 PERIODS** |

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Apply data modelling techniques to design and configure custom objects, fields, and relationships in Salesforce. |
| **CO2:** | Apply advanced data management and customization techniques in Salesforce to enhance data organization and user experience |
| **CO3:** | Evaluate and recommend appropriate Salesforce user setup and security settings to control access and permissions. |
| **CO4:** | Develop advanced automation solutions using Process Builder and Visual Workflow to meet complex business requirements. |
| **CO5:** | Evaluate and recommend appropriate reporting and analytics strategies based on business requirements. |

**TEXT BOOKS:**

| | |
|---|---|
| 1. | Enrico Murru, “Salesforce Advanced Administrator Certificate”, Packt Publishers, 2019. |
| 2. | Rakesh Gupta, “Mastering Salesforce CRM Administration”, Packt Publishers, 2017. |

**REFERENCES:**

| | |
|---|---|
| 1. | Wes Nolte, Jeff Douglas, “Salesforce Handbook”, Includes Winter ’11 Publishers, 2011. |
| 2. | Tom Wong, Liz Kao, Matt Kauff, “Salesforce.com for Dummies”, Fifth Edition, Expert Salesforce.com Consultants, 2015. |
| 3. | Rakesh Gupta, “Learning Salesforce Visual Workflow and Process Builder”, Packt |

| | |
|---|---|
| | Publishers, Second Edition, 2017. |
| 4. | Jonathan Keel, "Salesforce.com Lightning Process Builder and Visual Workflow", Apress, 2016. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO2 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO3 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO4 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO5 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |

3-High, 2- Medium, 1-Low

## VERTICAL II: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

| CS22521 | SOFT COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To learn various evolutionary Algorithms.
- To become familiar with neural networks that can learn from available examples and
- generalize to form appropriate rules for inference systems.
- To introduce case studies utilizing the above and illustrate the Intelligent behavior of
- programs based on soft computing

| UNIT I | INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC | 6 |
|---|---|---|

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems

| UNIT II | NEURAL NETWORKS | 6 |
|---|---|---|

Supervised Learning Neural Networks – Perceptrons - Backpropagation -Multilayer

| | | |
|---|---|---|
| Perceptrons –Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks | | |
| **UNIT III** | **GENETIC ALGORITHMS** | **6** |
| Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function | | |
| **UNIT IV** | **NEURO FUZZY MODELING** | **6** |
| ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability | | |
| **UNIT V** | **APPLICATIONS** | **6** |
| Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction. | | |
| | | **TOTAL:30 PERIODS** |

**PRACTICAL EXERCISES**

| | |
|---|---|
| 1 | Implementation of fuzzy control/ inference system. |
| 2 | Programming exercise on classification with a discrete perceptron. |
| 3 | Implementation of XOR with backpropagation algorithm. |
| 4 | Implementation of self organizing maps for a specific application |
| 5 | Programming exercises on maximizing a function using Genetic algorithm |
| 6 | Implementation of two input sine function |
| 7 | Implementation of three input non linear function |

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Summarize the fundamentals of fuzzy logic operators and inference mechanisms |
| **CO2:** | Describe neural network architecture for AI applications such as classification and Clustering |
| **CO3:** | Interpret the functionality of Genetic Algorithms in Optimization problems |
| **CO4:** | Use hybrid techniques involving Neural networks and Fuzzy logic |
| **CO5:** | Apply soft computing techniques in real world applications |

**TEXT BOOKS:**

| | |
|---|---|
| 1. | J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, Pearson Education, 2015. |
| 2. | Himanshu Singh, Yunis Ahmad Lone, “Deep Neuro-Fuzzy Systems with Python”, Apress, 2020. |

**REFERENCES:**

| | |
|---|---|
| 1. | Roj Kaushik and Sunita Tiwari, “Soft Computing-Fundamentals Techniques and Applications”, McGraw Hill, 2018. |
| 2. | S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic |

| | |
|---|---|
| | Algorithms", PHI, 2011. |
| 3. | Samir Roy, Udit Chakraborthy, "Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms", Pearson Education, 2013. |
| 4. | S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Third Edition, Wiley India Pvt Ltd, 2019. |
| 5. | Russell C. Eberhart, Yuhui Shi, "Computational Intelligence Concepts to Implementations", Elsevier, 2011. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 3 | 3 | 3 | - | - | - | 3 | 1 | 3 | 2 | 3 | 1 | 2 |
| CO2 | 2 | 3 | 3 | 2 | 3 | - | - | - | 3 | 2 | 3 | 2 | 2 | 1 | 3 |
| CO3 | 1 | 3 | 2 | 2 | 1 | - | - | - | 3 | 1 | 1 | 2 | 1 | 3 | 2 |
| CO4 | 1 | 2 | 1 | 3 | 2 | - | - | - | 3 | 3 | 1 | 1 | 2 | 1 | 1 |
| CO5 | 2 | 3 | 1 | 2 | 1 | - | - | - | 3 | 3 | 3 | 2 | 1 | 2 | 3 |
| CO | 2 | 3 | 2 | 2 | 2 | - | - | - | 3 | 2 | 2 | 2 | 2 | 2 | 2 |

3-High, 2- Medium, 1-Low

| IT22521 | ARTIFICIAL INTELLIGENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To know the basics of AI and Intelligent agents
- To understand the basic problem-solving strategies
- To outline constraint satisfaction problems, adversial and game theory-based search
- To understand logical reasoning and Bayes' rule
- To discuss the applications, ethics and future of AI

| UNIT I | INTRODUCTION AND INTELLIGENT AGENTS | 6 |
|---|---|---|

Introduction: Foundations of AI - History of AI - Intelligent agents: Agents and Environments – Concepts of Rationality - Nature of environments - Structure of Agents - Problem Solving Agents, Example Problems.

| UNIT II | PROBLEM-SOLVING | 6 |
|---|---|---|

Solving Problems by Searching: Search Algorithms, Uninformed Search Strategies, Informed (Heuristic) Search Strategies -Search in Complex Environments: Local search and optimization problems.

| UNIT III | CONSTRAINT SATISFACTION PROBLEMS AND ADVERSARIAL SEARCH | 6 |
|---|---|---|

Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems - Backtracking Search for CSPs - Local Search for CSPs - Adversarial Search and Games: Game Theory - Optimal Decisions in Games: The minimax search algorithm, Alpha-Beta Pruning- Monte Carlo Tree Search.

| UNIT IV | LOGICAL REASONING AND QUANTIFYING UNCERTAINTY | 6 |
|---|---|---|
| Logical Agents: Knowledge-Based Agents - Propositional Logic - First-Order Logic: Syntax and Semantics of First-Order Logic-Inference in First Order logic - Quantifying Uncertainty: Acting under Uncertainty - Basic Probability Notation - Bayes' Rule and Its Use - Naive Bayes Models. | | |
| **UNIT V** | **APPLICATIONS, ETHICS AND FUTURE OF AI** | **6** |
| AI Applications: NLP, Robotics - Ethics of AI - Future of AI: AI Components -AI Architectures. | | |
| | | **TOTAL PERIODS: 30** |

| **LIST OF EXPERIMENTS:** | |
|---|---|
| 1 | Implement basic search strategies: 8-Puzzle Problem |
| 2 | Implement Uninformed Search Technique: Breadth First Search |
| 3 | Implement Uninformed Search Technique: Depth First Search |
| 4 | Implement Informed Search Technique: A* Algorithm |
| 5 | Implement Local Search Technique: Hill Climbing Algorithm |
| 6 | Solve Constraint Satisfaction Problems |
| **7** | Implement Game Playing Algorithms: Minimax and Alpha Beta Pruning |
| | **TOTAL PERIODS: 30** |

| **COURSE OUTCOMES** | |
|---|---|
| Upon completion of the course, students will be able to | |
| **CO1:** | Explain the basics of AI, intelligent and problem-solving agents |
| **CO2:** | Implement the search algorithm for solving AI problems |
| **CO3:** | Illustrate constraint satisfaction problems, adversial and game theory-based search |
| **CO4:** | Apply logical reasoning and Bayes' rule that can reason under uncertainty |
| **CO5:** | Illustrate the applications, ethics and future of AI |
| **CO6:** | Analyse the various search techniques in AI |

| **TEXT BOOKS** | |
|---|---|
| 1. | Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2022. |
| 2. | David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Third Edition, Cambridge University Press, 2023. |

| **REFERENCE BOOKS** | |
|---|---|
| **1.** | Lavika Goel, "Artificial Intelligence: Concepts and Applications", Wiley, 2021. |
| **2.** | Ela Kumar , "Artificial Intelligence", Dreamtech Press, 2020. |

| | |
|---|---|
| **3.** | Dr. Nilakshi Jain, "Artificial Intelligence: Making a System Intelligent", Wiley, 2019. |
| **4.** | Ertel Wolfgang, "Introduction to Artificial Intelligence",WTICS,2017. |
| **5.** | Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO2 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO4 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO5 | 3 | 3 | 3 | 3 | - | 2 | - | 3 | - | - | - | 1 | - | 3 | - |
| CO | 3 | 3 | 3 | 2 | 3 | 2 | - | - | - | - | - | 1 | - | 3 | - |

3-High, 2- Medium, 1-Low

| IT22621 | OPTIMIZATION TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To know the basics of optimization
- To understand various linear programming methods
- To understand optimization algorithms for solving unconstrained optimization problems
- To study various optimization algorithms for solving unconstrained optimization problems
- To know various methods of Optimization

| UNIT I | INTRODUCTION TO OPTIMIZATION | 6 |
|---|---|---|

Introduction to Optimization: Engineering application of Optimization – Statement of an Optimization problem – Optimal Problem formulation – Classification of Optimization problem. Optimum design concepts: Definition of Global and Local optima – Optimality criteria – Review of basic calculus concepts – Global optimality.

| | | |
|---|---|---|
| **UNIT II** | **LINEAR PROGRAMMING METHODS** | **6** |
| Linear programming methods for optimum design: Review of Linear programming methods for optimum design – Post optimality analysis – Application of LPP models in design and manufacturing. | | |
| **UNIT III** | **UNCONSTRAINED OPTIMIZATION PROBLEMS** | **6** |
| Optimization algorithms for solving unconstrained optimization problems – Gradient based method: Cauchy's steepest descent method, Newton's method, Conjugate gradient method. | | |
| **UNIT IV** | **CONSTRAINED OPTIMIZATION PROBLEMS** | **6** |
| Optimization algorithms for solving constrained optimization problems – direct methods – penalty function methods – steepest descent method – Engineering applications of constrained and unconstrained algorithms. | | |
| **UNIT V** | **OPTIMIZATION METHODS** | **6** |
| Modern methods of Optimization: Genetic Algorithms – Simulated Annealing – Ant colony optimization – Tabu search – Neural-Network based Optimization – Fuzzy optimization techniques – Applications. Use of Matlab to solve optimization problems. | | |
| | | **TOTAL: 30 PERIODS** |

| **LIST OF EXPERIMENTS** | |
|---|---|
| 1. | Formulate engineering system design problem as an optimization problem. |
| 2. | The problem formulated in Experiment No. 1 should be solved graphically and identify the nature of problem. |
| 3. | By using excel solver solve unconstrained and constrained optimization problems create excel worksheets. |
| 4. | Apply the simplex method algorithm and solve LPP by two-phase simplex method numerically. |
| 5. | Solve quadratic programming problem numerically and verify results. |
| 6. | Verify the descent conditions for a given search direction for unconstrained optimization problem and calculate step size along search direction using Equal Interval Search method numerically and verify results. |
| | **TOTAL: 30 PERIODS** |

| **COURSE OUTCOMES:** | |
|---|---|
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Explain the basics of optimization |
| **CO2:** | Illustrate the various linear programming methods |
| **CO3:** | Apply numerical methods algorithms to solve unconstrained problems. |
| **CO4:** | Examine various constrained problems |
| **CO5:** | Apply algorithm of simplex method to solve quadratic programming problem numerically. |

| **TEXT BOOKS:** | |
|---|---|
| **1** | Rao S. S., "Engineering Optimization, Theory and Practice", Fourth Edition, |

| | |
|---|---|
| | New Age International Publishers, 2012. |
| **2** | Ashok D. Belegundu and Tirupathi R. Chandrupatla, "Optimization Concepts and Applications in Engineering", Third Edition, Pearson Education Delhi, 2019. |
| **REFERENCES:** | |
| **1** | Deb K., "Optimization for Engineering Design Algorithms and Examples", Second Edition, PHI, 2012. |
| **2** | Arora J., "Introduction to Optimization Design', Elsevier Academic Press", Third Edition, New Delhi, 2011. |
| **3** | Kapil Gupta & Munish Kumar Gupta, "Optimization of Manufacturing Processes", Springer Series in Advanced Manufacturing, 2019. |
| **4** | F.S. Hillier and G.J. Lieberman, "Introduction to Operations Research- Concepts and Cases", Ninth Edition, Tata Mc-Graw Hill, 2010. |
| **1** | Rao S. S., "Engineering Optimization, Theory and Practice", Fourth Edition, New Age International Publishers, 2012. |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO4 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO5 | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 2 |

3-High, 2- Medium, 1-Low

| **CS22622** | **DEEP LEARNING** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**COURSEOBJECTIVES:**

- To learn deep neural network foundation.
- To be familiar with preprocessing the data using Tensorflow/Keras Environment.
- To understand convolutional networks and its operations.
- To illustrate the Recurrent Neural Network..
- To get exposure on variants of autoencoders and Generative Adversarial Networks

| **UNIT I** | **INTRODUCTION** | **6** |
|---|---|---|

Introduction to Neural Network- Perceptron – Multi-layer feed forward Network- Activation Function-Defining Deep Learning- Common Architectural Principles of Deep Networks. Regression MLPs- Implementing MLPs with Keras – Building Image Classifier and

| | | |
|---|---|---|
| Regression MLP using the Sequential API-Fine-tuning Neural Network Hyperparameters. | | |
| **UNIT II** | **LOADING AND PREPROCESSING DATA** | **6** |
| Using TensorFlow like NumPy – The tf.data API: Chaining Transformations – Shuffling the data – Interleaving Lines from Multiple Files - Preprocessing the data. Keras Preprocessing Layers. | | |
| **UNIT III** | **COMPUTER VISION USING CONVOLUTIONAL NEURAL NETWORKS** | **6** |
| Convolutional Layers - Pooling Layers – CNN Architecture: GoogLeNet, ResNet, SENet – Pretrained Models from Keras - Transfer Learning - Classification and Localization - Object Detection – Object Tracking - Semantic Segmentation. | | |
| **UNIT IV** | **RECURRENT NEURAL NETWORKS** | **6** |
| Recurrent Neurons and Layers – Training RNN – Natural Language Processing with RNN: Generating Text using a Character RNN – Sentiment Analysis – An Encoder-Decoder Network for Neural Machine Translation. | | |
| **UNIT V** | **AUTOENCODERS AND GENERATIVE ADVERSARIAL NETWORKS** | **6** |
| Autoencoders: Stacked Autoencoders - Convolutional Autoencoders - Sparse Autoencoders – Denoising Autoencoders. Generative Adversarial Networks: Deep Convolutional GANs- Progressive Growing of GANs- StyleGANs. | | |
| | | **30 PERIODS** |
| **PRACTICAL EXERCISES** | | |
| 1 | Implement a perceptron in TensorFlow/Keras Environment. | |
| 2 | Implement a Feed-Forward Network in TensorFlow/Keras. | |
| 3 | Implement a regression model in Keras. | |
| 4 | Implement an Image Classifier using CNN in TensorFlow/Keras. | |
| 5 | Implement a Transfer Learning concept in Image Classification. | |
| 6 | Implement Object Detection using CNN. | |
| 7 | Perform Sentiment Analysis using RNN. | |
| | | **30 PERIODS** |
| | | **TOTAL: 60 PERIODS** |
| **COURSE OUTCOMES:** | | |
| **At the end of the course, the students will be able to:** | | |
| **CO1:** | Use Multilayer perceptron for applications with hyper-parameter tuning. | |
| **CO2:** | Use Tensorflow/Keras Environment to preprocess the data. | |
| **CO3:** | Apply convolutional networks for real world applications in Computer Vision domain. | |
| **CO4:** | Design Recurrent Neural Network for Natural Language processing. | |
| **CO5:** | Apply the Autoencoders and Generative Adversarial Network based deep learning | |

| | |
|---|---|
| | techniques for recent applications. |
| **TEXT BOOKS:** | |
| 1. | Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow”, O’Reilly, 2022. |
| 2. | Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media, 2021. |
| **REFERENCES:** | |
| 1. | Santanu Pattanayak, “Pro Deep Learning with TensorFlow 2.0”, Apress, 2023. |
| 2. | Antonio Gulli, Amita Kapoor, Sujit Pal, “Deep Learning with Tensorflow 2 and Keras”, Second Edition, Packt Publishing, 2019. |
| 3. | Umberto Michelucci, “Advanced Applied Deep Learning: Convolutional Neural Networks and Object Detection”, Apress, 2019. |
| 4. | Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications, 2021. |
| 5. | Yoshua Bengio and Ian J.Goodfellow and Aaron Courville, "Deep Learning", MIT Press, 2015. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| IT22721 | COGNITIVE SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition and applications

| UNIT I | INTRODUCTION TO COGNITIVE SCENCE | 6 |
|---|---|---|
| The mind in cognitive science- Logic and science of the mind – Place of psychology within cognitive science – Cognitive Neuroscience - Perception - Decision – Learning and memory – Language understanding and processing – Mental- Physical relation – From materialism to mental science. | | |
| **UNIT II** | **COGNITIVE INTELLIGENCE** | **6** |
| Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making -Learning -Language – Vision. | | |
| **UNIT III** | **PROBABILISTIC PROGRAMMING LANGUAGE** | **6** |
| WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations -Enumeration. | | |
| **UNIT IV** | **INFERENCE MODELS OF COGNITION** | **6** |
| Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference. | | |
| **UNIT V** | **LEARNING MODELS OF COGNITION & COGNITIVE APPLICATIONS** | **6** |
| Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models-Learning (Deep) Continuous Functions – Mixture Models. Process of building a Cognitive Application, Building a Cognitive Healthcare Application, Smarter Cities: Cognitive Computing in Government, Emerging Cognitive Computing Areas, Future Applications for Cognitive Computing. | | |
| | | **TOTAL: 30 PERIODS** |

| **PRACTICAL EXERCISES** | |
|---|---|
| 1 | Demonstration of Mathematical functions using WebPPL. |
| 2 | Implementation of reasoning algorithms. |
| 3 | Developing an Application system using generative model. |
| 4 | Developing an Application using conditional inference learning model. |
| 5 | Application development using hierarchical model. |
| 6 | Application development using Mixture model. |
| | **TOTAL :30 PERIODS** |

| **COURSE OUTCOMES** | |
|---|---|
| At the end of the course, the student should be able to | |
| **CO1:** | Explain about cognitive computing and how it differs from traditional approaches. |
| **CO2:** | Illustrate the theory behind cognitive intelligence. |
| **CO3:** | Summarize the mathematical functions behind WebPPL |
| **CO4:** | Outline the applications using cognitive inference model. |
| **CO5:** | Develop real time applications using cognitive models (social relevant areas) |

| **TEXTBOOK:** | |
|---|---|
| 1 | Jose Luis Bermúdez, “Cognitive Science -An Introduction to the Science of the Mind”, Cambridge University Press, 2020. |

| | |
|---|---|
| 2 | Vijay V Raghavan, Venkat N. Gudivada, Venu Govindaraju and C.R .Rao, “Cognitive Computing: Theory and Applications”, Elsevier publications, 2016. |
| **REFERENCES:** | |
| 1 | Jose Luis Bermudez, “ Cognitive Science : An Introduction to the Science of the Mind”, Cambridge University Press,2022. |
| 2 | Noah D. Goodman and Joshua B. Tenenbaum, “Probabilistic Models of Cognition”, Second Edition, The Prob Mods Contributors, 2016. |
| 3 | Judith Hurwitz, Marcia Kaufman and Adrian Bowles, “Cognitive Computing and Big Data Analytics”, Wiley Publications, 2015. |
| 4 | Robert A. Wilson, Frank C. Keil, “The MIT Encyclopaedia of the Cognitive Sciences”, The MIT Press,2011. |
| 5 | Michael R. W. Dawson,” Foundations of Cognitive Science”, Athabasca University Press, 2013. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | 2 | 1 | 2 | - | - |
| CO2 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | 2 | 1 | 2 | - | - |
| CO3 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | 2 | 1 | 2 | - | - |
| CO4 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | 2 | 1 | 2 | - | - |
| CO5 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | 2 | 1 | 2 | - | - |
| CO | 3 | 3 | - | 2 | 2 | - | - | - | - | - | 2 | 1 | 2 | - | - |

3-High, 2- Medium, 1-Low

| IT22722 | GENERATIVE AI | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To know the basics of Generative AI, OpenAI and ChatGPT .
- To understand how to setting ChatGPT accounts and prompt design principles.
- To understand the applications of ChatGPT in day-to-day productivity.
- To learn the marketing and research reinvented with ChatGPT.
- To identify the compliance requirements for using Azure OpenAI and use cases for enterprises.

| UNIT I | INTRODUCTION TO GENERATIVE AI, OpenAI AND ChatGPT | 6 |
|---|---|---|

Introduction to Generative AI: Introducing generative AI - The history and current status of research - OpenAI and ChatGPT: What is OpenAI? - An overview of OpenAI model families - Road to ChatGPT - ChatGPT: the state of the art.

| UNIT II | ChatGPT IN ACTION | 6 |
|---|---|---|
| Getting Familiar with ChatGPT : Setting up a ChatGPT account - Familiarizing yourself with the UI - Organizing chats - Understanding Prompt Design: What is a prompt and why is it important? - Zero-, one-, and few-shot learning – typical of transformers models - Principles of well-defined prompts to obtain relevant and consistent results. | | |
| **UNIT III** | **BOOSTING DAY-TO-DAY PRODUCTIVITY WITH ChatGPT** | **5** |
| Boosting Day-to-Day Productivity with ChatGPT: ChatGPT as a daily assistant - Generating text - Improving writing skills and translation - Quick information retrieval and competitive intelligence. | | |
| **UNIT IV** | **MASTERING MARKETING AND RESEARCH REINVENTED WITH ChatGPT** | **7** |
| Mastering Marketing with ChatGPT: Marketers' need for ChatGPT - New product development and the go-to-market strategy - A/B testing for marketing comparison - Making more efficient websites and posts with Search Engine Optimization (SEO) - Research Reinvented with ChatGPT: Researchers' need for ChatGPT - Brainstorming literature for your study - Providing support for the design and framework of your experiment - Generating and formatting a bibliography - Generating a presentation of the study. | | |
| **UNIT V** | **OpenAI FOR ENTERPRISES** | **6** |
| OpenAI and ChatGPT for Enterprises: OpenAI and Microsoft for enterprise-level AI – introducing Azure OpenAI - Understanding responsible AI - Trending Use Cases for Enterprises: How Azure OpenAI is being used in enterprises - Contract analyzer and generator - Understanding call center analytics - Exploring semantic search. | | |
| | | **TOTAL PERIODS: 30** |

| **LIST OF EXPERIMENTS:** | |
|---|---|
| 1 | Create a ChatGPT account and familiarize yourself with the interface. |
| 2 | Write a poem, a news article, and a code snippet using ChatGPT prompts. Discuss the quality and accuracy of each output. |
| 3 | Experiment with different prompt styles and lengths, observing how they affect the generated text. |
| 4 | Translate a short text from English to another language using ChatGPT. |
| 5 | Develop a marketing campaign for a new product using ChatGPT for brainstorming ideas, creating ad copy, and testing different slogans. |
| 6 | Research a specific academic topic using ChatGPT to identify relevant literature, summarize key findings, and format a bibliography. |
| 7 | Generate a presentation outline and slides for your research project using ChatGPT prompts. |
| | **TOTAL PERIODS: 30** |

| **COURSE OUTCOMES** | |
|---|---|
| Upon completion of the course, students will be able to | |
| **CO1:** | Explain the concept of Generative AI, OpenAI and ChatGPT |

| | |
|---|---|
| **CO2:** | Identify the setting up of ChatGPT and prompt design principles. |
| **CO3:** | Demonstrate the applications of ChatGPT in boosting day-to-day productivity. |
| **CO4:** | Apply ChatGPT to real-world marketing and research scenarios. |
| **CO5:** | Summarize Microsoft Azure for enterprise-level AI and use cases for enterprises. |
| **TEXT BOOKS** | |
| 1. | Valentina Alto, "Modern Generative AI with ChatGPT and OpenAI Models", Packt Publishing, 2023. |
| 2. | Tom Taulli, "Generative AI: How ChatGPT and Other AI Tools Will Revolutionize Business" APress, 2023. |
| **REFERENCE BOOKS** | |
| 1. | Numa Dhamani and Maggie Engler, "Introduction to Generative AI: An ethical, societal, and legal overview", Manning Publication, 2024. |
| 2. | Ben Auffarth, "Generative AI with LangChain: Build large language model (LLM) apps with Python, ChatGPT, and other LLMs", Packt Publishing, 2023. |
| 3. | Akshay Kulkar , Adarsha Shivananda, Anoosh Kulkarni, Dilip Gudivada, "Applied Generative AI for Beginners: Practical Knowledge on Diffusion Models, ChatGPT, and Other LLMs", APress, 2023. |
| 4. | Ajit Dash, "Chatgpt Generative AI - The Step-By-Step Guide for OpenAI & Azure OpenAI", EPublishing, 2023. |
| 5. | David M. Patel , "Artificial Intelligence & Generative AI for Beginners: The Complete Guide", 2023. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO2 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO4 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO5 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |

3-High, 2- Medium, 1-Low

## VERTICAL III: DATA SCIENCE

| IT22531 | DATA ANALYTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

| COURSE OBJECTIVES | | |
|---|---|---|
| • To understand the basics of big data analytics | | |
| • To understand the big data frameworks | | |
| • To learn data analysis methods for big data | | |
| • To learn stream computing for big data processing | | |
| • To gain knowledge on advanced database frameworks for big data analytics | | |
| **UNIT I** | **INTRODUCTION TO BIG DATA** | **6** |
| Big Data - Definition, Characteristic Features - Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems. | | |
| **UNIT II** | **HADOOP FRAMEWORK** | **6** |
| Distributed File Systems - Large-Scale File System Organization - HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Hadoop. | | |
| **UNIT III** | **DATA ANALYSIS** | **6** |
| Classification: Naïve Bayes classification, Regression modeling: linear regression, logistic regression - Rule Mining - Cluster Analysis: k-means clustering. | | |
| **UNIT IV** | **MINING DATA STREAMS** | **6** |
| Streams: Concepts - Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data. | | |
| **UNIT V** | **BIG DATA FRAMEWORKS** | **6** |
| Introduction to NoSQL - Aggregate Data Models - Hbase: Data Model and Implementations - Hbase Clients - Examples - Cassandra: Data Model - Examples - Cassandra Clients – HiveQL. | | |
| **TOTAL PERIODS: 30** | | |

| PRACTICAL EXERCISES | |
|---|---|
| 1 | Implement linear regression. |
| 2 | Implement multiple linear regression |
| 3 | Implement logistic regression |
| 4 | Implement Apriori algorithm |
| 5 | Implement k-means clustering algorithm. |
| 6 | Implement analysis over stream data. |
| **TOTAL PERIODS: 30** | |

| COURSE OUTCOMES | |
|---|---|
| Upon completion of the course, students will be able to | |
| **CO1:** | Describe the basics of big data analytics. |
| **CO2:** | Describe the frameworks for big data processing. |
| **CO3:** | Analyze the performance of data analysis methods over big data. |
| **CO4:** | Apply processing methods over stream data. |
| **CO5:** | Explain databases and frameworks for big data. |

| TEXT BOOKS | |
|---|---|
| 1. | Seema Acharya and Subhashini Chellappan, “Big Data and Analytics”, Wiley Publications, 2015. |
| 2. | David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL and Graph”, Elsevier Publishers, 2013. |
| **REFERENCE BOOKS** | |
| 1. | Judith Huruwitz, Alan Nugent, Fern Halper and Marcia Kaufman, “Big data for dummies”, John Wiley & Sons, Inc., 2013. |
| 2. | Tom White, “Hadoop The Definitive Guide”, Fourth Edition, O’Reilly Publications, 2015. |
| 3. | Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown and Rafael Coss, “Hadoop For Dummies”, Wiley Publications, 2014. |
| 4. | Robert D.Schneider, “Hadoop For Dummies”, John Wiley & Sons Inc,2012. |
| 5. | Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill, 2012. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO4 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 |
| CO5 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 |
| CO | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 |

3-High, 2- Medium, 1-Low

| CS22512 | NOSQL DATABASES | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSEOBJECTIVES:**

- To learn the fundamental of NoSQL databases.
- To gain knowledge on clustering techniques in NoSQL databases.
- To learn the basic concepts involved in document databases.
- To understand the fundamental concepts of MongoDB.
- To learn different data models in MongoDB.

| UNIT I | NoSQL DATABASES | 6 |
|---|---|---|
| NoSQL Databases - Evolution of NoSQL Databases-Different types of NoSQL databases-Advantages of NoSQL databases, Scalability and performance. Document data stores, Key-Value data stores. Case studies of MongoDB, HBase, Neo4J. NoSQL database design for applications. | | |
| **UNIT II** | **CLUSTERING IN NoSQL** | **6** |
| Clustering in NoSQL databases. Data distribution methods. Configurations for replication and fault-tolerance. NoSQL configurations for disaster tolerance. NoSQL query languages, CQL, Pig Latin. | | |
| **UNIT III** | **DOCUMENT DATABASES** | **6** |
| Document Databases: Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Complex Transactions, Queries against Varying Aggregate Structure. | | |
| **UNIT IV** | **MONGODB** | **6** |
| Introducing MongoDB: MongoDB Design Philosophy, Speed, Scalability, and Agility, Non-Relational Approach, JSON-Based Document Store, Performance vs. Features, Running the Database Anywhere, SQL Comparison, The MongoDB Data Model: JSON and BSON. | | |
| **UNIT V** | **MONGODB SHELL** | **6** |
| Basic Querying, Create and Insert, Explicitly Creating Collections, Inserting Documents Using Loop, Inserting by Explicitly Specifying _id, Update, Delete, Read, Using Indexes, Stepping Beyond the Basics, Using Conditional Operators, Regular Expressions, MapReduce, aggregate(), Designing an Application's Data Model. | | |
| | | **PERIODS:30** |
| **PRACTICAL EXERCISES** | | |
| 1 | Create a database and perform the manipulations and querying ( Insert, Update, Delete, Projection, Query- Where Clause, AND, OR operations) | |
| 2 | Execute Aggregation Pipeline and its operations. | |
| 3 | Execute Limit Records and Sort Records operation in MongoDB. | |
| 4 | Implementation of Aggregation and Map Reduce functions in MongoDB. | |
| 5 | Implementations of Indexing, Advanced Indexing using MongoDB. | |
| 6 | Implementations of Hashing using MongoDB. | |
| 7 | Establish a connection with a database or access any tabular data source using Java Driver/Python Driver/PHP Driver to do the following operations.<br>a) Send various MongoDB statements.<br>b) Retrieve and process the results received from the database | |
| | | **PERIODS:30** |
| | | **TOTAL: 60 PERIODS** |
| **COURSE OUTCOMES:** | | |
| **At the end of the course, the students will be able to:** | | |
| **CO1:** | Outline the evolution and application of NoSQL databases. | |
| **CO2:** | Summarize the clustering techniques and different aggregate structures in NoSQL | |

| | |
|---|---|
| | databases. |
| **CO3:** | Identify strategies to perform queries in MongoDB. |
| **CO4:** | Apply the concepts of Indexing, Advanced Indexing and Hashing techniques using MongoDB. |
| **CO5:** | Apply aggregation and Map Reduction in MongoDB. |

| **TEXT BOOKS:** | |
|---|---|
| 1. | Guy Harrison, "Next Generation Databases — NoSQL and Big data", 2018. |
| 2. | Kristina Chodorow, "MongoDB: The Definitive Guide-Powerful and Scalable Data Storage", Third Edition, O'Reilly Media Inc,2020. |
| **REFERENCES:** | |
| 1. | Peter Membrey and Eelco Plugge, "The Definitive Guide to MongoDB: The NoSQL Database for Cloud and Desktop Computing", 2013. |
| 2. | Sadalage P. & Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Wiley Publications, 2019. |
| 3. | Christopher D.Manning, Prabhakar Raghavan and Hinrich Schutze, "An introduction to Information Retrieval", Cambridge University Press, 2017. |
| 4. | Daniel Abadi, Peter Boncz and Stavros Harizopoulas, "The Design and Implementation of Modern Column-Oriented Database Systems", Now Publishers, 2013. |
| 5. | Francesco Marchioni ,"MongoDB for Java Developers", Packt Publishing, 2015. |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO4 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO5 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | - | - |
| CO | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | - | - |

3-High, 2- Medium, 1-Low

| **IT22631** | **DATA VISUALIZATION TECHNIQUES** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES:**

- Recognize the importance of data visualization in effectively communicating insights, aiding decision-making, and engaging stakeholders.
- Explore the historical development of data visualization techniques, understanding

| | | |
|---|---|---|
| key milestones and contributions that have shaped the field | | |
| • Explore techniques for visualizing hierarchical and network data structures, including tree maps, network diagrams, and sunburst charts, to reveal hierarchical relationships, network structures, and clusters within complex datasets. | | |
| • Learn to design and implement interactive data visualizations using tools and libraries | | |
| • Apply advanced visualization techniques learned throughout the course to real-world case studies and projects | | |
| **UNIT I** | **INTRODUCTION TO DATA VISUALIZATION** | **6** |
| Importance of data visualization-Historical overview-Types of visualizations -Principles of effective visualization | | |
| **UNIT II** | **VISUALIZATION TOOLS AND SOFTWARE** | **6** |
| Introduction to popular visualization tools (e.g., Tableau, Power BI)-Basic functionalities and features-Hands-on exercises with visualization software-Introduction to programming libraries (e.g., Matplotlib, ggplot2) | | |
| **UNIT III** | **DATA VISUALIZATION PRINCIPLES** | **6** |
| Gestalt principles-Color theory and usage-Perception and cognition in visualization-Design best practices for effective communication | | |
| **UNIT IV** | **EXPLORATORY DATA ANALYSIS** | **6** |
| nivariate, bivariate, and multivariate visualization-Distribution plot-Scatter plots-pair plots-correlation matrices- Hands-on exploratory data analysis exercises | | |
| **UNIT V** | **ADVANCED VISUALIZATION TECHNIQUES** | **6** |
| Time series and temporal data visualization-Geospatial data visualization-Hierarchical and network visualization-Interactive data visualization-Case studies and real-world applications | | |
| **TOTAL: 30 PERIODS** | | |
| **LIST OF EXPERIMENTS** | | |
| 1. | Write a Python script using Matplotlib or ggplot2 to visualize a dataset that demonstrates the importance of data visualization in uncovering trends or patterns that would be difficult to discern from raw data alone | |
| 2. | Create an interactive timeline visualization using D3.js or Plotly to showcase key milestones in the history of data visualization, along with descriptions and images for each milestone. | |
| 3. | Write a Python script using Matplotlib or ggplot2 to create visualizations that explore the use of color in conveying information. Experiment with different color palettes, color scales, and color combinations to illustrate the impact of color choices on visualization effectiveness | |
| 4. | Implement a series of visualizations using Matplotlib or ggplot2 to explore different types of plots (e.g., histograms, scatter plots, box plots) based on a given dataset. Add annotations, labels, and customized styles to enhance the visualizations. | |
| 5. | Creating 3D plots. | |
| **TOTAL: 30 PERIODS** | | |
| **COURSE OUTCOMES:** | | |

| At the end of the course, the students will be able to: | |
|---|---|
| **CO1:** | Summarize the importance, history, types, and principles of effective data visualization. |
| **CO2:** | Explain popular tools (Tableau, Power BI), their functionalities, and use programming libraries for advanced visualizations. |
| **CO3:** | Outline the gestalt principles, color theory, and design best practices for effective data communication. |
| **CO4:** | Implement univariate, bivariate, and multivariate visualizations, including distribution plots, scatter plots, and correlation matrices. |
| **CO5:** | Apply advanced techniques like time series, geospatial, hierarchical, and interactive visualizations with real-world case studies. |
| **TEXT BOOKS:** | |
| 1 | Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly Media, 2016. |
| 2 | Tamara Munzner, "Visualization Analysis and Design", CRC Press, 2014. |
| **REFERENCES:** | |
| 1 | Kirthi Raman, "Mastering Python Data Visualization", Packt Publishing, 2015. |
| 2 | Chad Adams, "Learning Python Data Visualisation", Packt Publishing, 2014. |
| 3 | Scott Murray, "Interactive Data Visualization for the Web", O'Reilly Media, 2013. |
| 4 | Julie Steele and Noah Iliinsky, "Beautiful Visualization", O Reilly,2022. |
| 5 | Dona M. Wong, "The Wall Street Journal Guide to Information Graphics",W.W.Norton & Company,2021. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| CO4 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO5 | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 2 |

3-High, 2- Medium, 1-Low

| | | | | | |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES:**

- To use regular expressions for pattern matching and calculating the minimum edit distance.
- To understand vector semantics and sequence labelling technique.
- To implement chatbots and dialogue systems to develop conversational AI applications.
- To understand automatic speech recognition (ASR) tasks and various techniques.
- To understand information extraction tasks, and techniques.

| | | |
|---|---|---|
| **UNIT I** | **TEXT AND SPEECH ANALYSIS** | **6** |

Regular Expressions - Word Normalization, Lemmatization and Stemming - Sentence Segmentation - Minimum Edit Distance.

| | | |
|---|---|---|
| **UNIT II** | **VECTOR SEMANTICS AND SEQUENCE LABELING** | **6** |

Lexical Semantics - Vector Semantics - Words and Vectors - (Mostly) English Word Classes - Part-of-Speech Tagging - Named Entities and Named Entity Tagging.

| | | |
|---|---|---|
| **UNIT III** | **BUILDING INTELLIGENT CHATBOTS** | **6** |

Designing conversational systems - Creating chatbot personalities - Handling user input and providing context-aware responses.

| | | |
|---|---|---|
| **UNIT IV** | **AUTOMATIC SPEECH RECOGNITION AND TEXT-TO-SPEECH** | **6** |

The Automatic Speech Recognition Task - Feature Extraction for ASR: Log Mel Spectrum - Speech Recognition Architecture – CTC.

| | | |
|---|---|---|
| **UNIT V** | **INFORMATION EXTRACTION** | **6** |

Relation Extraction - Relation Extraction Algorithms - Extracting Events - Representing Time - Representing Aspect.

**TOTAL: 30 PERIODS**

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1 | Create Regular expressions in Python for detecting word patterns and tokenizing text. |
| 2 | Getting started with Python and NLTK - Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, Bigrams. |
| 3 | Write a function that finds the 50 most frequently occurring words of a text that are not stop words. |
| 4 | Implement the Word2Vec model. |
| 5 | Design a chatbot with a simple dialog system. |
| 6 | Convert text to speech and find accuracy. |
| 7 | Design a speech recognition system and find the error rate. |

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Use regular expressions for pattern matching and calculating the minimum edit distance. |
| **CO2:** | Explain vector semantics and sequence labelling technique. |
| **CO3:** | Implement chatbots and dialogue systems to develop conversational AI applications. |

| | |
|---|---|
| **CO4:** | Explain automatic speech recognition (ASR) tasks and various techniques. |
| **CO5:** | Explain information extraction tasks, and techniques. |
| **TEXT BOOKS:** | |
| **1** | Daniel Jurafsky and James H. Martin, "Speech and Language Processing : An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition" , Third Edition, Pearson Education,2024. |
| **2** | Emil Hvitfeldt and Julia Silge, "Supervised machine learning for text analysis in R", Taylor & Francis group,2021. |
| **REFERENCES:** | |
| **1** | Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018. |
| **2** | Sunil Patel, "Getting started with Deep Learning for Natural Language Processing" , BPB Publications, 2021. |
| **3** | Daniel M. Bikel and Imed Zitouni, "Multilingual Natural Language Processing Applications: From Theory to Practice", Pearson Education India, 2012. |
| **4** | Sachin Srinivastava, "Natural Language Processing with Python", Notion Press, 2021. |
| **5** | Aadam Quraishi, Pinki Nayak, Ismail Keshta &T.Saju Raj, "Machine Learning For Natural Language Processing: Text And Speech Analysis", Xoffencer, 2024. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 3 | 2 | - | 3 | - | - | - | - | - | - | 3 | - | 3 | - |
| CO2 | 2 | 2 | 2 | - | 3 | - | - | - | - | - | - | 3 | - | 3 | - |
| CO3 | 2 | 3 | 3 | - | 3 | - | - | - | - | - | - | 3 | - | 3 | - |
| CO4 | 2 | 2 | 2 | - | 3 | - | - | - | - | - | - | 3 | - | 3 | - |
| CO5 | 2 | 2 | 1 | - | 3 | - | - | - | - | - | - | 3 | - | 3 | - |
| CO | 2 | 2 | 2 | - | 3 | - | - | - | - | - | - | 3 | - | 3 | - |

3-High, 2- Medium, 1-Low

| **IT22731** | **BUSINESS INTELLIGENCE** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES**

- To know the basics and models in business intelligence.
- To understand the data provisioning concepts.
- To describe and visualize data in business process.
- To understand the business process analysis, compliance and mining.
- To identify the multiple business perspectives of business processes.

| **UNIT I** | **INTRODUCTION AND MODELING IN BUSINESS INTELLIGENCE** | **6** |
|---|---|---|

| | | |
|---|---|---|
| Introduction: Definition of Business Intelligence - Putting Business Intelligence into Context - Business Intelligence: Tasks and Analysis Formats - Use Cases - Modeling in Business Intelligence: Models and Modeling in Business Intelligence - Models and Data. | | |
| **UNIT II** | **DATA PROVISIONING** | **6** |
| Data Provisioning: Introduction and Goals - Data Collection and Description - Data Extraction - From Transactional Data Towards Analytical - Schema and Data Integration. | | |
| **UNIT III** | **DATA DESCRIPTION AND VISUALIZATION** | **6** |
| Data Description and Visualization: Introduction - Description and Visualization of Business Processes - Description and Visualization of Data in the Customer Perspective - Basic Visualization Techniques – Reporting. | | |
| **UNIT IV** | **PROCESS ANALYSIS** | **6** |
| Process Analysis: Introduction and Terminology - Business Process Analysis and Simulation - Process Performance Management and Warehousing - Process Mining - Business Process Compliance - Evaluation and Assessment. | | |
| **UNIT V** | **BUSINESS PERSPECTIVES** | **6** |
| Analysis of Multiple Business Perspectives: Introduction and Terminology - Social Network Analysis and Organizational Mining - Decision Point Analysis - Text Mining. | | |
| | | **TOTAL PERIODS: 30** |

| **LIST OF EXPERIMENTS** | |
|---|---|
| 1. | Import the legacy data from different sources such as (Excel, SqlServer, Oracle etc.) and load in the target system. |
| 2. | Data Modelling and Analytics with Pivot Table in Excel. |
| 3. | Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sqlserver / Power BI. |
| 4. | Data Visualization from ETL Process. |
| 5. | Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data. |
| 6. | Data Analysis and Visualization using Advanced Excel. |
| | **TOTAL: 30 PERIODS** |

| **COURSE OUTCOMES** | |
|---|---|
| Upon completion of the course, students will be able to | |
| **CO1:** | Explain the basic concepts and models in business intelligence. |
| **CO2:** | Summarize the data provisioning process, from data collection and extraction to transformation and integration. |
| **CO3:** | Apply the description and visualization of business processes and data using basic visualization techniques. |
| **CO4:** | Illustrate the process analysis techniques and methodologies. |
| **CO5:** | Identify the business processes from multiple perspectives. |

| TEXT BOOKS | |
|---|---|
| 1. | Wilfried Grossmann and Stefanie Rinderle-Ma, “Fundamental of Business Intelligence”, Springer, 2015. |
| 2. | Ramesh Sharda, Dursun Delen and Efraim Turban, "Business Intelligence, Analytics, and Data Science: A Managerial Perspective", Fourth Edition, Pearson Education, 2017. |
| **REFERENCE BOOKS** | |
| 1. | Prasad R.N. and Seema Acharya, "Fundamentals of Business Analytics", Second Edition, Wiley, 2016. |
| 2. | David Loshin, "Business Intelligence: The Savvy Manager’s Guide", Second Edition, Morgan Kaufmann, USA, 2012. |
| 3. | Bernard Marr,”Data Straergy”, Second Edition, Kogan Page Publishers,2017. |
| 4 | Vercellis C, **“**Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley,2010. |
| 5 | Tobias Zwingmann, “AI-Powered Business Intelligence: Improving Forecasts and Decision Making with Machine Learning”, Grayscale Indian Edition, 2022. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO2 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO4 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO5 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 3 | - |

3-High, 2- Medium, 1-Low

| IT22732 | SOCIAL MEDIA ANALYTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To learn the concepts and techniques of social media analytics.
- To identify key concepts in social media metrics.
- To learn social media analytics tools.
- To learn sentiment analysis and text mining using predictive tools in social media.

| | | |
|---|---|---|
| • To understand how social media analytics can be applied in business and marketing strategies. | | |
| **UNIT I** | **SOCIAL MEDIA ANALYTICS: AN OVERVIEW** | **6** |
| Core Characteristics of Social Media, Types of Social Media, Social media landscape, Need for Social Media Analytics (SMA), SMA in small & large organizations. Purpose of Social Media Analytics, Social Media vs. Traditional Business Analytics, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Challenges to Social Media Analytics, Social Media Analytics Tools. | | |
| **UNIT II** | **SOCIAL NETWORK STRUCTURE, MEASURES & VISUALIZATION** | **6** |
| Basics of Social Network Structure - Nodes, Edges & Tie Describing the Networks Measures - Degree Distribution, Density, Connectivity, Centralization, Tie Strength & Trust Network Visualization - Graph Layout, Visualizing Network features, Scale Issues. Social Media Network Analytics: Common Network Terms, Common Social Media Network Types, Types of Networks, Common Network Terminologies, Network Analytics Tools. | | |
| **UNIT III** | **SOCIAL MEDIA TEXT, ACTION & HYPERLINK ANALYTICS** | **8** |
| Social Media Text Analytics - Types of Social Media Text, Purpose of Text Analytics, Steps in Text Analytics, Social Media Text Analysis Tools. Social Media Action Analytics - What is Actions Analytics? Common Social Media Actions, Actions Analytics Tools. Social Media Hyperlink Analytics - Types of Hyperlinks, Types of Hyperlink Analytics, Hyperlink Analytics Tools | | |
| **UNIT IV** | **SOCIAL MEDIA LOCATION & SEARCH ENGINE ANALYTICS** | **5** |
| Location Analytics - Sources of Location Data, Categories of Location Analytics, Location Analytics and Privacy Concerns, Location Analytics Tools. Search Engine Analytics - Types of Search Engines, Search Engine Analytics, Search Engine Analytics Tools. | | |
| **UNIT V** | **SOCIAL MEDIA ANALYTICS & APPLICATIONS** | **5** |
| Social media in public sector - Analyzing public sector social media, analyzing individual users, case study. Business use of Social Media - Measuring success, Interaction and monitoring, case study. | | |
| | | **TOTAL: 30 PERIODS** |
| **LIST OF EXPERIMENTS** | | |
| 1. | Study various -<br>i) Social Media platforms (Facebook, twitter, YouTube etc.).<br>ii) Social Media analytics tools (Facebook insights, google analytics, Netlytic etc.).<br>iii) Social Media Analytics techniques and engagement metrics (page level, post level, member level).<br>iv) Applications of Social media analytics for business. e.g. Google Analytics. | |
| 2. | Data Collection-Select the social media platforms of your choice (Twitter, Facebook, LinkedIn, YouTube, Web blogs etc), connect to and capture social media data for business (scraping, crawling, parsing). | |
| 3. | Develop Content (text, emotions, image, audio, video) based social media analytics model for business (e.g. Content Based Analysis: Topic , Issue ,Trend, sentiment/opinion analysis, audio, video, image analytics). | |
| 4. | Develop Structure based social media analytics model for any business (e.g. | |

| | |
|---|---|
| | Structure Based Models -community detection, influence analysis). |
| 5. | Develop a dashboard and reporting tool based on real time social media data. |
| 6. | Design the creative content for promotion of your business on social media platform. |
| 7. | Develop social media text analytics models for improving existing product/ service by analyzing customer's reviews/comments. |
| | **TOTAL: 30 PERIODS** |

| | |
|---|---|
| **COURSE OUTCOMES:** | |
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Illustrate the nature of social media data, its sources, formats, and characteristics. |
| **CO2:** | Explain social networks, calculate key network measures, visualize network structures, and SNA techniques to various domains. |
| **CO3:** | Utilize social media text, user actions, and hyperlinks to derive meaningful insights for business and marketing purposes. |
| **CO4:** | Make use of use location and search engine analytics to gain valuable insights into user behavior. |
| **CO5:** | Summarize social media analytics methods and tools for decision-making and business impact across domains. |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | Gohar F. Khan, "Seven Layers of Social Media Analytics: Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, and Location Data", Amazon Digital Services, 2015. |
| 2 | Matthew A. Russell and Mikhail Klassen, "Mining the Social Web Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More" O'Reilly Media, 2018. |
| **REFERENCES:** | |
| 1 | Derek Hansen, Ben Shneiderman, Marc A. Smith and Itai Himelboim, "Analysing Social Media Networks with Node XL", Second Edition, Morgan Kaufmann, 2019. |
| 2 | David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World", Third Edition, Cambridge University Press, 2017. |
| 3 | Charu C Aggarwal "Recommender Systems the Textbook", Springer International Publishing Switzerland, 2016. |
| 4 | Krish Krishnan & Shawn P. Rogers "Social Data Analytics: Collaboration for the Enterprise", Morgan Kaufmann, 2014. |
| 5 | Sharan Kumar Ravindran, Vikram Garg Mastering Social Media Mining with R, Packt Publishing Limited, 2015. |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | - | 1 | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

## VERTICAL IV: INFORMATION ASSURANCE AND SECURITY

| IT22541 | CYBER ETHICS AND LEGAL ISSUES | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To demonstrate the basic concepts of cyber ethics.
- To describe the ethical concepts and theories.
- To apply the concepts of security in digital devices.
- To apply the hacking and cybercrime concepts.
- To demonstrate the ethical aspects of emerging and converging technologies

| UNIT I | CYBER ETHICS | 6 |
|---|---|---|

Introduction To Cyberethics: Concepts, Perspectives, And Methodological Frameworks : Cyberethics and cybertechnology – Cyberethics evolution – Are Cyberethics issues Unique ethical issues? –Three Distinct perspectives – A Comprehensive Cyberethics Methodology.

| UNIT II | ETHICAL CONCEPTS AND THEORIES | 6 |
|---|---|---|

Establishing and Justifying a Moral System: Ethics and Morality – Ethical Theories. Professional Ethics, Codes of Conduct, and Moral Responsibility: Professional Ethics – Professional Code of Ethics and Code of Conduct – Risk Assessment in the software development process.

| UNIT III | CYBERSPACE | 6 |
|---|---|---|

Privacy and cyberspace – Personal Privacy – Why is privacy important? – Gathering, exchanging and mining personal data. security in cyberspace : Security in the context of cybertechnology – Categories of Cyber security – Hacking and Hacker ethic.

| UNIT IV | CYBERCRIME AND INTELLECTUAL PROPERTY | 6 |
|---|---|---|

Cybercrime and cyber related crimes: Cybercrimes and Cybercriminals -Hacking, Cracking and Counter hacking – Categories of cybercrime. Intellectual property disputes in cyber space: What is Intellectual Property – Copyright law and Digital Media – Patents, Trademarks and Trade Secrets.

| UNIT V | ETHICAL ASPECTS OF EMERGING AND CONVERGING TECHNOLOGIES | 6 |
|---|---|---|

Ambient Intelligence and Ubiquitous Computing – Bioinformatics and Computational Genomics – Nanotechnology and Nanocomputing – Autonomous machine and machine

| | |
|---|---|
| ethics. | |
| | **TOTAL PERIODS: 30** |
| **PRACTICAL EXERCISES** | |
| 1. | Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User). |
| 2. | Setting and configuring two factor authentication in the Mobile phone. |
| 3. | Installation and configuration of Computer Host Firewall. |
| 4. | Demonstration of email phishing attack and preventive measures. |
| 5. | Investigations on Email Crime. |
| 6. | Hacking a web page |
| 7. | Recovering deleted files from a hard disk |
| | **TOTAL PERIODS: 30** |
| **COURSE OUTCOMES** | |
| Upon completion of the course, students will be able to | |
| **CO1:** | Demonstrate the basic concepts of cyber ethics. |
| **CO2:** | Describe the ethical concepts and theories. |
| **CO3:** | Apply the concepts of security in digital devices. |
| **CO4:** | Apply the hacking and cybercrime concepts. |
| **CO5:** | Demonstrate the ethical aspects of emerging and converging technologies |
| **TEXT BOOKS** | |
| 1. | Herman T. Tavani," Ethics and Technology Controversies, Questions, and Strategies for Ethical Computing", Fourth Edition,Wiley, 2015. |
| 2. | Mark Grabowski and Eric P. Robinson," Cyber Law and Ethics", Routledge,2021. |
| **REFERENCE BOOKS** | |
| 1. | Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd,2011. |
| 2. | Kumar & Sharma, "Cyber Laws: Intellectual Property and E-commerce Security", Dominant Publishers & Distributors Private Ltd, 2011. |
| 3. | Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021. |
| 4. | Alfreda Dudley, James Braman and Giovanni Vincenti, "Investigating Cyber Law and Cyber Ethics: Issues, Impacts and Practices", IGI Global, 2011. |
| 5. | Ishaani Priyadarshini and Chase Cotton, "Cybersecurity Ethics, Legal, Risks, and Policies", Taylor and Francis Group, 2021. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 2 | 1 | - | - | 3 | - | 3 | - | - | - | 1 | - | 3 | - |
| CO2 | 2 | 2 | 1 | - | - | 3 | - | 3 | - | - | - | 1 | - | 3 | - |
| CO3 | 2 | 2 | 1 | 3 | 3 | 3 | - | 3 | - | - | - | 1 | - | 3 | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO4 | 2 | 2 | 1 | 3 | 3 | 3 | - | 3 | - | - | - | 1 | - | 3 | - |
| CO5 | 2 | 2 | 1 | - | - | 3 | - | 3 | - | - | - | 1 | - | 3 | - |
| CO | 2 | 2 | 1 | 3 | 3 | 3 | - | 3 | - | - | - | 1 | - | 3 | - |

3-High, 2- Medium, 1-Low

| IT22542 | PENETRATION TESTING AND VULNERABILITY ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- 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 | INFORMATION GATHERING | 6 |
|---|---|---|

Introduction - Terminologies - Categories of Penetration Testing - Phases of Penetration Test - 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 | HOST DISCOVERY AND EVADING TECHNIQUES | 6 |
|---|---|---|

Vulnerability Scanner Function, pros and cons - Vulnerability Assessment with NMAP - Testing SCADA environment with NMAP - Nessus Vulnerability Scanner - Safe check - Silentdependencies - Port Range Vulnerability Data Resources.

| UNIT III | COMMON VULNERABILITY ANALYSIS OF APPLICATION PROTOCOLS | 6 |
|---|---|---|

Testing for vulnerability web application and resources - Authentication Bypass with Insecure Cookie Handling - XSS Vulnerability - File inclusion vulnerability - Remote file Inclusion -Patching file Inclusions - Testing a website for SSI Injection.

| UNIT IV | WIRELESS NETWORK VULNERABILITY ANALYSIS | 6 |
|---|---|---|

WLAN and its inherent insecurities - Bypassing WLAN Authentication: uncovering hidden SSIDs - MAC Filters - Bypassing open and shard authentication - Attacking the client: Caffe Latte attack De-authenticating 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** | **EXPLOITS** | **6** |
| Architecture and Environment- Leveraging Metasploit on Penetration Tests, Understanding - Metasploit Channels, Metasploit Framework and Advanced Environment configurations - Understanding the Soft Architecture, Configuration and Locking, Advanced payloads and addon modules Global datastore, module datastore, saved environment Meterpreter. | | |
| | | **TOTAL: 30 PERIODS** |
| **LIST OF EXPERIMENTS** | | |
| 1. | Set up of Kali Linux in a Virtual machine and setup with DNS info and collection of local networks. | |
| 2. | Scan the network for Windows XP and Windows 7 Target machines in local network and virtual network. | |
| 3. | Identify the open ports and firewall rules setup. | |
| 4. | Use password guessing tools to guess a password. Use password strengthening tools to strengthen the password. Try guessing the password and tabulate the enhanced difficulty due to length of password and addition of special characters. | |
| 5. | Extract password hashes from Windows XP/NT machine. Use a password extraction tool, using word list, single crack or external mode to recover the password. Increase the complexity of the password and determine the point at which the cracking tool fails. | |
| 6. | Experiments on SQL injections. | |
| 7. | Experiments on Metasploit Framework. | |
| | | **TOTAL: 30 PERIODS** |
| **COURSE OUTCOMES:** | | |
| **At the end of the course, the students will be able to:** | | |
| **CO1:** | Explain the basic principles for Information Gathering and Detecting Vulnerabilities in the system. | |
| **CO2:** | Illustrate the various attacks caused using the network and communication system in an application | |
| **CO3:** | Identify the potential risks associated with specific application protocols. | |
| **CO4:** | Examine the security threats and vulnerabilities in computer networks using penetration testing techniques | |
| **CO5:** | Make use of penetration testing tools. | |
| **TEXT BOOKS:** | | |
| 1 | Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, CRC Press, 2015. | |
| 2 | Patrick Engebretson, “The Basics of Hacking and Penetration Testing Ethical Hacking and Penetration Testing made easy”, Syngress publications, Elsevier, 2013. | |
| **REFERENCES:** | | |
| 1 | Vivek Ramachandran and BackTrack “Wireless Penetration Testing, Beginners | |

| | |
|---|---|
| | guide Master bleeding edge wireless testing techniques with BackTrack", Packt Publishing, 2011. |
| 2 | Mayor, K.K.Mookey, Jacopo Cervini, Fairuzan Roslan and Kevin Beaver, "Metasploit Toolkit for Penetration Testing, Exploit Development and Vulnerability Research",Syngress publications, Elsevier, 2011. |
| 3 | Abhinav Singh, "Metasploit Penetration Testing Cookbook", Packt Publishing, 2012. |
| 4 | Ken Dunham, "Mobile Malware Attacks and Defence", Syngress publications, Elsevier, 2010. |
| 5 | Andrew Whitaker and Daniel P. Newman, "Penetration Testing and Network Defence :The practical guide to simulating, detecting and responding to network attacks", CiscoPress, 2010. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 1 | 3 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 1 | 3 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 1 | 3 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 1 | 3 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| IT22641 | DIGITAL FORENSICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To study the fundamentals of digital Forensics
- To learn, analyze and validate Forensics Data
- To study the tools and tactics associated with Cyber Forensics

| UNIT I | DIGITAL FORENSIC- INTRODUCTION | 6 |
|---|---|---|

Computer forensics and investigations as a profession, Understanding computer forensics, computer forensics versus other related disciplines, A brief History of computer Forensics, Understanding case laws, Developing computer forensics resources, Preparing for computer investigations, Understanding law enforcement agency investigations, Following the legal process, Understanding corporate investigations, Establishing company policies, Displaying warning Banners.

| UNIT II | WINDOWS SYSTEMS AND ARTIFACTS | 6 |
|---|---|---|

Introduction, Windows File Systems, File Allocation Table, New Technology File System, File System Summary, Registry, Event Logs, Prefetch Files, Shortcut Files, Windows Executables.

| UNIT III | LINUX SYSTEMS AND ARTIFACTS | 6 |
|---|---|---|

Introduction, Linux File Systems, File System Layer, File Name Layer , Metadata Layer, Data Unit Layer, Journal Tools, Deleted Data, Linux Logical Volume Manager, Linux Boot Process and Services, System V , BSD, Linux System Organization and Artifacts, Partitioning, File system Hierarchy, Ownership and Permissions, File Attributes, Hidden Files, User Accounts , Home Directories, Shell History GNOME Windows Manager Artifacts, Logs, User Activity Logs, Syslog, Command Line Log Processing, Scheduling Tasks.

| UNIT IV | CURRENT COMPUTER FORENSICS | 6 |
|---|---|---|

Tools Evaluating Computer Forensics - Tool Needs, Types of Computer Forensics Tools, Tasks Performed by Computer Forensics Tools, Tool Comparisons, Other Considerations for Tools, Computer Forensics Software Tools, Command-Line Forensics Tools, UNIX/Linux Forensics Tools, Other GUI Forensics Tools, Computer Forensics Hardware Tools, Forensic Workstations, Using a Write-Blocker.

| UNIT V | IDENTIFICATION OF DATA | 6 |
|---|---|---|

Timekeeping, Forensic Identification and Analysis of Technical Surveillance Devices, Reconstructing Past Events: How to Become a Digital Detective, Useable File Formats, Unusable File Formats, Converting Files, Investigating Network Intrusions and Cyber Crime, Network Forensics and Investigating logs, Investigating network Traffic, Investigating Web attacks ,Router Forensics. Cyber forensics tools and case studies.

**TOTAL: 30 PERIODS**

**PRACTICAL EXERCISES:**

| | |
|---|---|
| 1 | Study of Computer Forensics and different tools used for forensic investigation. |
| 2 | Live Forensics case Investigation using Autopsy |
| 3 | How to Recover deleted Files using Forensics Tools |
| 4 | Find last Connected USB on your system (USB Forensics) |
| 5 | How to Collect Email Evidence in Victim PC |
| 6 | How to Extract6 Exchangeable image file format (EXIF) Data from Image Files using Exifreader Software |
| 7 | Study the steps for hiding and extract any text file behind an image file/Audio file using Command Prompt |

| | |
|---|---|
| | **TOTAL: 30 PERIODS** |
| **COURSE OUTCOMES:** | |
| **At the end of the course, the students will be able to:** | |
| **CO1:** | Summarize the highest professional and ethical standards. |
| **CO2:** | Compare technical and legal information and emerging industry trends. |
| **CO3:** | Identify and document potential security breaches of computer data. |
| **CO4:** | Identify digital investigations that conform to accepted professional standards. |
| **CO5:** | Apply collaboratively with clients, management, and/or law enforcement to advance digital investigations or protect the security of digital resources. |
| **TEXT BOOKS:** | |
| 1 | Cory Altheide and Harlan Carvey, "Digital Forensics with Open Source Tools", Syngress imprint of Elsevier, 2011. |
| 2 | Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations", Fourth Edition, Course Technology,2014. |
| **REFERENCES:** | |
| 1 | Angus M.Marshall, "Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, 2010. |
| 2 | John Sammons , "The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics", Syngress imprint of Elsevier, 2012. |
| 3 | Anders Flaglien, Inger Marie Sunde and Ausra Dilijonaite, "Digital Forensics", John Wiley & Sons, Ltd, 2017. |
| 4 | William Oettinger , "Learn Computer Forensics", Packt publishers, 2020. |
| 5 | Thomas J. Holt , "Cybercrime and Digital Forensics An Introduction", Third Edition, Routledge Publishers, 2022. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 1 | 1 | - | - | - | 1 | 1 | 2 | 2 | 3 | - | - |
| CO2 | 2 | 1 | 1 | 3 | 2 | - | - | - | 2 | 2 | 1 | 2 | 2 | - | - |
| CO3 | 3 | 2 | 1 | 2 | 2 | - | - | - | 2 | 1 | 1 | 2 | 1 | - | - |
| CO4 | 3 | 2 | 3 | 2 | 2 | - | - | - | 3 | 3 | 3 | 2 | 2 | - | - |
| CO5 | 3 | 1 | 2 | 3 | 3 | - | - | - | 2 | 2 | 2 | 2 | 3 | - | - |
| CO | 3 | 2 | 2 | 2 | 2 | - | - | - | 2 | 2 | 2 | 2 | 2 | - | - |

3-High, 2- Medium, 1-Low

| | | | | | |
|---|---|---|---|---|---|
| **IT22642** | **INFORMATION SECURITY** | **L** | **T** | **P** | **C** |
| | | **2** | **0** | **2** | **3** |

| COURSE OBJECTIVES: | | |
|---|---|---|
| • To understand the basics of Information Security | | |
| • To know the need for Information Security | | |
| • To become aware of Security management | | |
| • To know the aspects of risk management | | |
| • To know the technological aspects of Information Security | | |
| **UNIT I** | **INTRODUCTION** | **6** |
| History - What is Information Security? - Critical Characteristics of Information - CNSS Security Model - Components of an Information System, Security and the Organization: Balancing Security and Access - Approaches to Information Security Implementation. | | |
| **UNIT II** | **NEED FOR INFORMATION SECURITY** | **5** |
| Introduction to the Need for Information Security - Information Security Threats and Attacks – The 12 Categories of Threats. | | |
| **UNIT III** | **SECURITY MANAGEMENT** | **6** |
| Introduction to the Management of Information Security - Information Security Planning and Governance - Information Security Policy, Standards, and Practices- Security Education, Training, and Awareness Program- Information Security Blueprint, Models, And Frameworks. | | |
| **UNIT IV** | **RISK MANAGEMENT** | **6** |
| Risk Management: The Risk Management Framework- The Risk Management Process- Systems Risk Treatment/Risk Response - Managing Risk - Alternative Risk Management Methodologies. | | |
| **UNIT V** | **SECURITY TECHNOLOGY** | **7** |
| Introduction to Access Controls - Firewall Technologies - Protecting Remote Connections - Intrusion Detection and Prevention Systems | | |
| | | **TOTAL: 30 PERIODS** |
| **LIST OF EXPERIMENTS** | | |
| 1. | Implement STS to issue security tokens for authentication and access control in a distributed system. | |
| 2. | Configure Multi-Factor Authentication (MFA) for a system or application and test the login process with multiple authentication factors. | |
| 3. | Set up an IDS in a lab environment to monitor remote access attempts. Simulate various attack scenarios (e.g., brute force attacks) and analyze IDS alerts. | |
| 4. | Configure the firewall to log traffic events and use a log analysis tool (e.g., Splunk, ELK stack) to parse and analyze the logs. Identify suspicious traffic patterns, successful/failed connection attempts, and other security events. | |
| 5. | Set up a honeypot (e.g., Honeyd, Kippo) in a lab environment. Configure the | |

| | |
|---|---|
| | honeypot to mimic a vulnerable system or service to attract attackers. |
| 6. | Create a small-scale honeynet by deploying multiple honeypots interconnected with a dedicated network segment. Configure the honeypots to collect and share attack information. |
| | **TOTAL: 30 PERIODS** |

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Explain the basics of Information Security. |
| **CO2:** | Summarize the need for Information Security. |
| **CO3:** | Identify the key areas and concepts in Information Security Management. |
| **CO4:** | Illustrate the aspects of Risk Management. |
| **CO5:** | Make use of Security Technology. |

**TEXT BOOKS:**

| | |
|---|---|
| 1 | Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Cengage Publication, 2022. |
| 2 | Matt Bishop "Computer Security Art and Science", Second Edition,Addisson-Wesley,2019. |

**REFERENCES:**

| | |
|---|---|
| 1 | Micki Krause and Harold F. Tipton, "Information Security Management handbook", Sixth Edition,Auerbach Publications, 2012. |
| 2 | Stuart McClure, Joel Scrambray and George Kurtz, "Hacking Exposed: Network Security Secrets and Solutions", Fifth Edition,Tata McGraw- Hill Osborne Media, 2019. |
| 3 | Mark Stamp, "Information Security Principles and Practice", John Wiley and sons, 2011. |
| 4 | Timothy J. Shineall and Jonathan M. Spring , "Introduction to Information Security: A strategic Based Approach", Elsevier, 2014. |
| 5 | Jason Andress and Steven Winterfield, "The Basics of Information Security Understanding the fundamentals of InfoSec in Theory Practice", Elsevier, 2014. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 2 | 2 | - | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 2 | 2 | - | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 2 | 2 | - | 3 | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low



| IT22741 | MULTIMEDIA SECURITY | L | T | P | C |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES:**

- To understand the basics of digital watermarking
- To know about the concepts of digital watermarking techniques.
- To understand the basic concepts of steganography.
- To implement various steganography schemes.
- To learn about multimedia encryption techniques.

| | | |
|---|---|---|
| **UNIT I** | **INTRODUCTION TO DIGITAL WATERMARKING** | **5** |

Digital Watermarking Basics: Models of Watermarking, Basic Message Coding, Error Coding, Digital Watermarking Theoretic Aspects: Mutual information and Channel Capacity, Designing a good digital watermark, Theoretical analysis of Digital watermarking.

| | | |
|---|---|---|
| **UNIT II** | **SIGNAL & MULTIMEDIA WATERMARKING** | **8** |

Audio Watermarking, Speech Watermarking, Image Watermarking, Video Watermarking.

| | | |
|---|---|---|
| **UNIT III** | **STEGANOGRAPHY** | **5** |

Introduction- Digital Image formats- Modern Steganography, Steganography Channels Steganography Goals

| | | |
|---|---|---|
| **UNIT IV** | **STEGANOGRAPHY SCHEMES** | **6** |

Image : Substitution, Bit Plane Coding, Transform Domain, Audio: Data Echo Hiding, Phase Coding, Video: Temporal technique, Spatial technique .

| | | |
|---|---|---|
| **UNIT V** | **MULTIMEDIA ENCRYPTION** | **6** |

Fundamentals of Multimedia Encryption Techniques, Chaos-Based Encryption for Digital Images and Videos, Key Management and Protection for IP Multimedia.

**TOTAL: 30 PERIODS**

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1 | Compare the performance of different encryption algorithms (e.g., AES, RSA) on multimedia files (e.g., images, videos) in terms of security and speed. |
| 2 | Develop an application for image watermarking. |
| 3 | Develop an application for audio watermarking. |
| 4 | Implement a function to encode the message into a text file. |
| 5 | Implement a function to encode the message into an image file. |
| 6 | Implement a function to encode the message into an audio file. |

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Demonstrate the watermarking techniques to design a good digital watermark. |
| **CO2:** | Apply digital watermarking techniques. |
| **CO3:** | Explain the basic concept of steganography. |
| **CO4:** | Utilize steganography techniques in real-world applications. |
| **CO5:** | Summarize multimedia encryption methods. |

**TEXT BOOKS:**

| | |
|---|---|
| 1 | Frank Shih, "Digital Watermarking and Steganography: Fundamentals and Techniques", Second Edition,CRC press, 2017. |
| 2 | Nematollahi, Mohammad Ali, Vorakulpipat, Chalee, Rosales and Hamurabi |

| | |
|---|---|
| | Gamboa, “Digital Watermarking: Techniques and Trends”, Springer, 2017. |
| **REFERENCES:** | |
| 1 | Ingemar Cox, Matthew Miller, Jeffrey Bloom, Jessica Fridrich and TonKalker, “Digital Watermarking and Steganography”, Second Edition, Elsevier, 2017. |
| 2 | David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning about a Highly Connected World”, Third Edition, Cambridge University Press, 2017. |
| 3 | Singh, Amit Kumar, Mohan and Anand, “Handbook of Multimedia Information Security: Techniques and Applications”, Springer, 2019. |
| 4 | Pande, Amit, Zambreno and Joseph, “Embedded Multimedia Security Systems”, Springer, 2013. |
| 5 | B. Furht and D. Kirovski ,” Multimedia Security Handbook”, CRC press, 2020. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 1 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 2 | 1 | 1 | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO | 3 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | - | 3 | - | - |

3-High, 2- Medium, 1-Low

| CS22732 | BLOCKCHAIN TECHNOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSEOBJECTIVES:**

- Get to grips with the underlying technical principles of blockchain.
- Explore cryptography, mine crypto-currencies, and solve scalability issues with this comprehensive guide.
- Build powerful applications using Ethereum to secure transactions and create smart contracts.
- Investigate Securing, interconnecting public and private blockchain
- Understand the decentralized applications (Dapps).

| UNIT I | INTRODUCTION AND CONSENSUS MECHANISM | 6 |
|---|---|---|

Introduction: Overview of Block chain, History of Blockchain, Peer to Peer Network, Smart Contract, Wallet, Digital Currency, Ledgers, Types of Blockchain Platform. Permissioned Blockchain, Permissionless Blockchain, Different Consensus Mechanism- Proof of Work,

| | | |
|---|---|---|
| Proof of Stake, Proof of Activity, Proof of Burn, Proof of Elapsed Time, Proof of Authority, Proof of Importance. | | |
| **UNIT II** | **CRYPTO CURRENCY AND WALLET** | **6** |
| Types of Wallet, Desktop Wallet, App based Wallet, Browser based wallet, Meta-mask, Creating an account in Meta-mask, Use of faucet to fund wallet, transfer of cryptocurrency in meta-mask. | | |
| **UNIT III** | **SMART CONTRACT AND ETHEREUM** | 6 |
| Overview of Ethereum, Writing Smart Contract in Solidity, Remix IDE , Different networks of Ethereum, understanding blocks practically at blockhcain.com, how to compile and deploy smart contract in remix. | | |
| **UNIT IV** | **CRYPTO PRIMITIVES, SECURING AND INTERCONNECTING PUBLIC AND PRIVATE BLOCK CHAINS** | **7** |
| Hash Function and Merle Tree-Security Properties-Security Considerations for block chain-Digital Signature-Public Key Cryptography-Bitcoin blockchain incentive structures- Nash Equilibriums- evolutionary stable strategies,-and Pareto efficiency (game theory) | | |
| **UNIT V** | **USE CASES-APPLICATIONS IN DIFFERENT AREAS** | **5** |
| Industry applications of Blockchain-Blockchain in Government-Government use cases-Preventing Cybercrime through block chain-Block Chain in defense, tax payments | | |
| | | **30 PERIODS** |

| **PRACTICAL EXERCISES** | |
|---|---|
| 1 | Creating Merkle tree |
| 2 | Creation of Block |
| 3 | Block chain Implementation Programming code |
| 4 | Creating ERC20 token |
| 5 | Java code to implement blockchain in Merkle Trees |
| 6 | Java Code to implement Mining using block chain |
| 7 | Java Code to implement peer-to-peer using block chain |
| | **30 PERIODS** |
| | **TOTAL: 60 PERIODS** |

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Recognize the block chain technology. |
| **CO2:** | Comprehend the Consensus Mechanism, Crypto-Currency, smart contract, Hyperledger Fabric. |
| **CO3:** | Identify the block-chain based solutions and write smart contract using Ethereum Framework. |
| **CO4:** | Know to secure the private and public blockchain. |
| **CO5:** | Apply Blockchain in future use cases for security. |

**TEXT BOOKS:**

| | |
|---|---|
| 1. | Imran Bashir ,"Mastering Blockchain: A deep dive into distributed ledgers, consensus |

| | |
|---|---|
| | protocols, smart contracts, DApps, crypto currencies, Ethereum, and more", Third Edition, Packt Publishing, 2020. |
| 2. | Antonopoulos, Andreas M., and Gavin Wood, "Mastering ethereum: building smart contracts and Dapps", O'Reilly Media, 2018. |
| **REFERENCES:** | |
| 1. | Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O"Reilly, 2014. |
| 2. | Swan and Melanie," Blockchain: Blueprint for a new economy", O'Reilly Media, 2015. |
| 3. | Badr, Bellaj, Richard Horrocks and Xun Brian Wu. "Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Ltd, 2018. |
| 4. | Chittoda and Jitendra,"Mastering Blockchain Programming with Solidity: Write production-ready smart contracts for Ethereum blockchain with Solidity", Packt Publishing Ltd, 2019. |
| 5. | Antony Lewis, "The Basics Of Bitcoins And Blockchains:An Introduction To Cryptocurrencies And The Technology That Powers Them", Mango Media Illustrated edition,2018. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - |
| CO2 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - |
| CO3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - |
| CO4 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - |
| CO5 | - | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - |
| CO | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | 2 | - |

3-High, 2- Medium, 1-Low

## VERTICAL V: COGNITIVE TECHNOLOGIES

| IT22551 | QUANTUM COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |
| **COURSEOBJECTIVES:** | | | | | |
| • To know the background of classical computing and quantum computing. | | | | | |
| • To learn the fundamental concepts behind quantum computation. | | | | | |

- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum cryptography and future applications

| | | |
|---|---|---|
| **UNITI** | **QUANTUM COMPUTING BASIC CONCEPTS** | **6** |

History and Evolution of Quantum Computing, Classical vs Quantum Computers, Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Superpositions.

| | | |
|---|---|---|
| **UNIT II** | **DIGITAL QUANTUM GATES AND CIRCUITS** | **6** |

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction .

| | | |
|---|---|---|
| **UNIT III** | **QUANTUM PROGRAMMING** | **6** |

Introduction to Quantum Programming Languages (Q#), Writing and Testing Quantum Programs, Quantum Simulations .

| | | |
|---|---|---|
| **UNIT IV** | **QUANTUM ALGORITHMS** | **6** |

Quantum Teleportation, Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm .

| | | |
|---|---|---|
| **UNIT V** | **QUANTUM CRYPTOGRAPHY** | **6** |

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91, Quantum Communication Protocols, Futures of Quantum Computing.

**TOTAL: 30 PERIODS**

**PRACTICAL EXERCISES**

| | |
|---|---|
| 1 | Single qubit gate simulation - Quantum Composer |
| 2 | Multiple qubit gate simulation - Quantum Composer |
| 3 | Composing simple quantum circuits with q-gates and measuring the output into classical bits. |
| 4 | Implementation of Shor's Algorithms |
| 5 | Implementation of Grover's Algorithm |
| 6 | Implementation of Deutsch's Algorithm |
| 7 | Quantum Key Distribution Simulation |

**TOTAL :30 PERIODS**

**COURSE OUTCOMES**

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

| | |
|---|---|
| **CO1:** | Explain the basics of quantum computing. |
| **CO2:** | Interpret the background of Quantum Mechanics. |
| **CO3:** | Analyse the quantum computation models. |
| **CO4:** | Model the circuits using quantum computation, environments and frameworks. |
| **CO5:** | Describe the future of quantum computing |

**TEXTBOOK:**

| | |
|---|---|
| 1 | Parag K Lala, "Quantum Computing, A Beginners Introduction", Mc Graw Hill Education ,2020. |

| | |
|---|---|
| 2 | Michael A. Nielsen and Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010. |
| **REFERENCES:** | |
| 1 | Chris Bernhardt, "Quantum Computing for Everyone", The MIT Press,2020. |
| 2 | Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013. |
| 3 | N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2017. |
| 4 | John Gribbin, "Computing with Quantum Cats: From Colossus to Qubits", Third Edition, 2023. |
| 5 | William Easttom, "Quantum Computing Fundamentals", Addison-Wesley Professional, 2021. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 1 | - | 3 | - |
| CO2 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 1 | - | 3 | - |
| CO3 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO5 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO | 3 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |

3-High, 2- Medium, 1-Low

| IT22552 | SITE RELIABILTY ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSEOBJECTIVES:**

- To understand the core principles and concepts of Site Reliability Engineering.
- To design, build, and maintain highly reliable and available systems through a combination of theoretical knowledge and hands-on practical experience.
- To apply software engineering practices to infrastructure and operations challenges.
- To use relevant tools for monitoring, alerting, and incident response.
- To use version control systems and collaboration platforms for document management.

| UNITI | INTRODUCTION TO SRE | 6 |
|---|---|---|

SRE principles, roles, and responsibilities-Evolution of SRE: From DevOps to SRE.-Case studies of successful SRE implementations. Monitoring and Observability - Metrics, logs, and traces for observability- Implementing Prometheus for monitoring.-Building Grafana dashboards for visualization.

| | | |
|---|---|---|
| **UNIT II** | **SLIs, SLOs, AND SLAs** | **6** |
| Defining meaningful SLIs and setting quantifiable SLOs-Balancing reliability and feature development-Creating Service Level Agreements (SLAs) based on SLOs-Incident Management and Postmortems-Incident response processes and communication-Conducting blameless postmortems: Analysis and improvements-Learning from failures to prevent recurrence. | | |
| **UNIT III** | **INFRASTRUCTURE AS CODE (IAC)** | **6** |
| Concepts of IAC and its benefits-Using Terraform for provisioning and managing infrastructure-Automating configuration management with Ansible- Resilience and Scalability-Designing for failure: Redundancy and failover strategies-Horizontal and vertical scaling for optimal –Performance-Implementing auto-scaling in cloud environments. | | |
| **UNIT IV** | **LOAD BALANCING AND TRAFFIC MANAGEMENT** | **6** |
| Load balancing strategies and algorithms-Implementing load balancers (software and cloud-based)-Handling traffic spikes and maintaining high availability. Chaos Engineering and Testing-Introducing controlled failures using Chaos Engineering. Testing system resilience and identifying weak points-Tools like Chaos Monkey, Gremlin, and chaos engineering practices. | | |
| **UNIT V** | **COLLABORATION AND DOCUMENTATION** | **6** |
| Collaborative documentation with Confluence or Notion-Best practices for effective teamwork. Cloud-Native SRE Considerations-Microservices architecture and challenges-Kubernetes for container orchestration and management-Observability in distributed systems. | | |
| | | **TOTAL: 30 PERIODS** |

| **PRACTICAL EXERCISES** | |
|---|---|
| 1 | Set up Prometheus for collecting basic system metrics. |
| 2 | Create simple Grafana dashboards to visualize metrics. |
| 3 | Simulate a mock incident and practice incident response. |
| 4 | Set up NGINX as a reverse proxy for load balancing and deploy a sample web application and scale it horizontally. |
| 5 | Deploy and manage applications on Kubernetes. |
| | **TOTAL :30 PERIODS** |

| **COURSE OUTCOMES** | |
|---|---|
| **On completion of the course, the students will be able to:** | |
| **CO1:** | Explain the principles and goals of Site Reliability Engineering. |
| **CO2:** | Infer Service Level Indicators (SLIs), Objectives (SLOs), and Agreements |
| **CO3:** | Implement infrastructure automation using IAC tools |
| **CO4:** | Make use of load balancing, traffic management strategies, collaboration and documentation. |
| **CO5:** | Analyse SLIs, SLOs, AND SLAs form balancing reliability and feature development. |

| **TEXTBOOK:** | |
|---|---|
| 1 | Niall Richard Murphy, Betsy Beyer, Chris Jones, and Jennifer Petoff, “Site Reliability Engineering: How Google Runs Production Systems", O'Reilly Media, 2016. |
| 2 | Betsy Beyer, Niall Richard Murphy, David K. Rensin and Kent Kawahara, "The Site Reliability Workbook: Practical Ways to Implement SRE", O'Reilly Media,2018. |

| **REFERENCES:** | |
|---|---|
| 1 | Casey Rosenthal and Nora Jones, "Chaos Engineering: Building Confidence in System Behavior Through Experiments", O′Reilly, 2017. |
| 2 | David N. Blank-Edelman, "Seeking SRE: Conversations About Running Production |

| | |
|---|---|
| | Systems at Scale", O′Reilly, 2018. |
| 3 | Gene Kim, Kevin Behr, and George Spafford, "The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win", Fifth Edition, IT Revolution Press, 2018. |
| 4 | Brendan Burns, Joe Beda and Kelsey Hightower Shroff ,"Kubernetes Up & Running: Dive into the Future of Infrastructure",Third Edition, O'Reilly,2022. |
| 5 | Niall Murphy and David Rensin,” The Site Reliability Workbook: Practical Ways to Implement SRE”, O'Reilly, 2018. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 3 | - |
| CO2 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 1 | - | 3 | - |
| CO3 | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO4 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO5 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |
| CO | 3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 1 | - | 3 | - |

3-High, 2- Medium, 1-Low

| IT22651 | EDGE COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To understand the fundamental concepts of Edge computing , routing and networking layers.
- To understand the fog topologies in IoT.
- To learn the security issues of protocols in IoT.
- To Understand Raspberry Pi architecture and its components.
- To Work with Raspberry Pi components and evaluate its performance.

| UNIT I | EDGE COMPUTING DEFINITION AND USE CASES | 6 |
|---|---|---|

Edge computing purpose and definition, Edge hardware architectures, Operating systems, Edge platforms Edge Routing and Networking, Edge to Cloud Protocols, Edge computing use cases.

| UNIT II | CLOUD AND FOG TOPOLOGIES | 6 |
|---|---|---|

Cloud services model, Public, private, and hybrid cloud, Constraints of cloud architectures for IoT, Fog computing- Open Fog reference architecture, Fog topologies, Data Analytics and Machine Learning- Basic data analytics, Machine learning- Convolutional neural networks, Recurrent neural networks, IoT data analytics and machine learning comparison.

| UNIT III | IOT AND EDGE SECURITY | 6 |
|---|---|---|

Cybersecurity- Attack and threat terms, definitions of different cyber defense mechanisms and

| | | |
|---|---|---|
| technologies, Anatomy of IoT cyber-attacks, Physical and hardware security, Cryptography, Blockchain and cryptocurrencies in IoT, Consortiums and Communities | | |
| **UNIT IV** | **RASPBERRYPI** | **6** |
| RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensorwith Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi. | | |
| **UNIT V** | **EDGE COMPUTING WITH RASPBERRYPI** | **6** |
| Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols. Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTTpacket structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example. Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions | | |
| | | **TOTAL: 30 PERIODS** |

| **PRACTICAL EXERCISES** | |
|---|---|
| 1 | Set up various tools to create and manage iofog |
| 2 | Deploy micro services and writing your own microservices |
| 3 | Setup iofogtcl, common header YAML |
| 4 | Implementation of Microservices Development. |
| 5 | Deploy and manage real time applications on RASPBERRY Pi. |
| | **TOTAL :30 PERIODS** |

| **COURSE OUTCOMES** | |
|---|---|
| At the end of the course, the student should be able to | |
| **CO1:** | Explain the basics of Edge computing, Edge routing & network layers. |
| **CO2:** | Illustrate the various fog topologies in IoT. |
| **CO3:** | Identify and address security concerns in IoT protocols. |
| **CO4:** | Summarize about the Raspberry Pi Architecture. |
| **CO5:** | Develop real time application with Raspberry Pi devices. |

| **TEXTBOOK:** | |
|---|---|
| 1 | Perry Lea, “IoT and Edge Computing for Architects Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security”,Second Edition ,Packt Publishing, 2020. |
| 2 | Geng and Hwaiyu. "Internet of Things and Data Analytics in the Cloud with Innovation and Sustainability", John Wiley & Sons, Inc., 2017. |
| **REFERENCES:** | |
| 1 | K. Anitha Kumari, G. Sudha Sadasivam, D. Dharani and M. Niranjanamurthy, “Edge Computing Fundamentals, Advances and Applications”,CRC Press, 2021. |
| 2 | Rajkumar Buyya and Satish Narayana Srirama , “Fog and Edge Computing: Principles and Paradigms” , Wiley publication, 2019. |
| 3 | Simon Monk, “Raspberry Pi Cookbook, Third Edition, O'Reilly Media, Inc., 2019. |
| 4 | Yan Zhang, **“**Mobile Edge Computing”, 2021. |
| 5 | Abhinandan Bhadauria, “Edge Computing with Python”, 2022. |

**Mapping of Course Outcomes to Program Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | 2 | 1 | - | - | 1 |
| CO2 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | 2 | 1 | - | - | 1 |
| CO3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | 2 | 1 | - | - | 1 |
| CO4 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | 2 | 1 | - | - | 1 |
| CO5 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | 2 | 1 | - | - | 1 |
| CO | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | 2 | 1 | - | - | 1 |

3-High, 2- Medium, 1-Low

| IT22652 | AR/VR MIXED REALITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues.
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications.
- To know the intricacies of these platform to develop PDA applications with better optimality.

| UNIT I | INTRODUCTION | 6 |
|---|---|---|

The three I's of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback.

| UNIT II | VR DEVELOPMENT PROCESS | 6 |
|---|---|---|

Geometric modeling - kinematics modeling- physical modeling - behaviour modeling - model Management.

| UNIT III | CONTENT CREATION CONSIDERATIONS FOR VR | 6 |
|---|---|---|

Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment.

| UNIT IV | VR ON THE WEB & VR ON THE MOBILE | 6 |
|---|---|---|

| | | |
|---|---|---|
| JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)- frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics. | | |
| **UNIT V** | **APPLICATIONS** | **6** |
| Medical -military applications-robotics applications- Advanced Real time Tracking-other applications- games, movies, simulations, therapy. | | |
| | | **TOTAL: 30 PERIODS** |
| **PRACTICAL EXERCISES:** | | |
| 1. | Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender | |
| 2. | Download objects from asset store and apply various lighting and shading effects. | |
| 3. | Model three dimensional objects using various modelling techniques and apply textures over them. | |
| 4. | Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity. | |
| 5. | Add audio and text special effects to the developed application | |
| 6. | Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity. | |
| 7. | i)Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.<br>ii) Develop simple MR enabled gaming applications. | |
| | | **TOTAL: 30 PERIODS** |
| | | **TOTAL: 60 PERIODS** |
| **COURSE OUTCOMES:** | | |
| At the end of this course, the students will be able to: | | |
| **CO1:** | Identify problem statements and function as a member of an engineering design team. | |
| **CO2:** | Utilize technical resources. | |
| **CO3:** | Design a system to meet given specifications with realistic engineering constraints. | |
| **CO4:** | Propose technical documents and oral presentations related to design projects. | |
| **CO5:** | Apply VR in real time applications in the field of gaming and medical. | |
| **TEXT BOOKS:** | | |
| 1. | C. Burdea & Philippe Coiffet, “Virtual Reality Technology”, Second Edition, John Wiley & Sons, Inc.,2018. | |
| 2. | Jason Jerald, ”The VR Book: Human-Centred Design for Virtual Reality”, Association for Computing Machinery and Morgan & Claypool, New York, | |

| | |
|---|---|
| | 2015. |
| **REFERENCES:** | |
| 1. | Dieter Schmalstieg and Tobias Hollerer, “Augmented Reality: Principles and Practice”, Pearson Education, 2016. |
| 2. | Steve Aukstakalnis, “Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)”, Addison-Wesley Professional, 2016. |
| 3. | Robert Scoble and Shel Israel, “The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything”, Patrick Brewster Press, 2016. |
| 4. | Tony Parisi, “Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile”, O’Reilly Media, 2015. |
| 5. | Tony Parisi, “Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages”, O'Reilly Media, 2014. |
| 6. | Jos Dirksen, “Learning Three.js: The JavaScript 3D Library for WebGL”, Second Edition, Packt Publishing, 2015. |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 1 | 1 | 1 | - | - | - | - | 1 | 1 | 1 | 2 | 2 | - | - |
| CO2 | 2 | 3 | 1 | 3 | 1 | - | - | - | 3 | 2 | 2 | 3 | 3 | - | - |
| CO3 | 2 | 2 | 3 | 3 | 2 | - | - | - | 3 | 1 | 1 | 2 | 1 | - | - |
| CO4 | 2 | 2 | 1 | 2 | 1 | - | - | - | 1 | 3 | 2 | 1 | 1 | - | - |
| CO5 | 2 | 3 | 3 | 2 | 1 | - | - | - | 3 | 1 | 2 | 1 | 3 | - | - |
| CO | 2 | 2 | 2 | 2 | 1 | - | - | - | 2 | 2 | 2 | 2 | 2 | - | - |

3-High, 2- Medium, 1-Low

| **IT22751** | **PROMPT ENGINEERING** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES:**

- To understand of AI prompt engineering
- To utilize various techniques and tools in AI prompt engineering
- To design and implement conversational systems, intelligent and user-friendly chatbot applications.
- To apply AI prompt engineering techniques to various domains.

| | | |
|---|---|---|
| • To understand advancements in technology and techniques, emerging applications and use cases | | |
| **UNIT I** | **INTRODUCTION TO AI PROMPT ENGINEERING** | **6** |
| Overview of AI prompt engineering - Fundamentals of natural language processing and machine learning - Historical developments and current state of the field | | |
| **UNIT II** | **TECHNIQUES AND TOOLS FOR AI PROMPT ENGINEERING** | **6** |
| Neural networks and deep learning - Reinforcement learning - Transfer learning and pre-training - Evaluation and optimization techniques | | |
| **UNIT III** | **BUILDING INTELLIGENT CHATBOTS** | **6** |
| Designing conversational systems - Creating chatbot personalities - Handling user input and providing context-aware responses | | |
| **UNIT IV** | **APPLICATIONS OF AI PROMPT ENGINEERING** | **6** |
| Language generation in business and customer service - Language generation in entertainment and media - Language generation in education and e-learning - Language generation in healthcare and medicine | | |
| **UNIT V** | **THE FUTURE OF AI PROMPT ENGINEERING** | **6** |
| Advancements in technology and techniques - Emerging applications and use cases - Challenges and opportunities for the field. | | |
| | | **TOTAL: 30 PERIODS** |
| **LIST OF EXPERIMENTS** | | |
| 1 | Implement a simple text classification task using a machine learning algorithm such as Naive Bayes or Support Vector Machine. | |
| 2 | Experiment with NLP techniques such as tokenization, stemming, and tf-idf (term frequency-inverse document frequency) for feature extraction. | |
| 3 | Build a simple neural network model using TensorFlow or PyTorch to perform sentiment analysis on a dataset such as IMDb movie reviews. | |
| 4 | Implement a basic reinforcement learning algorithm, such as Q-learning or Deep Q-Network (DQN), to train an AI agent to play a text-based game or navigate a virtual environment. | |
| 5 | Implement the conversational system using a chatbot framework or platform like Dialogflow or Rasa. | |
| 6 | Create AI prompt engineering systems for generating content in entertainment media such as generating plot summaries, movie scripts, or generating dialogue for virtual characters. | |
| 7 | Build language generation models to assist in educational tasks such as generating quiz questions, summarizing educational content, or providing personalized learning recommendations. | |
| | | **TOTAL: 30 PERIODS** |
| **COURSE OUTCOMES:** | | |
| **At the end of the course, the students will be able to:** | | |

| | |
|---|---|
| **CO1:** | Explain the concept of AI prompt engineering. |
| **CO2:** | Utilize various techniques and tools in AI prompt engineering. |
| **CO3:** | Design and implement conversational systems, intelligent and user-friendly chatbot applications. |
| **CO4:** | Apply AI prompt engineering techniques to various domains. |
| **CO5:** | Illustrate the advancements in technology and techniques, emerging applications and use cases. |

| | |
|---|---|
| **TEXT BOOKS:** | |
| **1** | Michael Ferguson, "Prompt Engineering ; The Future Of Language Generation", EPublishing,2023. |
| **2** | James Phoenix and Mike Taylor, "Prompt Engineering for Generative AI", O'Reilly Media, Inc., 2023. |
| **REFERENCES:** | |
| 1 | Nathan Hunter, "The Art of Prompt Engineering with Chatgpt: A Hands-On Guide: 3", EPublishing,2023. |
| 2 | Padmaraj Nidagundi, "Prompt Engineering", EPublishing, 2023. |
| 3 | Sabit Ekin,"Prompt Engineering For ChatGPT: A Quick Guide To Techniques, Tips, And Best Practices", 2022. |
| 4 | Isaac Maxwell, "Prompt Engineering: Techniques, Trends, Challenges, Opportunities", EPublishing, 2023. |
| 5 | Russel Grant, "Prompt Engineering and ChatGPT: How to Easily 10X Your Productivity, Creativity, and Make More Money Without Working Harder", EPublishing, 2023. |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 3 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 3 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 3 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO5 | 3 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | - | 3 | - |
| CO | 3 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |

3-High, 2- Medium, 1-Low

| IT22752 | ROBOTICS PROCESS AUTOMATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

| UNIT I | INTRODUCTION TO ROBOTIC PROCESS AUTOMATION | 6 |
|---|---|---|

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation – Benefits of RPA – Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools – Templates, User Interface, Domains in Activities, Workflow Files.

| UNIT II | AUTOMATION PROCESS ACTIVITIES | 6 |
|---|---|---|

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

| UNIT III | APP INTEGRATION, RECORDING AND SCRAPING | 6 |
|---|---|---|

Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA ChallengeApp Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

| UNIT IV | HANDLING USER EVENTS & ASSISTANT BOTS, EXCEPTION HANDLING | 6 |
|---|---|---|

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

| UNIT V | DEPLOYMENT AND MAINTAINING THE BOT | 6 |
|---|---|---|

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server ,Publishing and managing updates. RPA Vendors – Open Source RPA, Future of RPA.

**TOTAL: 30 PERIODS**

**PRACTICAL EXERCISES**

| | |
|---|---|
| 1. | Create a Sequence to obtain user inputs display them using a message box |
| 2. | Build a process in the RPA platform using UI Automation Activities. |
| 3. | Create an automation process using key System Activities, Variables and Arguments. |
| 4. | Recording mouse and keyboard actions. |

| | |
|---|---|
| 5. | Implement Error Handling in RPA platform. |
| 6. | Scraping data from website and writing to CSV. |
| | **TOTAL :30 PERIODS** |

| **COURSE OUTCOMES** | |
|---|---|
| At the end of the course, the student should be able to | |
| **CO1:** | Explain the basics of Robotics process automation |
| **CO2:** | Illustrate the automation process activities |
| **CO3:** | Implement recording, web scraping and process mining by automation |
| **CO4:** | Use UIPath Studio to detect, and handle exceptions in automation processes |
| **CO5:** | Experiment the Robot Deployment. |

| **TEXTBOOK:** | |
|---|---|
| 1. | Alok Mani Tripathi, "Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool – UiPath" , Packt Publishing, 2018. |
| 2. | Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020. |
| **REFERENCES:** | |
| 1. | Frank Casale, Rebecca Dilla, Heidi Jaynes and Lauren Livingston, "Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation", Amazon Asia-Pacific Holdings Private Limited, 2018. |
| 2. | Richard Murdoch, "Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Amazon Asia-Pacific,2020. |
| 3. | A Gerardus Blokdyk, "Robotic Process Automation - A Complete Guide ", 2020. |
| 4. | Srikanth Merianda,"Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 2018. |
| 5. | Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes", Packt Publishing, 2018. |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | 2 | 2 | 1 | 3 | 3 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | 2 | 2 | 1 | 3 | 3 | 1 |
| CO3 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | 2 | 2 | 1 | 3 | 3 | 1 |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | 2 | 2 | 1 | 3 | 3 | 1 |
| CO5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | 2 | 2 | 1 | 3 | 3 | 1 |
| CO | 3 | 3 | 3 | 3 | 3 | - | - | - | - | 2 | 2 | 1 | 3 | 3 | 1 |

3-High, 2- Medium, 1-Low

| CS22713 | MODERN APPLICATION DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSEOBJECTIVES:**

- Create a deep understanding of how Software and Hardware work together.
- Introduce the students to Flutter.
- Introduce the students to Firebase.
- Help the students to solve real life problems with Data Oriented thinking.
- Motivate the students to follow Clean Coding Principles.

| UNIT I | **Story of Hidden Language** | 6 |
|---|---|---|

Codes and Combinations - Braille and Binary Codes - Anatomy of a Flashlight - Telegraphs and Relays - Bit by bit by bit - Logic and Switches - A binary adding Machines - Bytes and Hex - Assemblage of Memory - From Abaci to Chips - ASCII and a cast of Characters - The Operating System – Languages - High and Low - The Graphical Revolution

| UNIT II | **Flutter** | 6 |
|---|---|---|

Dart: Syntax Basics - Types – Functions - Control Flow - Error Handling - Classes & Objects - Class Modifiers – Concurrency - Null Safety - Core Libraries, Flutter: Widgets – Layout - Assets & Media - Platform Integration

| UNIT III | **Firebase** | 6 |
|---|---|---|

Introduction - Authentication - Firestore Database –Data Modeling - Storage - Hosting – Cloud Messaging - Cloud Functions – In App Messaging - Security Rules - Cost Estimation – Extensions

| UNIT IV | **Data Management** | 6 |
|---|---|---|

Understand: Emergence of NoSQL – Data Models – Consistency - Map Reduce, Implement: Key-Value Database – Document Database – Column-Family Database – Graph Database – Schema Migration – Polyglot Persistence – Choosing Database

| UNIT V | **Three Layer Architecture** | 6 |
|---|---|---|

Introduction – Paradigm Overview - SOLID Principles – Component Principles – Architecture – Boundaries – Policy – Business Rules - Clean Architecture - Details

**30 PERIODS**

**PRACTICAL EXERCISES**

| | |
|---|---|
| 1 | Study and Installation of Flutter Multi Platform Environment. |
| 2 | Develop a Flutter application using Firebase Authentication. |
| 3 | Develop a Flutter application that performs CRUD operations with Firestore Database. |

| | |
|---|---|
| 4 | Develop a ToDo application with authentication, Firestore, and Image upload. |
| 5 | Develop a Flutter application that persists data using Hive. |
| 6 | Mini Project. |
| | **30 PERIODS** |
| | **TOTAL: 60 PERIODS** |

**COURSE OUTCOMES:**

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

| | |
|---|---|
| **CO1:** | Create PWA with responsive UI for Mobile view and Desktop view |
| **CO2:** | Create PWA with Firebase Auth and Firestore |
| **CO3:** | Create PWA using Flutter deploy using Firebase |
| **CO4:** | Develop an Architecture for Offline first PWA |
| **CO5:** | Develop an Offline first PWA with Flutter, Firebase, Hive |

**TEXT BOOKS:**

| | |
|---|---|
| 1. | Robert Cecil Martin, "Clean Architecture: A Craftman's Guid to Software Structure and Design", Pearson Publication, 2017. |
| 2. | Robert Cecil Martin, "Clean Code: A Handbook of Agile Software Craftsmanship", Pearson Publication, 2008. |

**REFERENCES:**

| | |
|---|---|
| 1. | Martin Fowler, Pramod J. Sadalage, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional Publication, 2012. |
| 2. | Charles Petzold, "Code: The Hidden Language of computer Hardware and Software", Second Edition, Pearson Education, 2022. |
| 3. | Documentation of Flutter: docs.flutter.dev |
| 4. | Documentation of Dart: dart.dev/guides |
| 5. | Documentation of Firebase: firebase.google.com/docs |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO2 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO3 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO4 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO5 | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |
| CO | 2 | 1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - |

3-High, 2- Medium, 1-Low

## OPEN ELECTIVE-SYLLABUS

| IT22681 | DATA SCIENCE USING PYTHON | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To develop a strong understanding of Python basics, including writing their first programs, working with various data types, expressions, variables, and performing string operations.
- To be proficient in using Python data structures such as lists, tuples, sets, and dictionaries, understanding their properties, and knowing when to apply each data structure in solving different problems.
- To grasp libraries to solve real-world problems.
- Learn how to read and write data from files using Python's file handling capabilities and the Pandas library.
- To understand the use of python for doing data science projects.

| UNITI | INTRODUCTION TO PYTHON AND DATA SCIENCE | 9 |
|---|---|---|

Simple programs: Types-Variables and Expressions - Control Structures-Functions-String Operations, Sources of Data: Time Series – Transactional Data – Biological Data – Spatial Data – Social Network Data – Data Evolution

| UNIT II | PYTHON DATA STRUCTURES | 9 |
|---|---|---|

Simple Programs: Lists-Tuples-Sets-Dictionaries,Indexing - Naming - Adding & Removing elements - Operations on Vectors, Functions for vectors

| UNIT III | PYTHON LIBRARIES | 9 |
|---|---|---|

Numpy arrays -aggregations -computations on arrays -comparisons, masks, boolean logic - fancy indexing - structured arrays – Pandas for Data manipulation –Dealing with missing data.

| UNIT IV | WORKING WITH DATA IN PYTHON | 9 |
|---|---|---|

Matplotlib - Line plots - Scatter plots - density and contour plots - Histograms - legends - colors - subplots - text and annotation – three-dimensional plotting.

| UNIT V | CASE STUDY | 9 |
|---|---|---|

Predicting price of pre-owned cars, Classifying personal income, predict customer churn for a telecom company.

**TOTAL PERIODS: 45**

**COURSE OUTCOMES**

Upon completion of the course, students will be able to

| | |
|---|---|
| **CO1:** | Describe the basics of Python. |
| **CO2:** | Explain python data structures |

| | |
|---|---|
| **CO3:** | Explain the python libraries |
| **CO4:** | Explore the knowledge and work with data |
| **CO5:** | Applydata science concepts for case studies |
| **TEXT BOOKS** | |
| 1. | David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. |
| 2. | Gilbert Strang, "Introduction to Linear Algebra", Fifth Edition,Wellesley-Cambridge Press, 2016. |
| **REFERENCES** | |
| 1. | Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. |
| 2. | Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014. |
| 3. | Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. |
| 4. | Samir Madhavan, “Mastering python for data science”, Packt Publishing Ltd, 2015. |
| 5. | Douglas Montgomery and George Runger, “Applied statistics and probability for engineers”, Sixth edition, opensource. |

**Mapping of Course Outcomes to Program Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| CO | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | - | - |

3-High, 2- Medium, 1-Low

| **IT22682** | **INTERNET OF THINGS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **3** | **0** | **0** | **3** |
| **COURSE OBJECTIVES** | | | | | |

| | | |
|---|---|---|
| • To understand the fundamentals of Internet of Things. | | |
| • To know about the components of IoT systems. | | |
| • To learn about the basics of IOT-related protocols and technologies. | | |
| • To understand data analytics and cloud in the context of IoT. | | |
| • To apply the concept of IoT in the real world scenario. | | |
| **UNIT I** | **INTRODUCTION TO IOT** | **9** |
| Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT. | | |
| **UNIT II** | **IOT COMPONENTS** | **9** |
| Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules) | | |
| **UNIT III** | **IOT PROTOCOLS AND TECHNOLOGIES** | **9** |
| IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, BigData Analytics, Cloud Computing, Embedded Systems. | | |
| **UNIT IV** | **OPEN PLATFORMS AND PROGRAMMING** | **9** |
| IOT deployment for Raspberry Pi /Arduino platform-Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud. | | |
| **UNIT V** | **CASE STUDIES AND REAL-WORLD APPLICATIONS** | **9** |
| Real world design constraints - Applications - Industrial Automation, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control. | | |
| | | **TOTAL PERIODS: 45** |
| **COURSE OUTCOMES** | | |
| Upon completion of the course, students will be able to | | |
| **CO1:** | Explain the concept of IoT. | |
| **CO2:** | Differentiate the various IoT components and communication modules. | |
| **CO3:** | Explore various communication models and protocols for IoT | |
| **CO4:** | Illustrate portable IoT system using Rasperry Pi/Arduino. | |
| **CO5:** | Extend the IoT concepts in real time scenario. | |
| **TEXT BOOKS** | | |

| | |
|---|---|
| 1. | David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2018. |
| 2. | Samuel Greengard, "The Internet of Things", The MIT Press, 2021. |
| **REFERENCE BOOKS** | |
| 1. | Perry Lea, "Internet of things for architects", Packt Publishing, 2018. |
| 2. | Olivier Hersent, David Boswarthick and Omar Elloumi , "The Internet of Things - Key applications and Protocols", Wiley, 2012. |
| 3. | David Etter , "IOT (Internet of Things) Programming: A Simple and Fast Way of Learning", IOT Kindle Edition. |
| 4. | Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), "Architecting the Internet of Things", Springer, 2011. |
| 5. | ArshdeepBahga and Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | 1 | - | 2 | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 2 | 1 | - | 2 | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO | 3 | 2 | 1 | - | 2 | - | - | - | - | - | - | - | - | - | - |

3-High, 2- Medium, 1-Low

## OPEN ELECTIVE -II

| IT22781 | FRONT END WEB DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To understand various editors and hosting services for web development.
- To comprehend the structure of HTML documents and the roles of various structural elements.
- To understand different components of Bootstrap.
- To explore CSS values, selectors, and at-rules for styling web pages.
- To gain foundational knowledge of 2D and WebGL Canvas.

| UNIT I | DEVELOPING ENVIRONMENTS | 6 |
|---|---|---|

| | | |
|---|---|---|
| Editors, Hosting Services, Choosing Your Server: IIS, XAMPP, LAMP, MEAN/MERN/MEVN, Django, Setting Up Your Server: Connecting to a Remote Machine, Connecting Locally, Port Forwarding, Using a Domain Name, FTP. | | |
| **UNIT II** | **HYPER TEXT MARKUP LANGUAGE** | **6** |
| Structural Elements: Declaration, Head, Sectioning, iframe, Text Elements: Hyperlink, Formatting, Orientation, Figure Elements: List, Table, Image, Multimedia, Form Elements: Basics, Generic <input>. | | |
| **UNIT III** | **BOOTSTRAP** | **6** |
| Grid Layout, Basic Components, Popup Components, Navigation Components, Grouping Components, Button Components, Form Components, Waiter Components. | | |
| **UNIT IV** | **CASCADING STYLE SHEET** | **6** |
| Values, Selectors, at-rules, Text Properties, Graphic Properties, List and table properties, Box model properties, Animation properties, Responsive Web Design. | | |
| **UNIT V** | **2D & WEBGL CANVAS** | **6** |
| 2D Canvas: Outlining, Painting, Text, Images, Advanced Techniques, Libraries, WebGL Canvas: The Shading Language, 2D Drawing. | | |
| | | **TOTAL: 30 PERIODS** |

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1 | Install XAMPP and host a simple "Hello World" web page locally. |
| 2 | Design an Interactive Multimedia Web Page using HTML. |
| 3 | Design a user registration form using form elements and basic <input> types. |
| 4 | Apply CSS selectors and properties to style text, images, and tables. |
| 5 | Create a web page showcasing box model properties like margin, padding, and border. |
| 6 | Use HTML5 Canvas to draw shapes and add an image. |

**TOTAL: 30 PERIODS**

**TOTAL (T+P) = 60 PERIODS**

**COURSE OUTCOMES**

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

| | |
|---|---|
| **CO1:** | Summarize the features and functionalities of various editors and hosting services. |
| **CO2:** | Develop web pages with rich text, multimedia, hyperlink and form elements. |
| **CO3:** | Explain Bootstrap components for dynamic web interfaces. |
| **CO4:** | Apply responsive web designs using advanced CSS properties. |
| **CO5:** | Develop graphics using Canvas for outlining, painting, and rendering text and images. |

**TEXT BOOKS**

| | |
|---|---|
| **1** | Laurence Svekis, “Front-End Web Development with Modern HTML, CSS, and JavaScript”, Twenty Second Edition, Vitalsource Technologies Inc., 2022. |
| **2** | Jennifer Niederst Robbins, “Learning Web Design - A Beginner’s Guide to HTML, CSS, JavaScript and Web Graphics”, Fifth Edition, O’Reilly, 2018. |

**REFERENCES**

| | |
|---|---|
| **1** | Prem Kumar, “Web Design with HTML & CSS: HTML & CSS Complete Beginner’s Guide”, Notion Press, 2021. |
| **2** | Riaz Ahmed, “Full Stack Web Development For Beginners: Learn Ecommerce Web Development Using HTML5, CSS3, Bootstrap, JavaScript, MySQL, and PHP”, 2021. |
| **3** | Thomas Powell, “HTML & CSS: The Complete Reference”, Fifth Edition, McGraw Hill Education, 2017. |
| **4** | Laura Lemay, Rafe Colburn, Jennifer Kyrnin, “Mastering HTML, CSS & Java Script Web Publishing”, Fifth Edition, BPB Publications, 2016. |
| **5** | Ben Frain, “Responsive Web Design with HTML5 and CSS”, Packt Publishing, Fourth Edition, 2022. |

**Mapping of Course Outcomes to Programme Outcomes**

| **Course outcomes** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| CO1 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | - | - |
| CO2 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | - | - |
| CO3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | - | - |
| CO4 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | - | - |
| CO5 | 3 | 3 | 3 | 3 | - | 2 | - | 3 | - | - | - | 1 | - | - | - |
| CO | 3 | 3 | 3 | 2 | 3 | 2 | - | 3 | - | - | - | 1 | - | - | - |

3-High, 2- Medium, 1-Low

| **IT22782** | **INTRODUCTION TO DEVOPS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| | | **2** | **0** | **2** | **3** |

**COURSE OBJECTIVES**

- To introduce the basic concepts of DevOps in a simple and structured way.
- To understand version control using Git with minimal technical complexity.
- To gradually learn Continuous Integration, Testing, and Deployment processes.
- To explore cloud-based DevOps tools like Azure DevOps.
- To provide hands-on practice in configuration management using Ansible.

| **UNIT I** | **INTRODUCTION TO DEVOPS AND VERSION CONTROL** | **6** |
|---|---|---|

Introduction to DevOps: Basic concepts and importance. - Agile Development Model: Simple explanation with examples. - Introduction to cloud platforms: AWS, GCP, Azure (basic overview). - Version Control Systems: Git and GitHub (basic operations like clone, commit, push).

| **UNIT II** | **BUILD TOOLS AND DEPENDENCY MANAGEMENT** | **6** |
|---|---|---|

Introduction to Build Tools: Why they are used. - Maven: Installation and setup. - Basic operations: compiling, packaging, and testing. - Managing dependencies with Maven (step-

| | | |
|---|---|---|
| by-step). - Gradle: Installing Gradle and building simple applications. | | |
| **UNIT III** | **CONTINUOUS INTEGRATION WITH JENKINS** | **6** |
| Introduction to Jenkins: Overview and use cases. - Jenkins Setup: Creating and configuring jobs with simple examples. - Adding and using plugins (e.g., Git Plugin). - Automating builds: Using Jenkins with Git and Maven. | | |
| **UNIT IV** | **TESTING AND CONFIGURATION MANAGEMENT** | **6** |
| Basics of Testing: Different types of testing with simple examples. - Introduction to Selenium: Overview of Selenium and its key features. - Running basic automated tests. - Configuration Management: Introduction to Ansible. - Writing simple Ansible playbooks to automate tasks. | | |
| **UNIT V** | **DEVOPS PIPELINE USING AZURE** | **6** |
| Setting up GitHub: Creating repositories and pushing code. - Introduction to Azure DevOps: Setting up Azure organizations and creating pipelines. - Building and deploying sample code using Azure DevOps. - Modifying azure-*pipelines.yaml* for automation. | | |
| | | **TOTAL: 30 PERIODS** |

| **LIST OF EXPERIMENTS** | |
|---|---|
| 1 | Create and manage a GitHub repository. |
| 2 | Build a simple application using Maven. |
| 3 | Run basic tests using Selenium. |
| 4 | Set up and configure a Jenkins CI pipeline. |
| 5 | Create and deploy an Azure DevOps pipeline for a sample application. |
| 6 | Write an Ansible playbook to set up a basic web application infrastructure. |
| 7 | Use Ansible roles to organize playbooks effectively. |
| | **TOTAL: 30 PERIODS** |
| | **TOTAL (T+P) = 60 PERIODS** |

| **COURSE OUTCOME** | |
|---|---|
| **CO1:** | Explain basic DevOps concepts and version control tools. |
| **CO2:** | Describe the process of building and managing dependencies using Maven and Gradle. |
| **CO3:** | Demonstrate simple CI/CD tasks with Jenkins |
| **CO4:** | Apply Ansible for basic testing and configuration management. |
| **CO5:** | Demonstrate cloud-based DevOps tools using Azure DevOps pipelines. |
| **CO6:** | Develop and deploy automated software solutions by integrating GitHub, Maven, Selenium, Jenkins, Azure DevOps, and Ansible. |

| **TEXT BOOKS:** | |
|---|---|
| 1. | Gene Kim, Patrick Debois, John Willis, Jez Humble, “The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations”, Second Edition , IT Revolution Press,2021. |
| 2. | Mikael Krief, “Learning DevOps: Continuously Deliver Better Software”, Packt Publishing, 2019. |

| **REFERENCES** | |
|---|---|
| 1. | Jez Humble, David Farley, “Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation”, Addison-Wesley,2010. |
| 2. | John Arundel and Justin Domingus, “Cloud Native DevOps with Kubernetes: Building, Deploying, and Scaling Modern Applications in the Cloud", Second Edition, O'Reilly Media, 2023. |
| 3. | Joakim Verona, “Practical DevOps", Second Edition, Packt Publishing,2018. |
| 4. | Jeff Geerling, “Ansible for DevOps: Server and Configuration Management for Humans”, Second Edition, Midwestern Mac, LLC,2020. |

| | |
|---|---|
| 5. | Jennifer Davis, Katherine Daniels, "Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale", O'Reilly Media,2016. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 2 | 1 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 1 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | - |
| CO6 | 2 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | - |
| CO | 2 | 2 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | - |

3-High, 2- Medium, 1-Low

## OPEN ELECTIVE -III

| IT22783 | INTRODUCTION TO MOBILE APPLICATION DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To develop applications for emerging mobile computing devices, performing tasks at all stages of the software development life-cycle.
- To be aware of Characteristics of mobile applications
- To understand the User-interface design methods.
- To implement and deploy simple mobile applications
- To understand the basics of networking and multimedia services.

| UNIT I | INTRODUCTION TO ANDROID | 9 |
|---|---|---|

Mobile Application Development - Mobile Applications and Device Platforms - Alternatives for Building Mobile Apps -Comparing Native vs. Hybrid Applications -The Mobile Application Development Lifecycle-The Mobile Application Front-End-The Mobile Application Back-EndKey Mobile Application Services-What is Android-Android version history-Obtaining the Required Tools- Launching Your First Android Application-Exploring the IDE-Debugging Your Application-Publishing Your Application

| UNIT II | ACTIVITIES, FRAGMENTS, AND INTENTS | 9 |
|---|---|---|

Understanding Activities-Linking Activities Using Intents-Fragments-Displaying Notifications-Understanding the Components of a Screen-Adapting to Display Orientation-Managing Changes

| | | |
|---|---|---|
| to Screen Orientation- Utilizing the Action Bar-Creating the User Interface Programmatically Listening for UI Notifications | | |
| **UNIT III** | **USER INTERFACE WITH VIEWS** | **9** |
| Using Basic Views-Using Picker Views -Using List Views to Display Long Lists-Understanding Specialized Fragments - Using Image Views to Display Pictures -Using Menus with Views-Using Web View- Saving and Loading User Preferences-Persisting Data to Files-Creating and Using Databases. | | |
| **UNIT IV** | **CONTENT PROVIDERS AND MESSAGING** | **9** |
| Sharing Data in Android-Creating Your Own Content Providers -Using the Content Provider. SMS Messaging -Sending Email-Displaying Maps- Getting Location Data- Monitoring a Location. | | |
| **UNIT V** | **NETWORKING AND DEVELOPING ANDROID SERVICES** | **9** |
| Consuming Web Services Using HTTP-Consuming JSON Services- Creating Your Own Services - Binding Activities to Services -Understanding Threading. | | |
| | | **TOTAL PERIODS: 45** |
| **COURSE OUTCOMES** | | |
| Upon completion of the course, students will be able to | | |
| **CO1:** | Explain the technology and software development life-cycle | |
| **CO2:** | Develop Mobile Application of Activities, Fragments and Intents connectivity. | |
| **CO3:** | Develop Mobile Application of User Interface With Views Connectivity | |
| **CO4:** | Develop Mobile Application of content providing and messaging | |
| **CO5:** | Deploy mobile applications using an android and upload the developed App it into the web. | |
| **TEXT BOOKS** | | |
| **1.** | Jerome DiMarzio, “Beginning Android Programming with Android Studio”, Fourth Edition, John Wiley Wrox Pr Inc, 2017. | |
| 2. | Neil Smyth, “Android Studio 4.0 Development Essentials - Java Edition”, Payload Media Inc., 2020. | |
| **REFERENCE BOOKS** | | |
| 1 | Dawn Griffiths, David Griffiths, “Head First Android Development: A Brain-Friendly Guide”, Second Edition, O'Reilly, 2017. | |
| 2. | Neil Smyth,“Android Studio 3.0 Development Essentials: Android”, Eighth Edition, CreateSpace, 2017. | |
| 3. | Pradeep Kothari, “Android Application Development (With Kitkat Support)”, Black Book, Dreamtech Press, 2014. | |

| | |
|---|---|
| 4. | http://www.tutorialspoint.com/android/index.htm |
| 5. | http://developer.android.com/index.html. |

**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 2 | 1 | - | 3 | 1 | - | - | 1 | - | - | - | - | - | - |
| CO2 | 3 | 2 | 2 | - | 3 | 1 | - | - | 1 | - | - | - | - | - | - |
| CO3 | 3 | 3 | 3 | - | 3 | 1 | - | - | 1 | - | - | - | - | - | - |
| CO4 | 3 | 3 | 3 | - | 3 | 1 | - | - | 1 | - | - | - | - | - | - |
| CO5 | 3 | 3 | 3 | - | 3 | 1 | - | - | 1 | - | - | - | - | - | - |
| CO | 3 | 3 | 3 | - | 3 | 1 | - | - | 1 | - | - | - | - | - | - |

3-High, 2- Medium, 1-Low

| IT22784 | MULTI VARIATE DATA ANALYTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To introduce the basics of multivariate analysis, its trends, concepts, techniques, and classification.
- To learn about preparing for multivariate analysis, including understanding big data challenges, examining data, handling missing data, and testing assumptions.
- To learn how to apply Exploratory Factor Analysis to simplify data and interpret underlying patterns.
- To learn latent variable techniques like CFA, SEM, mediation, moderation, longitudinal studies, and Bayesian inference.
- To learn advanced multivariate techniques like multiple discriminant analysis, logistic regression, and cluster analysis to analyze complex data.

| UNIT I | INTRODUCTION | 6 |
|---|---|---|

Overview of Multivariate Methods- What is Multivariate Analysis? Three converging trends, Basic concepts of Multivariate Analysis, Managing the Multivariate Model, Classification of Multivariate techniques, Types of Multivariate techniques.

| UNIT II | PREPARING FOR MULTIVARIATE ANALYSIS | 6 |
|---|---|---|

The challenge of Big Data Research efforts- Preliminary examination of the Data -

| | | |
|---|---|---|
| Approaches for dealing with missing data – Testing the assumptions of multivariate analysis. | | |
| **UNIT III** | **EXPLORATORY FACTOR ANALYSIS** | **6** |
| Factor Analysis Decision Process - objectives, Designing, Assumptions, Deriving Factors and Assessing overall Fit, interpreting the Factors, Validation, Data Reduction. | | |
| **UNIT IV** | **LATENT VARIABLE TECHNIQUES** | **6** |
| Confirmatory Factor Analysis, Structural equation modelling: Mediation models, Moderation models, Conditional processes, longitudinal studies, latent growth model, Bayesian inference. | | |
| **UNIT V** | **ADVANCED MULTIVARIATE TECHNIQUES** | **6** |
| Multiple Discriminant Analysis, Logistic Regression, Cluster Analysis. | | |
| | | **TOTAL: 30 PERIODS** |

| **LIST OF EXPERIMENTS** | |
|---|---|
| 1 | Exploration of data sets and characteristics in PYTHON. |
| 2 | Implementation of dependent and interdependence techniques in PYTHON. |
| 3 | Explore scope of multivariate analytics in different applications using PYTHON. |
| 4 | Implementation of factor analysis in PYTHON . |
| 5 | Interpreting and validating factor analysis in PYTHON. |
| 6 | Implementation of cluster analysis in PYTHON. |
| 7 | Interpretation and validation of cluster analysis in PYTHON. |
| | **TOTAL: 30 PERIODS** |
| | **TOTAL (T+P) = 60 PERIODS** |

| **COURSE OUTCOMES** | |
|---|---|
| **At the end of the course, the students will be able to** | |
| **CO1:** | Explain basics of multivariate analysis, including its trends, concepts, and techniques. |
| **CO2:** | Demonstrate big data challenges, examine data, address missing data, and test assumptions for multivariate analysis. |
| **CO3:** | Apply exploratory factor analysis to simplify data and interpret factors. |
| **CO4:** | Describe latent variable techniques for complex data relationships. |
| **CO5:** | Apply techniques like Discriminant Analysis, Logistic Regression, and Cluster Analysis. |

| **TEXT BOOKS** | |
|---|---|
| 1 | Joseph F. Hair Jr., William C. Black, Barry J. Babin, Rolph E. Anderson, "Multivariate Data Analysis", Eighth edition, Cengage, 2019. |
| 2 | Daniel J. Denis, "Applied Univariate, Bivariate, and Multivariate Statistics Using Python - A Beginner's Guide to Advanced Data Analysis", Wiley, 2021. |

| **REFERENCES** | |
|---|---|
| 1 | Richard A Johnson and Dean W.Wichern, "Applied Multivariate Statistical Analysis", Prentice Hall, New Delhi, 2005. |

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|---|---|
| 2 | David R Anderson, Dennis J Seveency, and Thomas A Williams, "Statistics for Business and Economics", Thompson, Singapore, 2002. |
| 3 | Barbara G. Tabachnick, Linda S.Fidell, "Using Multivariate Statistics", Sixth Edition, Pearson, 2012. |
| 4 | Klaus Backhaus, Bernd Erichson, Sonja Gensler, Rolf Weiber, Thomas Weiber "Multivariate Analysis: An Application-Oriented Introduction", Second Edition, Springer, 2023. |
| 5 | R. Shanthi, "Multivariate Data Analysis using Spss And Amos", MIP Publisher,2019. |


**Mapping of Course Outcomes to Programme Outcomes**

| Course outcomes | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO1 | 3 | 3 | 3 | 1 | 2 | - | - | - | 2 | - | - | - | - | - | - |
| CO2 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | - | - | - | - | - | - |
| CO4 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | - | - | - | - | - | - |
| CO | 3 | 3 | 3 | 2 | 2 | - | - | - | 2 | - | - | - | - | - | - |

3-High, 2- Medium, 1-Low