# NANDHA ENGINEERING COLLEGE

*(AUTONOMOUS)*

(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)

ERODE – 638052 TAMIL NADU

*Email: principal@nandhaengg.org Mobile : 73737 12234*


## 1.1.2. Details of courses where syllabus revision was carried out in

## B.Tech –Information Technology

## R22 Curriculum

| Course Code | Course Name | % of Change |
|---|---|---|
| 22ITC13 | Advanced Java Programming | 30 |
| 22ITP07 | Advanced Java Programming Laboratory | 40 |
| 22ITC14 | Artificial Intelligence and Machine Learning | 100 |
| 22ITC15 | Cloud Computing | 55 |
| 22ITC16 | Internet of Things and its Applications | 100 |
| 22ITP08 | Cloud Computing Laboratory | 100 |
| 22ITP09 | Internet of Things and its Applications Laboratory | - |
| 22ITC17 | Full Stack Development | 75 |
| 22ITC18 | Mobile Application Development | 100 |
| 22ITP10 | Full Stack Development Laboratory | 100 |
| 22ITP11 | Mobile Application Development Laboratory | 100 |
| 22GED02 | Internship/Industrial Training | 100 |
| 22ITD01 | Project Work | - |
| 22ITX01 | Deep Learning | 100 |
| 22ITX02 | Knowledge Engineering | 100 |
| 22ITX03 | Recommender Systems | 100 |
| 22ITX04 | Soft Computing | 100 |
| 22ITX05 | Computer vision | 100 |

| | | |
|---|---|---|
| 22ITX06 | Ethics of AI | 100 |
| 22ITX07 | Business Intelligence | 100 |
| 22ITX08 | Robotic Process Automation | 100 |
| 22ITX11 | Pattern Recognition | 100 |
| 22ITX12 | Text and Speech Analytics | 100 |
| 22ITX13 | Big Data Analytics | 100 |
| 22ITX14 | Health care Analytics | 100 |
| 22ITX15 | Predictive Analytics | 100 |
| 22ITX16 | Image and Video Analytics | 100 |
| 22ITX17 | Natural Language Processing | 100 |
| 22ITX18 | Augmented Reality / Virtual Reality | 100 |
| 22ITX21 | Fundamentals of Cryptography and Network Security | 55 |
| 22ITX22 | Ethical Hacking | 100 |
| 22ITX23 | Cloud Security | 100 |
| 22ITX24 | Information Security Management | 80 |
| 22ITX25 | Social network security | 40 |
| 22ITX26 | Data Privacy and Protection | 100 |
| 22ITX27 | E-Commerce Security | 100 |
| 22ITX28 | Biometric Security | 100 |
| 22ITX31 | Industrial and medical IoT | 100 |
| 22ITX32 | Block chain Technology | 100 |
| 22ITX33 | Beyond 5G & IoT Technologies | 100 |
| 22ITX34 | Programming for IoT Boards | 100 |

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| | | |
|---|---|---|
| 22ITX35 | Wireless Ad-Hoc and Sensor Networks | 100 |
| 22ITX36 | Wearable Computing | 100 |
| 22ITX37 | Fog and Edge computing | 100 |
| 22ITX38 | Image Processing | 100 |
| 22ITX41 | Cloud Services Management | - |
| 22ITX42 | UI and UX Design | - |
| 22ITX43 | Devops | 100 |
| 22ITX44 | Principles of Programming Languages | 100 |
| 22ITX45 | MEAN Stack Development | 100 |
| 22ITX46 | Social and Information Networks | 100 |
| 22ITX47 | Web Mining | 100 |
| 22ITX48 | Multimedia Data Compression and Storage | 100 |
| 22ITX51 | Object Oriented Software Engineering. | 40 |
| 22ITX52 | Software Defined Networks | 100 |
| 22ITX53 | Software Project Management | 60 |
| 22ITX54 | Software Testing Tools and Techniques | 85 |
| 22ITX55 | Software Quality Assurance | 90 |
| 22ITX56 | Service Oriented Architecture | 100 |
| 22ITX57 | IT Operations | - |
| 22ITX58 | Product Life Cycle Management | - |
| | **Average** | **91.81%** |

18/7/24

Dr.G.R.Sreekanth
Professor & Head
Department of Information Technology
Nandha Engineering College (Autonomous)
Erode - 638 052, Tamil Nadu.

# NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

**Curriculum and Syllabi**

**for**

**B.TECH –Information Technology [R22]**

**[CHOICE BASED CREDIT SYSTEM]**

(This Curriculum and Syllabi are applicable to Students admitted from the academic year (2022-23) onwards)

**JULY 2024**

| INSTITUTE VISION AND MISSION | |
|---|---|
| **VISION** | • To be an Institute of excellence providing quality Engineering, Technology and Management education to meet the ever changing needs of the society. |
| **MISSION** | • To provide quality education to produce ethical and competent professionals with social Responsibility<br>• To excel in the thrust areas of Engineering, Technology and Entrepreneurship by solving real- world problems.<br>• To create a learner centric environment and improve continually to meet the changing global needs. |

| B.TECH – INFORMATION TECHNOLOGY | |
|---|---|
| **VISION** | • To build a prominent academic platform by disseminating quality technical education in the field of Information Technology to meet the changing needs of society. |
| **MISSION** | Department of Information Technology is committed to<br>• To produce professionally competent and ethically responsible graduates through a balanced curriculum.<br>• To empower the students in the thrust areas of information technology and Allied disciplines and to impart Entrepreneurial skills in the continually changing global market.<br>• To establish a learner-centered environment that encourages the adoption of emerging technologies in the changing needs of the society. |
| **PROGRAMME EDUCATIONAL OBJECTIVES (PEO)** | The graduates of Information Technology will be able to<br>**PEO 1: Core Competency:** Apply the knowledge of mathematics, science and engineering fundamentals to identify and solve technological problems by deploying various software tools for societal development.<br>**PEO 2: Research, Innovation and Entrepreneurship:** Implement recent tools, technologies and innovative ideas for leading successful careers in research / entrepreneurship and to excel in solving real world problems.<br>**PEO 3: Ethics, Human Valued and Life-Long Learning:** Exhibit professional ethics in the industry and possess the necessary skills for working in multi-disciplinary areas with focus on life-long learning. |
| **PROGRAMME SPECIFIC OUTCOMES (PSO)** | • **PSO 1:** Analyze, design and apply mathematical foundations, principles of computing, Algorithms, modeling and design of Information Technology based systems.<br>• **PSO 2:** Develop problem-solving skills in the broad area of programming concepts and to manage interdisciplinary projects. |

**PROGRAM OUTCOMES:**

At the end of this programme the students will be able to

| a-l | GRADUATE ATTRIBUTES | PO No. | PROGRAMME OUTCOMES |
|---|---|---|---|
| a | Engineering Knowledge | PO1 | Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| b | Problem Analysis | PO2 | Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| c | Design and Development of Solutions | PO3 | 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. |
| d | Investigation of Complex Problems | PO4 | 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. |
| e | Modern Tool Usage | PO5 | 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. |
| f | The Engineer and Society | PO6 | Apply reasoning acquired by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Engineering practice. |
| g | Environment and Sustainability | PO7 | Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the Knowledge of, and need for sustainable development. |
| h | Ethics | PO8 | Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| i | Individual and Team Work. | PO9 | Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| j | Communication | PO10 | 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. |
| k | Project Management and Finance | PO11 | 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. |
| l | Lifelong Learning | PO12 | 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. |

## MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Programme Educational Objectives and the outcomes is given in the following table

| PROGRAMME EDUCATIONAL OBJECTIVES | PROGRAMME OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 2 |
| 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 1 |
| 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 |

## MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

| PROGRAM SPECIFIC OUTCOMES | PROGRAMME OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L |
| 1 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| 2 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 2 |

**Contribution 1: Reasonable 2: Significant 3: Strong**

| SEMESTER: I | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRE-REQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **I** | 22MAN01 | Induction Programme | MC | - | - | - | - | - | - |
| **THEORY** | | | | | | | | | |
| 2 | 22EYA01 | Professional Communication - I | HSMC | - | 4 | 2 | 0 | 2 | 3 |
| 3 | 22MYB01 | Calculus and Linear Algebra * | BSC | - | 4 | 3 | I | 0 | 4 |
| 4 | 22PYB01 | Semiconductor Physics | BSC | - | 3 | 3 | 0 | 0 | 3 |
| 5 | 22ECC01 | Basics of Electronics Engineering | ESC | - | 3 | 3 | 0 | 0 | 3 |
| 6 | 22CSC01 | Problem Solving and C Programming | ESC | - | 3 | 3 | 0 | 0 | 3 |
| 7 | 22GYA01 | தமிழர் மரபு / Heritage of Tamils* | HSMC | - | I | I | 0 | 0 | I |
| **PRACTICAL** | | | | | | | | | |
| 8 | 22ECP01 | Basics of Electronics Engineering Laboratory | ESC | - | 4 | 0 | 0 | 4 | 2 |
| 9 | 22CSP01 | Problem Solving and C Programming Laboratory | ESC | - | 4 | 0 | 0 | 4 | 2 |
| 10 | 22PYP01 | Physics Laboratory* | BSC | - | 2 | 0 | 0 | 2 | I |
| **Mandatory Non Credit Courses** | | | | | | | | | |
| 11 | 22MAN02 | Soft/Analytical Skills - I | MC | - | 3 | I | 0 | 2 | 0 |
| 12 | 22MAN03 | Yoga – I * | MC | - | I | 0 | 0 | I | 0 |
| | | | | **TOTAL** | **32** | **16** | **I** | **15** | **22** |

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| SEMESTER: II | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRE-REQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **THEORY** | | | | | | | | | |
| 1 | 22EYA02 | Professional Communication- II | HSMC | 22EYA01 | 4 | 2 | 0 | 2 | 3 |
| 2 | 22MYB03 | Statistics and Numerical Methods * | BSC | - | 4 | 3 | 1 | 0 | 4 |
| 3 | 22ITC01 | Data structures using C* | ESC | 22CSC01 | 3 | 3 | 0 | 0 | 3 |
| 4 | 22ITC02 | Python Programming * | ESC | - | 3 | 3 | 0 | 0 | 3 |
| 5 | 22ITC03 | Digital Principles and Computer Organization * | ESC | - | 3 | 3 | 0 | 0 | 3 |
| 6 | 22GYA02 | தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology* | HSMC | - | 1 | 1 | 0 | 0 | 1 |
| **PRACTICAL** | | | | | | | | | |
| 7 | 22ITP01 | Data Structures Laboratory | ESC | 22CSP01 | 4 | 0 | 0 | 4 | 2 |
| 8 | 22ITP02 | Python Programming Laboratory | ESC | - | 4 | 0 | 0 | 4 | 2 |
| 9 | 22MEP01 | Engineering Graphics Laboratory | ESC | - | 4 | 0 | 0 | 4 | 2 |
| **Mandatory Non Credit Courses** | | | | | | | | | |
| 10 | 22MAN04 | Soft Analytical Skills - II | MC | 22MAN02 | 3 | 1 | 0 | 2 | 0 |
| 11 | 22MAN05 | Yoga - II* | MC | - | 1 | 0 | 0 | 1 | 0 |
| | | | | **TOTAL** | **34** | **16** | **1** | **17** | **23** |

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| SEMESTER: III | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRE-REQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **THEORY** | | | | | | | | | |
| 1 | 22MYB05 | Discrete Mathematics | BSC | - | 4 | 3 | 1 | 0 | 4 |
| 2 | 22ITC04 | Algorithms | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 3 | 22ITC05 | Operating Systems | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 4 | 22ITC06 | Java programming | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 5 | 22ITC07 | Computer Networks | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 6 | 22ITC08 | Design Thinking | PCC | - | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 7 | 22ITP03 | Algorithms Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| 8 | 22ITP04 | Java Programming Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| 9 | 22ITP05 | Computer Networks Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| **Mandatory Non Credit Courses** | | | | | | | | | |
| 10 | 22MAN07# / 22MAN07R ## | Soft / Analytical Skills - III | MC | 22MAN04 | 3 | 1 | 0 | 2 | 0 |
| 11 | 22MAN09 | Indian Constitution | MC | - | 1 | 1 | 0 | 0 | 0 |
| | | | | **TOTAL** | **35** | **20** | **1** | **14** | **25** |

# **Applicable for (2022-2026) Batch only**

## **Applicable for (2023-2027) Batch only**

| SEMESTER: IV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRE-REQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| **THEORY** | | | | | | | | | |
| 1 | 22ITC09 | Theory of Computation | PCC | 22MYB05 | 4 | 3 | 1 | 0 | 4 |
| 2 | 22ITC10 | Fundamentals of Data Science | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 3 | 22ITC111 | Database Management System | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 4 | 22ITC12 | Agile Methodologies | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 5 | 22ITC13 | Advanced Java Programming** | PCC | 22ITC06 | 3 | 3 | 0 | 0 | 3 |
| 6 | 22CYB07 | Environmental Science and Engineering | BSC | - | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 7 | 22ITP06 | Database Management System Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| 8 | 22ITP07 | Advanced Java Programming Laboratory** | PCC | 22ITP04 | 4 | 0 | 0 | 4 | 2 |
| **Mandatory Non Credit Courses** | | | | | | | | | |
| 9 | 22MAN08#/ 22MAN08R## | Soft / Analytical Skills - IV | MC | 22MAN07 | 3 | 1 | 0 | 2 | 0 |
| 10 | 22GED01 | Personality and Character Development | EEC | - | 1 | 1 | 0 | 0 | 0 |
| | | | | **TOTAL** | **31** | **20** | **1** | **10** | **23** |

# **Applicable for 2022-26 Batch only**
## **Applicable for 2023-27 Batch only**

** Ratified by Twelfth Academic Council

| SEMESTER: V | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
| **THEORY** | | | | | | | | | |
| 1 | 22ITC14 | Artificial Intelligence and Machine learning | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 2 | 22ITC15 | Cloud Computing | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 3 | 22ITC16 | Internet of Things and its Applications | ESC | - | 3 | 3 | 0 | 0 | 3 |
| 4 | E1 | Elective(PEC) | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 5 | E2 | Elective(PEC) | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 6 | E3 | Elective(OEC/PEC) | PEC/OEC | - | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 7 | 22ITP08 | Cloud Computing Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| 8 | 22ITP09 | Internet of Things and its Applications Laboratory | ESC | - | 4 | 0 | 0 | 4 | 2 |
| **Mandatory Non Credit Courses** | | | | | | | | | |
| 9 | 22MAN10R | Communication and Quantitative Reasoning | MC | - | 3 | 1 | 0 | 2 | 0 |
| | | | | **TOTAL** | **30** | **19** | **0** | **11** | **22** |

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| SEMESTER: VI | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
| **THEORY** | | | | | | | | | |
| 1 | 22ITC17 | Full Stack Development | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 2 | 22ITC18 | Mobile Application Development | PCC | 22ITC07 | 3 | 3 | 0 | 0 | 3 |
| 3 | E4 | Elective(PEC) | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 4 | E5 | Elective(PEC) | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 5 | E6 | Elective(OEC) | OEC | - | 3 | 3 | 0 | 0 | 3 |
| 6 | E7 | Elective(OEC/PEC) | PEC/OEC | - | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 7 | 22ITP10 | Full Stack Development Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| 8 | 22ITP11 | Mobile Application Development Laboratory | PCC | 22ITP05 | 4 | 0 | 0 | 4 | 2 |
| | | | | **TOTAL** | **30** | **19** | **0** | **11** | **22** |

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| SEMESTER: VII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
| **THEORY** | | | | | | | | | |
| 1 | 22GEA01 | Universal Human Values | HSMC | - | 2 | 2 | 0 | 0 | 2 |
| 2 | EM1 | Elective (Management) | HSMC | - | 3 | 3 | 0 | 0 | 3 |
| 3 | E8 | Elective(PEC) | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 4 | E9 | Elective(OEC/PEC) | PEC/OEC | - | 3 | 3 | 0 | 0 | 3 |
| 5 | E10 | Elective(OEC) | OEC | - | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | | |
| 6 | 22GED02 | Internship/Industrial Training | EEC | | 0 | 0 | 0 | 0 | 2 |
| | | | | **TOTAL** | **14** | **14** | **0** | **0** | **16** |

| SEMESTER: VIII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
| **PRACTICAL** | | | | | | | | | |
| 1 | 22ITD01 | Project Work | EEC | | 20 | 0 | 0 | 20 | 10 |
| | | | | **TOTAL** | **20** | **0** | **0** | **20** | **10** |

## (A) HSMC,BSC, and ESC Courses

### (a) Humanities and Management Sciences (HSMC)

| S.NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 22EYA01 | Professional Communication - I | HSMC | - | 4 | 2 | 0 | 2 | 3 |
| 2. | 22GYA01 | தமிழர் மரபு / Heritage of Tamils | HSMC | | 1 | 1 | 0 | 0 | 1 |
| 3. | 22EYA02 | Professional Communication- II | HSMC | 22EYA01 | 4 | 2 | 0 | 2 | 3 |
| 4. | 22GYA02 | தமிழரும் தொழில்நுட்பமும் / Tamils and Technology | HSMC | - | 1 | 1 | 0 | 0 | 1 |
| 5. | 22GEA01 | Universal Human Values | HSMC | - | 2 | 2 | 0 | 0 | 2 |

### (b) Basic Sciences (BSC)

| S.NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 22MYB01 | Calculus and Linear Algebra | BSC | - | 4 | 3 | 1 | 0 | 4 |
| 2. | 22PYB01 | Semiconductor Physics | BSC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 22PYP01 | Physics Laboratory | BSC | - | 2 | 0 | 0 | 2 | 1 |
| 4. | 22MYB03 | Statistics and Numerical Methods | BSC | - | 4 | 3 | 1 | 0 | 4 |
| 5. | 22MYB05 | Discrete Mathematics | BSC | - | 4 | 3 | 1 | 0 | 4 |
| 6. | 22CYB07 | Environmental Science and Engineering | BSC | - | 3 | 3 | 0 | 0 | 3 |

**(c) Engineering Sciences (ESC)**

| S.NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 22ECC01 | Basics of Electronics Engineering | ESC | | 3 | 3 | 0 | 0 | 3 |
| 2. | 22CSC01 | Problem Solving and C Programming | ESC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 22ECP01 | Basics of Electronics Engineering Laboratory | ESC | - | 4 | 0 | 0 | 4 | 2 |
| 4. | 22CSP01 | Problem Solving and C Programming Laboratory | ESC | - | 4 | 0 | 0 | 4 | 2 |
| 5. | 22ITC01 | Data structures using C | ESC | 22CSC01 | 3 | 3 | 0 | 0 | 3 |
| 6. | 22ITC02 | Python Programming | ESC | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 22ITC03 | Digital Principles and Computer Organization | ESC | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 22ITP01 | Data Structures Laboratory | ESC | 22CSP01 | 4 | 0 | 0 | 4 | 2 |
| 9. | 22ITP02 | Python Programming Laboratory | ESC | - | 4 | 0 | 0 | 4 | 2 |
| 10. | 22MEP01 | Engineering Graphics Laboratory | ESC | - | 4 | 0 | 0 | 4 | 2 |
| 11. | 22ITC16 | Internet of Things and its Applications | ESC | - | 3 | 3 | 0 | 0 | 3 |
| 12. | 22ITP09 | Internet of Things and its Applications Laboratory | ESC | - | 4 | 0 | 0 | 4 | 2 |

**(d) Employability Enhancement Courses (EEC)**

| COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 22GED01 | Personality and Character Development | EEC | - | 0 | 0 | 0 | 1 | 0 |
| 22GED02 | Internship/Industrial Training | EEC | - | 0 | 0 | 0 | 0 | 2 |
| 22ITD01 | Project Work | EEC | - | 20 | 0 | 0 | 20 | 10 |

| (e) PROGRAMME CORE (PCC) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.NO** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRE-REQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| 1. | 22ITC04 | Algorithms | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 22ITC05 | Operating Systems | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 22ITC06 | Java programming | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 22ITC07 | Computer Networks | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 22ITC08 | Design Thinking | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 22ITP03 | Algorithms Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| 7. | 22ITP04 | Java Programming Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| 8. | 22ITP05 | Computer Networks Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| 9. | 22ITC09 | Theory of Computation | PCC | 22MYB05 | 4 | 3 | 1 | 0 | 4 |
| 10. | 22ITC10 | Fundamentals of Data Science | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 11. | 22ITC11 | Database Management System | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 12. | 22ITC12 | Agile Methodologies | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 13. | 22ITC13 | Advanced Java Programming | PCC | 22ITC06 | 3 | 3 | 0 | 0 | 3 |
| 14. | 22ITP06 | Database Management System Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| 15. | 22ITP07 | Advanced Java Programming Laboratory | PCC | 22ITP04 | 4 | 0 | 0 | 4 | 2 |
| 16. | 22ITC14 | Artificial Intelligence and Machine learning | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 17. | 22ITC15 | Cloud Computing | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 18. | 22ITP08 | Cloud Computing Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| 19. | 22ITC17 | Full Stack Development | PCC | - | 3 | 3 | 0 | 0 | 3 |
| 20. | 22ITC18 | Mobile Application Development | PCC | 22ITC07 | 3 | 3 | 0 | 0 | 3 |
| 21. | 22ITP10 | Full Stack Development Laboratory | PCC | - | 4 | 0 | 0 | 4 | 2 |
| 22. | 22ITP11 | Mobile Application Development Laboratory | PCC | 22ITP05 | 4 | 0 | 0 | 4 | 2 |

| (f) Mandatory Non-Credit Courses (MC) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRE-REQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| 1. | 22MAN01 | Induction Programme | MC | - | 0 | 0 | 0 | 0 | 0 |
| 2. | 22MAN02 | Soft/Analytical Skills - I | MC | - | 3 | 1 | 0 | 2 | 0 |
| 3. | 22MAN03 | Yoga - I | MC | - | 1 | 0 | 0 | 1 | 0 |
| 4. | 22MAN04 | Soft Analytical Skills - II | MC | 22MAN02 | 3 | 1 | 0 | 2 | 0 |
| 5. | 22MAN05 | Yoga - II | MC | - | 1 | 0 | 0 | 1 | 0 |
| 6. | 22MAN07 | Soft / Analytical Skills - III | MC | 22MAN04 | 3 | 1 | 0 | 2 | 0 |
| 7. | 22MAN09 | Indian Constitution | MC | - | 1 | 1 | 0 | 0 | 0 |
| 8. | 22MAN08 | Soft / Analytical Skills - IV | MC | 22MAN07 | 3 | 1 | 0 | 2 | 0 |
| 9. | 22MAN10R | Communication and Quantitative Reasoning | MC | | 3 | 1 | 0 | 2 | 0 |

** Ratified by Twelfth Academic Council
* Ratified by Eleventh Academic Council

| PROGRAMME ELECTIVE COURSES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **VERTICAL I - MACHINE INTELLIGENCE** | | | | | | | | | |
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRE-REQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| 1. | 22ITX01 | Deep Learning | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 22ITX02 | Knowledge Engineering | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 22ITX03 | Recommender Systems | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 22ITX04 | Soft Computing | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 22ITX05 | Computer vision | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 22ITX06 | Ethics of AI | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 22ITX07 | Business Intelligence | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 22ITX08 | Robotic Process Automation | PEC | - | 3 | 3 | 0 | 0 | 3 |

| **VERTICAL II - DATA ANALYTICS** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRE-REQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| 1. | 22ITX11 | Pattern Recognition | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 22ITX12 | Text and Speech Analytics | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 22ITX13 | Big Data Analytics | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 22ITX14 | Health care Analytics | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 22ITX15 | Predictive Analytics | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 22ITX16 | Image and Video Analytics | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 22ITX17 | Natural Language Processing | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 22ITX18 | Augmented Reality / Virtual Reality | PEC | - | 3 | 3 | 0 | 0 | 3 |
| **VERTICAL III - CYBER SECURITY** | | | | | | | | | |
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRE-REQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| 1. | 22ITX21 | Fundamentals of Cryptography and Network Security | PEC | 22ITC07 | 3 | 3 | 0 | 0 | 3 |
| 2. | 22ITX22 | Ethical Hacking | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 22ITX23 | Cloud Security | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 22ITX24 | Information Security Management | PEC | - | 3 | 3 | 0 | 0 | 3 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5. | 22ITX25 | Social network security | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 22ITX26 | Data Privacy and Protection | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 22ITX27 | E-Commerce Security | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 22ITX28 | Biometric Security | PEC | - | 3 | 3 | 0 | 0 | 3 |

**VERTICAL IV - INTERNET OF THINGS**

| SL. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 22ITX31 | Industrial and medical IoT | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 22ITX32 | Block chain Technology | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 22ITX33 | Beyond 5G & IoT Technologies | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 22ITX34 | Programming for IoT Boards | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 22ITX35 | Wireless Ad-Hoc and Sensor Networks | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 22ITX36 | Wearable Computing | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 22ITX37 | Fog and Edge computing | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 22ITX38 | Image Processing | PEC | - | 3 | 3 | 0 | 0 | 3 |

**VERTICAL V - WEB DEVELOPMENT**

| SL. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 22ITX41 | Cloud Services Management | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 22ITX42 | UI and UX Design | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 22ITX43 | Devops | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 22ITX44 | Principles of Programming Languag | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 22ITX45 | MEAN Stack Development | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 22ITX46 | Social and Information Networks | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 22ITX47 | Web Mining | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 22ITX48 | Multimedia data compression and storage | PEC | - | 3 | 3 | 0 | 0 | 3 |

| VERTICAL VI - SOFTWARE DEVELOPMENT ENGINEERING | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SL. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
| 1. | 22ITX51 | Object Oriented Software Engineering. | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 22ITX52 | Software Defined Networks | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 22ITX53 | Software Project Management | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 22ITX54 | Software Testing Tools and Techniques | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 22ITX55 | Software Quality Assurance | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 22ITX56 | Service Oriented Architecture | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 22ITX57 | IT Operations | PEC | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 22ITX58 | Product Life Cycle Management | PEC | - | 3 | 3 | 0 | 0 | 3 |
| MANAGEMENT ELECTIVE | | | | | | | | | |
| SL. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
| 1. | 22GEA02 | Principles Of Management | HSBC | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 22GEA03 | Total Quality Management | HSMC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 22GEA04 | Professional Ethics | HSMC | - | 3 | 3 | 0 | 0 | 3 |

| OPEN ELECTIVE COURSES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SL. NO. | COURSE CODE | COURSE TITLE | CATEGORY | PRE-REQUISITE | CONTACT PERIODS | L | T | P | C |
| 1 | 22ITZ01 | Web Technology | OEC | - | 3 | 3 | 0 | 0 | 3 |
| 2 | 22ITZ02 | Software Testing | OEC | - | 3 | 3 | 0 | 0 | 3 |
| 3 | 22ITZ03 | Developing Mobile Apps | OEC | - | 3 | 3 | 0 | 0 | 3 |
| 4 | 22ITZ04 | Fundamentals of Cloud Computing | OEC | - | 3 | 3 | 0 | 0 | 3 |

| MINOR DEGREE – WEB TECHNOLOGIES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SL. NO.** | **COURSE CODE** | **COURSE TITLE** | **CATEGORY** | **PRE-REQUISITE** | **CONTACT PERIODS** | **L** | **T** | **P** | **C** |
| 1. | 17ITM01 | Fundamentals of Problem Solving | OEC | - | 3 | 3 | 0 | 0 | 3 |
| 2. | 17ITM02 | Java programming Basics | OEC | - | 3 | 3 | 0 | 0 | 3 |
| 3. | 17ITM03 | Database System Concepts | OEC | - | 3 | 3 | 0 | 0 | 3 |
| 4. | 17ITM04 | User Experience | OEC | - | 3 | 3 | 0 | 0 | 3 |
| 5. | 17ITM05 | Web essentials | OEC | - | 3 | 3 | 0 | 0 | 3 |
| 6. | 17ITM06 | Full stack web development | OEC | - | 3 | 3 | 0 | 0 | 3 |
| 7. | 17ITM07 | App development | OEC | - | 3 | 3 | 0 | 0 | 3 |
| 8. | 17ITM08 | Web Application Security | OEC | - | 3 | 3 | 0 | 0 | 3 |

**CREDIT DISTRIBUTION**

| Semester/ Category | HSMC | BSC | PCC | ESC | EEC | PEC | OEC | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 8 | | 10 | | | | 22 |
| 2 | 4 | 4 | | 15 | | | | 23 |
| 3 | | 4 | 21 | | | | | 25 |
| 4 | | 3 | 20 | | | | | 23 |
| 5 | | | 8 | 5 | | 9 | | 22 |
| 6 | | | 10 | | | 6 | 6 | 22 |
| 7 | 5 | | | | 2 | 3 | 6 | 16 |
| 8 | | | | | 10 | | | 10 |
| Total | 13 | 19 | 59 | 30 | 12 | 18 | 12 | 163 |
| % | 8.02 | 11.7 | 35.80 | 18.5 | 7.40 | 11.11 | 7.40 | |
| AICTE Credits Recommended | 16 | 23 | 59 | 29 | 15 | 12 | 9 | |
| % | 10 | 14 | 36 | 18 | 9 | 7 | 6 | |

**TOTALCREDITS (13+19+59+30+12+18+12) = 163CREDITS**

| 22ITC13 ADVANCED JAVA PROGRAMMING<br>*(Common to 22CSC12 and 22CCC14)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE : 22ITC06** | | | | | |
| **Course Objective:** | Be able to put into use the advanced features of the Java language to build and compile robust enterprise grade applications | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply the concepts of collections for high-performance implementations of data structures. | Ap | 20% |
| CO2 | Analyse how to use HTML and CSS in front end deign and JavaScript for responsive pages. | An | 40% |
| CO3 | Design web application based on client and server-side technologies and backend connectivity. | Ap | 20% |
| CO4 | Demonstrates the benefits of XML in data sharing. | An | 20% |
| CO5 | Implement mini project for any given web application using advanced web development concepts. | An | Internal Assessment |

| **UNIT I WRAPPER CLASSES AND COLLECTIONS** | (9) |
|---|---|
| **Wrapper Classes**: Autoboxing, Unboxing and Cloneable Interface<br>**I/O Streams:** Introduction to I/O, I/O Operations, Object Serialization<br>**Collection Framework:** Introduction to Collection, List, Array Lists, Linked Lists, Sorting Lists, Using Iterators, Generics, Set, Map, HashMap, Sorted Maps, Using Custom Objects, Map | |
| **UNIT II HTML & CSS** | (9) |
| **HTML :** Introduction to HTML and its elements, Basic Tags, Basic Elements, Formatting Tags, Layout tags and Semantic Tags, Tables, Forms and Frames, Style and div tags, Introduction to HTML5<br>**CSS:** Introduction to CSS, Styles and Style sheets, Formatting with CSS, Links and Lists, CSS Box Model, CSS3. | |
| **UNIT III JAVASCRIPT** | (9) |
| **JAVASCRIPT**: Introduction to JavaScript, variables, Data Types, JS Functions, JS Strings, JS Events, JS Objects, Arrays, Event Handling JS Validations, JS Regular Expressions. | |

| UNIT IV SERVLETS AND DATABASE CONNECTIVITY | (9) |
|---|---|
| **SERVLETS:** Introduction to Servlets, Servlet Lifecycle, Servlet-Get and Post Requests, Servlet Config and Servlet Context, Servlet-Cookies and Session Management.<br><br>**RDBMS / SQL / JDBC:** Introduction to RDBMS, Oracle 11g Introduction, Select Statement, Restricting and Sorting Data, DML, DDL, Introduction to JDBC, Establishing Connection, Executing Query and Processing Results, Meta data & Prepared Statement, Using Callable Statement and Transactions. | |
| **UNIT V JSP and XML** | (9) |
| **JSP :** overview-Basic JSP Architecture-Lifecycle-JSP in Eclipse-JSP scripting elements-Directives-Actions-Implicit objects<br>**XML:** Introduction to XML, Document Type Definition, XML Namespaces, XML Schema, XSLT. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Java: The Complete Reference, 10th, Herbert Schildt, McGraw-Hill
2. "Web Technologies--A Computer Science Perspective", Jeffrey C.Jackson, Pearson Education, 2007

**REFERENCES:**

1. ThomasA. Powell,"TheComplete Reference HTML &CSS",New Riders, 5th ed., 2017.
2. SteveSuehring,"JavaScript– Step by Step", PHI, 2nd ed.,2011.
3. https://www.w3schools.com
4. https://www.tutorialspoint.com/jsp

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | | 3 | | | | | | | | | | | | 3 |
| 3 | | | 3 | | | | | | | | | | 3 | |
| 4 | | | 2 | | 3 | | | | | | | | | 3 |
| 5 | | | | | 2 | | | | 2 | 2 | 2 | | | |
| CO (W.A) | 3 | 3 | 3 | | 3 | | | | 2 | 2 | 2 | | 3 | 3 |

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| 22ITP07 ADVANCED JAVA PROGRAMMING LABORATORY<br>*(Common to 22CSP08 and 22CCP09)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE: 22ITP04**

| **Course Objective:** | To use advanced client and server-side technologies to develop a web application. |
|---|---|

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** |
|---|---|---|
| CO1 | Apply Advanced Java concepts to solve real-world problems. | Ap |
| CO2 | Design and develop user-centric web applications focused on social and environmental issues. | C |
| CO3 | Integrate front-end and back-end components effectively with databases and external services | Ap |
| CO4 | Use web designing and scripting technologies to develop web applications. | An |
| CO5 | Demonstrate teamwork and problem-solving skills in project development. | An |

**LIST OF EXPERIMENTS :**

1. Practice programs on Java Collections Frameworks
2. Programs to convert primitive types to wrapper objects and vice versa
3. Programs with HTML and CSS
4. Programs with JavaScript.
5. Use JDBC connectivity and create Table, insert and update data.
6. Write a program in Java to create a Cookie and set the expiry time of the same.
7. Write a program in Java to create Servlet to count the number of visitors to a web page.
8. Write a program in Java to create a form and validate a password using Servlet.
9. Programs for creating web applications using JSP.
10. Programs on XML.

**TOTAL (P:60) = 60 PERIODS**

| Mapping of COs with POs / PSOs | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **POs** | | | | | | | | | | | | **PSOs** | |
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** |
| **1** | 3 | | | | 3 | | | | | | | | 3 | |
| **2** | | 3 | | | 3 | 3 | 3 | | | | | | 3 | |
| **3** | | | 3 | | 3 | | | | | | | | | 3 |
| **4** | | | | | 3 | | | | | | | | 3 | |
| **5** | | | | | | | | 3 | 3 | 3 | 2 | | | |
| **CO (W.A)** | **3** | **3** | **3** | | **3** | | **3** | **3** | **3** | **3** | **2** | | **3** | **3** |

## *22ITC14* - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

***(Common to 22CSC09,22CCC08, 22CIC08)***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE- REQUISITE: NIL**

**Course Objective:**

- Learn to design, implement, and evaluate AI/ ML models

| **Course Outcomes** The students will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply fundamental concepts of AI and implement basic heuristic techniques. | Ap | 30% |
| CO2 | Develop solution for search algorithms, constraint satisfaction and planning problem | Ap | 30% |
| CO3 | Analyze the basic concepts of machine learning and preprocess the dataset | An | 20% |
| CO4 | Implement supervised learning techniques for complex problems | An | 20% |
| CO5 | Collaborate and design neural networks to predict real world problems | E | Internal Assessment |

| | |
|---|---|
| **UNIT I -PROBLEM SOLVING** | **(9)** |
| Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP). | |
| **UNIT II - PROBABILISTIC REASONING** | **(9)** |
| Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks. | |
| **UNIT III - SUPERVISED LEARNING** | **(9)** |
| Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests. | |
| **UNIT IV - ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING** | **(9)** |
| Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization. | |
| **UNIT V - NEURAL NETWORKS** | **(9)** |
| Artificial Neural Networks – Structures, perceptron, Multilayer perceptron, activation functions, network training, Learning in multilayer networks , Learning neural network structures, Case study: Handwritten digit recognition, Word senses and house prices. | |
| **TOTAL (L: 45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

**REFERENCES:**

1. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013.
2. MehryarMohri, AfshinRostamizadeh, AmeetTalwalkar, "Foundations of Machine Learning", MIT Press, 2012.
3. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | | |
| 2 | | | 3 | | | | | | | | | | | |
| 3 | | 3 | | | 2 | | | | | | | | 3 | |
| 4 | | | | 3 | | | | | | | | | | |
| 5 | | | | | | 3 | | | 2 | 2 | | | | 3 |
| **CO (W.A)** | **3** | **3** | **3** | **3** | **2** | **3** | | | **2** | **2** | | | **3** | **3** |

| 22ITC15 CLOUD COMPUTING<br>*(Common to 22AIX41, 22CSX41 and 22CIX44)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE: NIL**

| **Course Objective:** | Understand the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges |
|---|---|

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply the concept of virtualization and Experiment with virtualization of hardware resources and Docker. | Ap | 40% |
| CO2 | Analyze various cloud programming models and apply them to solve problems on the cloud. | An | 20% |
| CO3 | Develop and deploy services on the cloud and set up a cloud environment | An | 20% |
| CO4 | Evaluate the security issues related to cloud computing and handle the security threats and construct different cloud delivery design models | An | 20% |
| CO5 | Build cloud solutions for the societal problems | An | Internal Assessment |

| **UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE** | **(9)** |
|---|---|
| Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges. | |
| **UNIT II -VIRTUALIZATION BASICS** | **(9)** |
| Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices. | |
| **UNIT III -VIRTUALIZATION INFRASTRUCTURE AND DOCKER** | **(9)** |
| Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories | |
| **UNIT IV -CLOUD DEPLOYMENT ENVIRONMENT** | **(9)** |
| Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack | |

| UNIT V -CLOUD SECURITY | (9) |
|---|---|
| Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice. | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOKS:**


1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.


**REFERENCES:**


1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.


**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | 3 | | | | | | | | | 3 | |
| 2 | 3 | 3 | | | | | | | | | | | 3 | 3 |
| 3 | | | 3 | | | | | | | | | | | 3 |
| 4 | | | | 3 | | | | | | | | | 3 | |
| 5 | | | | | 3 | 3 | | | | | | | | 3 |
| CO (W.A) | 3 | 3 | 3 | | | 3 | | | | | | | 3 | 3 |

## 22ITC16- INTERNET OF THINGS AND ITS APPLICATIONS
*(Common to 22AIC14, 22CIC0 and 22CSC17)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE-REQUISITE: NIL**

| | |
|---|---|
| **Course Objective:** | • To provide an understanding of the technologies and the standards relating to the Internet of Things.<br>• To review about IoT protocols and arduino processor with underlying technologies, limitations, and challenges. |

| **Course Outcomes** The student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Identify various characteristics and deployment levels of IoT. | Ap | 30% |
| CO2 | Analyze the concepts of M2M and IoT architecture. | An | 20% |
| CO3 | Implement Various IoT communication protocols like MQTT,CoAP, and HTTP in developing IoT applications. | Ap | 20% |
| CO4 | Analyze the functioning ofarduinoboards and various communications technologies to use with it. | An | 30% |
| CO5 | Perform in a team to build automation, agriculture and various real time applications using arduino. | Ap | Internal Assessment |

| **UNIT I – INTRODUCTION TO INTERNET OF THINGS** | **(9)** |
|---|---|
| Characteristics of IoT - Physical and Logical Design of IoT - IoT Enabling Technologies - Wireless Sensor Networks - Cloud Computing - Big Data Analytics - Communication Protocols - Embedded Systems-Functional Blocks - Communication Models and APIs - IoT Levels and Deployment Templates – Overview of Microcontroller, Basics of Sensors and Actuators - Examples and Working Principles of Sensors and Actuators. | |
| **UNIT II - M2M AND IOT ARCHITECTURE** | **(9)** |
| Building Architecture - An IoT Architecture Outline - M2M and IoT Technology Fundamentals: Devices and Gateways - Local and Wide Area Networking - Data management, Everything as a Service, M2M and IoT Analytics - Knowledge Management - IoT Reference Model. | |
| **UNIT III - IOT PROTOCOLS** | **(9)** |
| PHY/MAC Layer: 3GPP MTC, IEEE 802.15 – Wireless HART- Z-Wave, BLE- Zigbee - DASH7 – Network Layer: 6LoWPAN - 6TiSCH - RPL - CORPL - CARP - Transport Layer: TCP - MPTCP - UDP-DCCP-Session Layer: HTTP- CoAP- XMPP- AMQP- MQTT. | |

| UNIT IV - PROGRAMMING USING ARDUINO | (9) |
|---|---|
| Introduction to Arduino processor- General Block diagram- Working of Analog and Digital I/O pins- Serial(UART), I2C Communications and SPI communication - Arduino Boards: Mega, Due, Zero and 101- Prototyping basics - Technical description - Setting Up Arduino IDE- Introduction to Arduino programming-Case Studies. | |
| **UNIT V - APPLICATIONS OF IOT** | **(9)** |
| Various Real time applications of IoT- Home Automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation – Domain Specific applications - Case Studies. | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOKS:**


1. Internet of Things, RMD SundaramShriram K Vasudevan, Abhishek S Nagarajan, John Wiley and Sons, Second Edition, 2019.
2. ArshdeepBahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.
3. Veneri,Giacomo and Antonio capasso "Hands on Industrial Internet of things:create a powerful industrial IoT infrastructure using Industry 4.0, 1st edition, Packet Publishing,Ltd,2018.


**REFERENCES:**


1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.


**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | | |
| 2 | 3 | | | | | | | | | | | | | |
| 3 | | | 3 | | | | | | | | | | 3 | |
| 4 | | | | | 3 | | | | | | | | | 3 |
| 5 | | | | | | | | | 1 | | 1 | 1 | | |
| **CO (W.A)** | **3** | | **3** | | **3** | | | | **1** | | **1** | **1** | **3** | **3** |

| 22ITP08 CLOUD COMPUTING LABORATORY | | | | |
|---|---|---|---|---|
| | L | T | P | C |
| | 3 | 0 | 0 | 3 |
| **PRE-REQUISITE: NIL** | | | | |

| **Course Objective:** | To experiment with various virtualization tools such as Virtual Box and VMware workstation |
|---|---|

| | **Course Outcomes** The Student will be able to | **Cognitive Level** |
|---|---|---|
| CO1 | Apply large data sets in a parallel environment. | Ap |
| CO2 | Configure various virtualization tools such as Virtual Box, VMware workstation. | An |
| CO3 | Design and deploy a web application in a PaaS environment. | C |
| CO4 | Install and use a generic cloud environment that can be used as a private cloud. | An |
| CO5 | Aware of recent technological advancements in cloud computing through self learning. | An |

**LIST OF EXPERIMENTS :**

1. 1Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applicationsusing python/java.
4. Use GAE launcher to launch the webapplications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not presentingCloudSim.
6. Find a procedure to tansfer the files from one virtual machine to another virtualmachine
7. Find a procedure to launch virtual machine using trystack (Online Openstack DemoVersion)
8. Install Hadoop single node cluster and run simple applications likewordcount

| HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS: |
|---|
| **Hardware:**<br>LAN System with 30 nodes (OR) Standalone PCs – 30 Nos,.<br>**Software:**<br>Open stack , Hadoop SOFTWAREEucalyptus or Open Nebula orequivalent |
| **TOTAL (P:60) = 60 PERIODS** |

| Mapping of COs with POs / PSOs | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **POs** | | | | | | | | | | | | **PSOs** | |
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** |
| **1** | 3 | | | | | | | | | | | | 3 | 3 |
| **2** | 3 | 3 | | | 3 | | | | | | | | 3 | |
| **3** | | 3 | 3 | | | | | | | | 2 | | | 3 |
| **4** | | | | 3 | | | | | | | | | 3 | |
| **5** | | | | | | | | | | | | 3 | | 3 |
| **CO (W.A)** | **3** | **3** | **3** | **3** | **3** | | | | | | **3** | **3** | **3** | **3** |

## 22ITP09- INTERNET OF THINGS AND ITS APPLICATIONS LABORATORY

*(Common to 22CSP11 and 22CIP04)*

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

**PRE-REQUISITE: NIL**

| | |
|---|---|
| **Course Objective:** | To equip students with comprehensive knowledge and hands on experience in designing and developing IoT systems and applications. |

| | **Course Outcomes**<br>The student will be able to | **Cognitive Level** |
|---|---|---|
| CO1 | Apply the knowledge of controlling sensors using arduino. | Ap |
| CO2 | Analyze the given Aduino program to build practical IoT solutions. | An |
| CO3 | Apply Arduino programming techniques to use various sesnors and actuators. | Ap |
| CO4 | Design IoT based system for given application and specifications. | An |
| CO5 | Implement a mini-project to demonstrate the given problem using suitable sensors with Arduino development board. | C |

**LIST OF EXPERIMENTS**

1. Implement a program to Blink LED using Arduino.
2. Implement a program to control intensity light using Arduino.
3. Implement a program for LCD Display using Arduino.
4. Implement a program for Buzzer Indication using Arduino.
5. Implement a program for LDR using Arduino.
6. Implement a program for LM35 Sensor using Arduino.
7. Implement a program for Key Input with LED using Arduino.
8. Implement a program for Servo Motor Control using Arduino.
9. Implement a program for blinking LED using NODEMCU with Blynk.
10. Implement a program for Sensor value logging in Cloud

**HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 33 STUDENTS:**

**Hardware:**

WiFi UNIT or ESP 8266 UNIT 33, Connecting cable or USB cable 33, Ultrasonic sensor 33, Jumper wires 33,Vibration sensor 33, Touch Sensor 33, Temperature and humidity sensor 33, Raspberry pi 33, HDMI 33,Micro USB power input 33, Breadboard 33, Resistor (47K/1W) 33, LED 33,
Arduino Uno 33, 16 x 2 LCD display 33, ACS712 Voltage sensor 33, 9/12V Battery 33, Center tapped transformer (230/6-0-6V) 33 , Diode (IN4007) 33, Opto-coupler 33

**Software:**

OS – Windows / UNIX Clone 33
Computer with Arduino IDE software 33

**TOTAL (P:60) : 60 PERIODS**

| Mapping of COs with POs / PSOs | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **POs** | | | | | | | | | | | | **PSOs** | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | | | 2 | 2 | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | 2 |
| 4 | | | | | 3 | | | | | | | | | 2 |
| 5 | | 2 | | | 3 | | | | 1 | | | | 3 | |
| **CO (W.A)** | **3** | **2** | **2** | **2** | **3** | | | | **1** | | | | **3** | **2** |

## 22ITC17 - FULL STACK DEVELOPMENT

*Common to 22AIC15,22CIC15 and 22CSC15)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE-REQUISITE: 22ITC13**

| | |
|---|---|
| **Course Objective:** | To provide students with a solid foundation in the front-end and back-end web development fundamentals, integrate with databases and external services, and apply best practices in web development |

| **Course Outcomes** The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply fundamental concepts of MERN stack for Web application development. | Ap | 20% |
| CO2 | Analyze and develop web applications using bootstrap, node and Express JS focused on social and environmental issues | An | 40% |
| CO3 | Integrate front-end and back-end components effectively with databases and external services. | An | 20% |
| CO4 | Implement Full stack application through React framework. | An | 20% |
| CO5 | Demonstrate teamwork and problem-solving skills in project development. | C | Internal Assessment |

| **UNIT I - BASICS OF MERN STACK** | (9) |
|---|---|
| MERN Introduction-MERN Components - Need for MERN - Server-Less Hello World - Server Setup - nvm - Node.js npm. | |
| **UNIT II – BOOTSTRAP AND NODE JS BASICS** | (9) |
| Introduction to Bootstrap - Bootstrap Basics - Bootstrap Grids - Bootstrap Themes - Bootstrap CSS - Bootstrap JS.<br>Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Node.js File system - Node Inspector - Node.js Event Emitter. | |
| **UNIT III - NODE JS EXPRESS** | (9) |
| Node.js Data Access - Express REST APIs - REST - Resource Based - HTTP Methods as Actions - JSON-Express - Routing - Handler Function – Middleware-Rest API. | |
| **UNIT IV - MONGODB** | (9) |
| MongoDB - MongoDB Basics - Documents -Collections - Query Language - Installation - The Mongo Shell - Schema Initialization - MongoDB Node.js Driver - Reading from MongoDB - Writing to MongoDB. | |

| UNIT V - REACT | (9) |
|---|---|
| React Introduction – State - Lifecycle methods - Hooks – useState, useEffect, useContext - Event handling - Forms – controlled components, submission, validation. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**


3. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, A Press Publisher, 2019.
4. Bradshaw, S., Brazil, E., & Chodorow, K. (2019). MongoDB: the definitive guide: powerful and scalable data storage. O'Reilly Media.
5. Mardan, A. (2014). Express. js Guide: The Comprehensive Book on Express. js. Azat Mardan.
6. Kogent Learning Solutions Inc. "HTML5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQUERY", Wiley India Pvt. Limited, 2011.
7. Deitel and Deitel and Nieto, "Internet and World Wide Web – How to Program", Prentice Hall, 5th Edition, 2011.
8. Zammetti, F. (2020). Modern Full-Stack Development: Using TypeScript, React, Node. js, Webpack, and Docker. Apress.


**REFERENCES:**


1. Silvio Moreto, Matt Lambert, Benjamin Jakobus, Jason Marah, "Bootstrap 4–Responsive Web Design" Packt Publishing (6 July 2017)
2. Thomas Powell, "Web Design: The Complete Reference" ,Osborne / McGraw-Hill
3. https://www.w3schools.com/


**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | 3 | | | | | | | | 3 | |
| 2 | | 3 | 3 | | 3 | 3 | 3 | | | | | | 3 | |
| 3 | | | 3 | | 3 | | | | | | | | | 3 |
| 4 | | | | 3 | 3 | | | | | | | | 3 | |
| 5 | | | | | 3 | | | 3 | 3 | 3 | 3 | | | 3 |
| CO (W.A) | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | 3 | 3 |

## 22ITC18 - MOBILE APPLICATION DEVELOPMENT

*(Common to 22CSC18)*

| | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**PRE-REQUISITE : NIL**

| | |
|---|---|
| **Course Objective:** | To design and develop mobile apps, integrate services like APIs and databases, to ensure usability and security and to prepare apps for deployment on app stores, focusing on practical skills and industry standards. |

| **Course Outcomes** The student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Analyze and identify the computing requirements appropriate to a real world problem | An | 20% |
| CO2 | Design an Android application using layout, UI components | Ap | 20% |
| CO3 | Portray and implement the ethical responsibilities in mobile application development using modern tools | Ap | 20% |
| CO4 | Develop a fully functional native mobile app by applying industry's best practices | Ap | 20% |
| CO5 | Present their projects and compile thorough reports, demonstrating teamwork and reflective learning. | C | Internal assessment |

| | |
|---|---|
| **UNIT I – MOBILE PLATFORM AND APPLICATIONS** | **(9)** |
| Mobile Device Operating Systems - Special Constraints & Requirements - Commercial Mobile Operating Systems - Software Development Kit: iOS, Android, BlackBerry, Windows Phone - MCommerce - Structure - Pros & Cons - Mobile Payment System - Security Issues. | |
| **UNIT II - INTRODUCTION TO ANDROID** | **(9)** |
| Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file. | |
| **UNIT III - ANDROID APPLICATION DESIGN ESSENTIALS** | **(9)** |
| Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions. - Activity Lifecycle - Navigation | |
| **UNIT IV - ANDROID USER INTERFACE DESIGN & MULTIMEDIA** | **(9)** |
| User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures. | |
| **UNIT V - ANDROID APIs** | **(9)** |
| Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World – Error Handling – Case studies | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOKS:**

1. Prasanth Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd, New Delhi-2012 (UNIT – 1)
2. Lauren Darcey and Shane Conder, "Android Wireless Application Development", 2nd edition, Pearson Education, 2011 (UNIT 2 – 5)

**REFERENCES:**


1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd, 2010.
2. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.
3. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O"Reilly SPD Publishers, 2015.


**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | | 3 | | | | | | | | | | | 2 | |
| 2 | 3 | | | | | | | | | | | | | |
| 3 | 3 | | | | 2 | | | 2 | | | | | 2 | |
| 4 | 3 | | | | 2 | | | | | | | | 2 | 3 |
| 5 | | 2 | | | | | | 3 | 2 | 2 | | | 2 | 3 |
| **CO (W.A)** | **3** | **2.5** | | | **2** | | | **2.5** | **2** | **2** | | | **2** | **3** |

## 22ITP10 - FULL STACK DEVELOPMENT LABORATORY

*(Common to 22CSP09)*

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

**PRE-REQUISITE : NIL**

| | |
|---|---|
| **Course Objective:** | To develop full stack applications with clear understanding of user interface, business logic and data storage. |

| Course Outcomes<br>The Student will be able to | | Cognitive Level |
|---|---|---|
| CO1 | Install and develop programs using React JS. | Ap |
| CO2 | Make use of multiple node js modules to implement the application. | An |
| CO3 | Develop responsive and dynamic web pages | C |
| CO4 | Develop responsive and mobile supported applications | C |
| CO5 | Perform database operations using MongoDB and aware of recent technologies in Full Stack through self-learning. | An |

**LIST OF EXPERIMENTS :**

1. Build a Basic React APP that display custom message from users
2. Create a Login form using React JS
3. Write a program to upload Single/Multiple images to cloudinary using Node JS
4. Write a program to create router using Node.js with Express
5. Design a program to create Single Responsive Page using Bootstrap
6. Implement Create and Read Operations in MongoDB.
7. Implement Update and Delete Operations in MongoDB.

**TOTAL (P:60) = 60 PERIODS**

| Mapping of COs with POs / PSOs | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **POs** | | | | | | | | | | | | **PSOs** | |
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** |
| **1** | 3 | | | | | | | | | | | | 3 | |
| **2** | | 3 | | | 3 | | | | | | | | 3 | |
| **3** | | 3 | 3 | | | | | | | | | | | 3 |
| **4** | | | | 3 | 3 | | | | | | | | 3 | |
| **5** | | | | | 3 | | | | 2 | | | 3 | | |
| **CO (W.A)** | **3** | **3** | **3** | **3** | **3** | | | | **2** | | | **3** | **3** | **3** |

## 22ITP11- MOBILE APPLICATION DEVELOPMENT LABORATORY

*(Common to 22CSP12)*

| | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 4 | 2 |

**PRE-REQUISITE : NIL**

| | |
|---|---|
| **Course Objective:** | To provide hands-on experience in designing, developing, testing, and deploying mobile apps. |

| **Course Outcomes** The student will be able to | | **Cognitive Level** |
|---|---|---|
| CO1 | Analyze and identify the computing requirements appropriate to a real world problem | An |
| CO2 | Design an Android application using layout, UI components using event listeners | C |
| CO3 | Develop Android application with data storage | C |
| CO4 | Develop a native mobile app | C |
| CO5 | Utilize RSS feeds and integrate into web applications | Ap |

**LIST OF EXPERIMENTS :**

1. Develop an application that uses GUI components, Font and Colors.
2. Develop an application that uses Layout Managers.
3. Develop an application that uses event listeners.
4. Develop an application that uses adapters, Toast.
5. Develop an application that makes use of databases.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading.
8. Develop a native application that uses Camera and writes the image to the storage.
9. Develop a basic SMS receiver application.
10. Implement an application that creates an alert upon receiving a message.

**HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 33 STUDENTS:**

Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development, Tools with appropriate emulators and debuggers - 33 Nos.

**TOTAL (P:60) : 60 PERIODS**

| Mapping of COs with POs / PSOs | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **POs** | | | | | | | | | | | | **PSOs** | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | | 3 | | | | | | | | | | | | 2 |
| 2 | | | 3 | | | | | | | | | | | 2 |
| 3 | | | 3 | | 3 | 3 | | 3 | | | | | 2 | 2 |
| 4 | | | 3 | | | | | | 3 | | | | 2 | 3 |
| 5 | 3 | | | | | | | | | 3 | 3 | 3 | 2 | 3 |
| **CO (W.A)** | **3** | **3** | **3** | | **3** | **3** | | **3** | **3** | **3** | **3** | **3** | **2** | **2.4** |

| 22GED02 – INTERNSHIP / INDUSTRIAL TRAINING | | | | |
|---|---|---|---|---|
| | L | T | P | C |
| | 0 | 0 | 0 | 2 |
| **PRE-REQUISITE : NIL** | | | | |
| **Course Objective:** | • To obtain a broad understanding of the emerging technologies in Industry<br>• To gain knowledge about I/O models. | | | |

| **Course Outcomes** The Student will be able to | | **Cognitive Level** |
|---|---|---|
| CO1 | Engage in Industrial activity which is a community service. | U |
| CO2 | Prepare the project report, three minute video and the poster of the work. | Ap |
| CO3 | Identify and specify an engineering project/product that can make their life comfortable. | An |
| CO4 | Prepare a business plan for a commercial venture of the proposed project/product together with complying to relevant norms. | Ap |
| CO5 | Identify the community that shall benefit from the project /product. | E |

During semester breaks, students are encouraged to engage in industrial training or undergo internship in an industry related to the field of study. The duration of the activity shall be of 4 to 6 weeks. The work carried out in the semester break is assessed through an oral seminar accompanied by a written report. It is expected that this association will motivate the student to develop simple project/product to make their life comfortable and convert new ideas into project/product .

Every student is required to complete 4 to 6 weeks of internship (with about 40 hours per week), during the Summer/Winter semester breaks. The Internships are evaluated through Internship Reports and Seminars during the VI and VIII semesters. The internships can be taken up in an industry, a government organization, a research organization or an academic institution, either in the country or outside the country, that include activities like:

- Successful completion of Internships/ Value Added Programs/Training
- Programs/ workshops organized by academic Institutions and Industries
- Soft skill training by the Placement Cell of the college
- Active association with incubation/ innovation /entrepreneurship cell of the institute;
- Participation in Inter-Institute innovation related competitions like Hackathons
- Working for consultancy/ research project within the institutes
- Participation in activities of Institute's Innovation Council, IPR cell, Leadership
- Talks, Idea/ Design/ Innovation contests
- Internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises
- Development of a new product/ business plan/ registration of a start-up

| Mapping of COs with POs / PSOs | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **POs** | | | | | | | | | | | | **PSOs** | |
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** |
| **1** | | | | | | 2 | | | | | | | | |
| **2** | | | | | | | | | | 3 | | | | |
| **3** | | 2 | | | | | | | | | | | | |
| **4** | | | | | | | 2 | 3 | | | 2 | | | |
| **5** | | | | | | 2 | | | 2 | | | | | 2 |
| **CO (W.A)** | | **2** | | | | **2** | **2** | **3** | **2** | **3** | **2** | | | **2** |

| 22ITD01- Project Work - I | | | | | |
|---|---|---|---|---|---|
| | | L | T | P | C |
| | | 0 | 0 | 20 | 10 |
| **PRE-REQUISITE :NIL** | | | | | |
| **Course Outcomes** The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** | | |
| CO1 | Engage in independent study to research literature in the identified area and consolidate the literature search to identify and formulate the engineering problem. | Ap | 20 % - First Review (Internal) | | |
| CO2 | Prepare the Gantt Chart for scheduling the project , engage in budget analysis, and designate responsibility for every member in the team and identify the community that shall benefit through the solution to the identified research work and also demonstrate concern for environment | Ap, E | 20 % - Second Review (Internal) | | |
| CO3 | Identify, apply the mathematical concepts, science concepts, and engineering concepts necessary to implement the identified engineering problem, select the engineering tools /components required to reproduce the identified project, design, implement, analyze and interpret results of the implemented project | Ap, An, C | 20% - Third Review (External) | | |
| CO4 | Engage in effective written communication through the project report, the one-page poster presentation, and preparation of the video about the project and the four page IEEE format of the work and effective oral communication through presentation of the project work and demonstration of the project. | E | 20 % - Final Review (External) | | |
| CO5 | Perform in the team, contribute to the team and mentor/lead the team, demonstrate compliance to the prescribed standards/ safety norms and abide by the norms of professional ethics and clearly specify the outcome of the project work (leading to start-up/ product/ research paper/ patent) | Ap, An | 20% - Final Review (External) | | |

| **DESCRIPTION** |
|---|
| Project work may be allotted to a single student or to a group of students not exceeding 3 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations |
| **TOTAL (P: 300) = 300 PERIODS** |

| Mapping of COs with POs / PSOs | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COs | POs | | | | | | | | | | | | PSOs | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | | 3 | | | | | | | | | | 3 | 3 | 3 |
| 2 | | | | | | 3 | 3 | | | | 3 | | 3 | 3 |
| 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 |
| 4 | | | | | | | | 3 | | 3 | | | 3 | 3 |
| 5 | | | | | | | | | 3 | | 3 | 3 | 3 | 3 |
| CO (W.A) | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

| 22ITX01 - DEEP LEARNING<br>*(Common to 22AIC13,22CSX01,22CIX13 )* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE : NIL** | | | | | |
| **Course Objective:** | To understand and apply deep learning techniques to support real-time applications. | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply the concepts of neural networks and deep learning. | Ap | 20% |
| CO2 | Categorize the types of auto encoders in frameworks. | An | 20% |
| CO3 | Demonstrate the hardware support and frameworks (Keras - PyTorch) in Boltzmann machines model. | Ap | 20% |
| CO4 | Apply the concepts of CNN and RNN. | An | 40% |
| CO5 | Build the Recurrent Neural Network to model the sequence data. | C | Internal Assessment |

| **UNIT I –NEURAL NETWORKS** | **(9)** |
|---|---|
| Introduction – Basic Architecture of Neural Networks – Training Neural Network with Backpropagation – Practical Issues in Neural Network Training - Power of Function Composition – Common Neural Architectures – Neural Architectures : Binary Classification Models – Multiclass Models.Introduction to Deep Learning | |
| **UNIT II –AUTOENCODER AND FRAMEWORKS** | **(9)** |
| Introduction to Autoencoder – Features of Autoencoder - Types of Auto Encoder: Vanilla Autoencoder – Multilayer Autoencoder – Stacked Autoencoder – Deep Autoencoder – Denoising Autoencoder - Convolutional Autoencoder – Regularization in Autoencoder – Open Source Frameworks: SciPy – TensorFlow – Keras - PyTorch | |
| **UNIT III – BOLTZMANN MACHINES AND HARDWARE SUPPORT** | **(9)** |
| Boltzmann Machine: Relation to Hopfield Networks. RBM Architecture: Energy Based Model – Gibbs Distribution – Gibbs Sampler – Contrastive Divergence – Example – Types of RBM – Hardware support for Deep Learning. | |
| **UNIT IV – CONVOLUTION NEURAL NETWORKS** | **(9)** |
| Convolution Network – Components of CNN Architecture - Rectified Linear Unit(ReLU )Layer-Exponential Linear Unit (ELU or SELU) - Unique Propertied of CNN - Architectures of CNN – Application of CNN – Case studies: Image Classification using CNN - Visual Speech Recognition using 3D-CNN | |

| UNIT V – RECURRENT NEURAL NETWORKS | (9) |
|---|---|
| RNN versus CNN – Feedforward Neural Network versus RNN. - Simple Recurrent Neural Network : training an RNN – Backpropagation Through time (BPTT) – RNN Topology – Challenges with Vanishing Gradients – Bidirectional and Stateful RNNs – Long Short term memory(LSTM) – LSTM Implementation – Gated Recurrent Unit (GRU) – Deep Recurrent Neural Network.- Case studies: Stock Market Prediction Using RNN – Next Word Prediction Using RNN-LSTM.- Tamil Handwritten Character Optical Recognition Using CRNN | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Aggarwal, Charu C, "Neural Networks and Deep learning", 2ndEdition, Springer Cham, 2023.
2. Lovelyn, S., Rose, L. Ashok kumar, D. KarthikaRenuka, Deep Learning using Python, Wiley India Pvt. Ltd., First Edition, 2019.


**REFERENCES:**


1. Ian Goodfellow, Yoshua Bengio, and Aaron Courvill, "Deep Learning", 1 st Edition, MIT Press, USA, 2018.
2. Josh Patterson and Adam Gibson,"Deep Learning–A Practitioner"s Approach",1st Edition,O"ReillySeries,August2017.


**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | | 3 | | | 3 | | | | | | | | | 3 |
| 3 | 3 | | 3 | | 3 | | | | | | | | | |
| 4 | 3 | | | | | | | | | | | | 3 | |
| 5 | | | | | 3 | | | | 3 | 3 | | | | |
| **CO (W.A)** | **3** | **3** | **3** | | **3** | | | | **3** | **3** | | | **3** | **3** |

## 22ITX02 - KNOWLEDGE ENGINEERING

***(Common to 22AIX01,22CSX02 and 22CCX21)***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE-REQUISITE : NIL**

| | |
|---|---|
| **Course Objective:** | To implement various techniques for knowledge acquisition and representation. |

| **Course Outcomes** The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply knowledge representation with production rules. | Ap | 20% |
| CO2 | Implement SLD derivations with horn clauses. | An | 20% |
| CO3 | Apply reasoning with inheritance network and default logic. | Ap | 20% |
| CO4 | Apply subjective probability with actions and planning. | Ap | 20% |
| CO5 | Perform object oriented representation using frames | Ap | 20% |

| | |
|---|---|
| **UNIT I – INTRODUCTION** | **(9)** |
| Knowledge Representation and Reasoning – Syntax, Semantics, Pragmatics, Explicit and Implicit Belief - Expressing Knowledge – Resolution: Propositional Case-Handling Variables and Quantifiers-Dealing with Computational Intractability | |
| **UNIT II – HORN CLAUSES** | **(9)** |
| Horn Clauses-SLD Resolution-g SLD Derivations-Procedural Control of Reasoning - Rules in Production Systems: Production Rules- Conflict Resolution- Applications and Advantages | |
| **UNIT III – OBJECT-ORIENTED REPRESENTATION** | **(9)** |
| Objects and Frames-Frame Formalism-Frames to Plan a Trip-Beyond the Basics-Structured Descriptions-A Description Language-Meaning and Entailment-Computing Entailments-Taxonomies and Classification | |
| **UNIT IV – INHERITANCE AND DEFAULTS** | **(9)** |
| Inheritance Networks-Strategies for Defeasible Inheritance-A Formal Account of Inheritance Networks-Defaults: Introduction-Closed-World Reasoning-Circumscription-Default Logic-Autoepistemic Logic | |
| **UNIT V – VAGUENESS, UNCERTAINTY AND DEGREES OF BELIEF** | **(9)** |
| Noncategorical Reasoning-Objective Probability-Subjective Probability-Vagueness-Diagnosis-Explanation-Actions-Planning- Tradeoff between Expressiveness and Tractability. | |
| **TOTAL (L:45) = 45 PERIODS** | |

| **TEXT BOOKS:** |
|---|
| 1. Ronald J. Brachman, Hector J. Levesque," Knowledge Representation and Reasoning", Morgan Kaufmann, 2004.<br>2. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, "Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning", Cambridge University Press, First Edition, 2016. |
| **REFERENCES:** |
| 1. John F. Sowa," Knowledge Representation: Logical, Philosophical, and Computational Foundations", Brooks/Cole, Thomson Learning, 2000<br>2. Ela Kumar," Knowledge Engineering", I K International Publisher House, 2018. |

| **Mapping of COs with POs / PSOs** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **POs** | | | | | | | | | | | | **PSOs** | |
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** |
| 1 | 3 | 3 | | | | | | | | | | | 3 | |
| 2 | | 3 | 3 | | | | | | | | | | | |
| 3 | 3 | | | | | | | | | | | | 3 | |
| 4 | 3 | | | | | | | | | | | | 3 | |
| 5 | 3 | | | | | | | | | | | | | |
| **CO (W.A)** | **3** | **3** | **3** | | | | | | | | | | **3** | |

| 22ITX03 - RECOMMENDER SYSTEMS<br>*(Common to 22AIX02,22CSX03,22CIX14)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE : NIL**

| **Course Objective:** | To learn the significance of machine learning algorithms for Recommender systems. |
|---|---|

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply the concepts and applications of recommender systems. | Ap | 20% |
| CO2 | Analyze various collaborative filtering models in content based recommendation. | An | 20% |
| CO3 | Conduct investigation about the issues in recommender system and experimental setup. | Ap | 20% |
| CO4 | Apply Recommendation system properties in IPVT. | Ap | 20% |
| CO5 | Implement the knowledge sources and recommendation types. | Ap | 20% |

| **UNIT I – INTRODUCTION** | **(9)** |
|---|---|
| Introduction - Recommender Systems Function - Data and Knowledge Sources - Recommendation Techniques - Application and Evaluation - Applications of recommendation systems - Issues with recommender system. | |
| **UNIT II – CONTENT-BASED RECOMMENDATION** | **(9)** |
| High level architecture of content-based systems - Advantages and drawbacks of content based filtering- Item Representation - Learning User Profiles and Filtering - Trends and Future Research - Neighborhood-based Recommendation - Components of Neighborhood Methods. | |
| **UNIT III – COLLABORATIVE FILTERING** | **(9)** |
| Preliminaries: Baseline predictors - The Netflix data - Implicit feedback - Matrix factorization models - Neighborhood models - Enriching neighborhood models - Between neighborhood and factorization - Constraint-based Recommenders. | |
| **UNIT IV – CONTEXT-AWARE RECOMMENDER SYSTEMS** | **(9)** |
| Context in Recommender Systems - Paradigms for Incorporating Context in Recommender Systems - Combining Multiple Approaches – Case Studies - Additional Issues in Context-Aware Recommender Systems- Evaluating Recommender Systems: Experimental Settings - Recommendation System Properties. | |

| UNIT V – IPVT, MATCHING RECOMMENDATION TECHNOLOGIES | (9) |
|---|---|
| IPTV Architecture - Recommender System Architecture- Recommender Algorithms- Recommender Services – System Evaluation - Knowledge Sources – Domain - Knowledge Sources - Mapping Domains to Technologies. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Francesco Ricci , Lior Rokach , Bracha Shapira , "Recommender Sytems Handbook", 1st ed, Springer (2011)
2. Charu C. Aggarwal, "Recommender Systems: The Textbook", First Ed., Springer, 2016.

**REFERENCES:**

1. Manouselis N., Drachsler H., Verbert K., Duval E., "Recommender Systems for Learning", Springer, 1st Edition, 2013.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich, "Recommender Systems: An Introduction", Cambridge University Press (2011), 1st ed.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | | 3 | | | | | | | | | | | | |
| 3 | 3 | | | 3 | | | | | | | | | | |
| 4 | 3 | | | | | | | | | | | | 3 | |
| 5 | 3 | 3 | | | | | | | | | | | | 3 |
| **CO (W.A)** | **3** | **3** | | **3** | | | | | | | | | **3** | **3** |

## 22ITX04 - SOFT COMPUTING

***(Common to 22AIX03,22CSX04 )***

| | L | T | P | C |
|---|---|---|---|---|
| | 3 | 0 | 0 | 3 |

**PRE-REQUISITE :**

| **Course Objective:** | To learn and understand soft computing concepts and Fuzzy inference systems. |
|---|---|

| **Course Outcomes** The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Make use of the soft computing concepts along with its architecture | Ap | 20% |
| CO2 | Apply the techniques of back propagation network along with its parameter tuning. | Ap | 20% |
| CO3 | Interpret the fuzzy logics to solve the neural network problems | Ap | 20% |
| CO4 | Utilize the genetic algorithm techniques to obtain the optimized solution | Ap | 20% |
| CO5 | Illustrate the working of hybrid soft computing and to solve real world problems | An | 20% |

| **UNIT I –INTRODUCTION** | **9** |
|---|---|
| Introduction to Soft computing-Soft Computing Constituents-From Conventional AI to Computational Intelligence- Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks - basic models - important technologies – applications. | |
| **UNIT II –NEURAL AND BACKPROPAGATION NETWORK** | **9** |
| Back propagation Neural Networks -single layer artificial neural network- Back propagation learning model for Multilayer perceptron-Back propagation learning- Neural Networks- Kohonen Neural Network - Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network -Applications-Effect of tuning parameters of Backpropagation neural network- Unsupervised Learning Neural Networks. | |
| **UNIT III-FUZZY LOGIC** | **9** |
| Fuzzy set theory- Introduction to Fuzzy Logic- Fuzzy Sets - Classical Relations and Fuzzy Relations-Fuzzyversus Crisp-crisp set: operations on Crisp sets-Properties of Crisp sets- partition and covering-membership function-basic fuzzy set operations-properties of fuzzy sets-Crisp relations: Cartesian product-other crisp relations. | |
| **UNIT IV – GENETIC ALGORITHMS** | **9** |
| History –Basic concepts-Creation of offspring-Working principle- Encoding-Fitness Function- Population initialization and selection methods - Evaluation function - Operators - Cross Over - Inversion and Deletion -Mutation Operator- Generational cycle-Bit-wise Operators -Convergence of Genetic Algorithm. | |

| UNIT V – HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS | 9 |
|---|---|
| Hybrid systems-Neural networks ,fuzzy logic and genetic algorithms hybrids-GA Based Weight Determination –Fuzzy backpropagation networks-Simplified fuzzy ARTMAP-Fuzzy associative memories-Soft computing tools-Fuzzy constrains-Fuzzy logic controller. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS**

1. S. Rajasekharan& G. A. VijayalakshmiPai, "Neural Networks, Fuzzy Systems and Evolutionary algorithms: synthesis and applications", 2nd Edition, Prentice Hall of India, New Delhi, 2018.
2. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
3. 2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2019.

**REFERENCE**

1. George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" Prentice Hall, 1997.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | 3 | 3 | | 3 | | | | | | | | 3 | |
| 2 | 3 | 3 | | | 3 | | | | | | | | | 3 |
| 3 | | | 3 | 3 | | | | | | | | | 3 | |
| 4 | | 3 | | 3 | | | | | | | | | 3 | |
| 5 | | | | 3 | 3 | | | | | | | | | 3 |
| **CO (W.A)** | **3** | **3** | **3** | | **3** | | | | | | | | **3** | **3** |

| 22ITX05 - COMPUTER VISION<br>*(Common to 22AIX05,22CSX05,22CIX16,22CCX23)* | | | | |
|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE :NIL** | | | | |
| **Course Objective:** | To impart knowledge and understanding about the application of algorithms and techniques used to interpret and analyze visual data from the world. | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Implement image processing techniques for feature extraction and enhancement in computer vision applications. | Ap | 30% |
| CO2 | Analyze object detection and recognition systems using various techniques. | An | 20% |
| CO3 | Make use of the optimization technique for image alignment and geometric transformations. | Ap | 30% |
| CO4 | Apply deep learning models to synthesize images for advanced photography techniques. | An | 20% |
| CO5 | Build an innovative solution for immersive rendering techniques in virtual reality. | C | Internal Assessment |

| **UNIT I –INTRODUCTION** | **9** |
|---|---|
| Introduction-Image Formation: Geometric primitives and transformations-Photometric image formation-The digital camera-Image processing: Point operators-Linear filtering -Fourier transforms -Geometric transformations. | |
| **UNIT II – RECOGNITION &FEATURE DETECTION AND MATCHING** | **9** |
| Instance Recognition-Image Classification-Object detection-Semantic segmentation-Points and patches-Edges and contours-Contour tracking-Lines and vanishing points-Segmentation. | |
| **UNIT III – IMAGE ALIGNMENT AND STITCHING & STRUCTURE FROM MOTION** | **9** |
| Pairwise alignment-Image stitching-Geometric Intrinsic calibration-pose estimation-Two-frame structure from motion-Multi-frame structure from motion-Simultaneous localization and mapping(SLAM):"Enhancing Autonomous Navigation: A Case Study on SLAM Implementation" | |
| **UNIT IV – COMPUTATIONAL PHOTOGRAPHY & DEPTH ESTIMATION** | **9** |
| Photometric calibration-High dynamic range imaging-Super-resolution:"Advancing Image Clarity: A Case Study on Super-Resolution Techniques"-denoising-blur removal-Image matting and compositing-Epipolar geometry-Sparse correspondence-Dense correspondence-Local methods-Global optimization-Multi-view stereo | |

| UNIT V – 3D RECONSTRUCTION & IMAGE-BASED RENDERING | 9 |
|---|---|
| Shape from X-3D Scanning-Surface representation-Point-based representation-Volumetric representation-GAN:Generative Adversarial Networks-Vision Transformation-Light fields and Lumigraphs:"Case study on Immersive Rendering in VR"-Video-based rendering:"Case study on Dynamic Scene Reconstruction Techniques". | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS**


1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. E. R. Davies,"Computer Vision: Principles, Algorithms, Applications, Learning",Cambridge University Press,recent edition,2022.


**REFERENCES**


1. Simon J.D. Prince,"Computer Vision: Models, Learning, and Inference" ,2nd edition, Cambridge University Press.2012.
2. David A. Forsyth and Jean Ponce,"Computer Vision: A Modern Approach" , published by Prentice Hall,recent edition 2022.


**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | | 3 | | | | | | | | | | | | |
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| 3 | | | 3 | | | | | | | | | | | |
| 4 | | | | 3 | | | | | | | | | | |
| 5 | | | | | | | 3 | 3 | 3 | | 3 | | | 3 |
| **CO (W.A)** | | **3** | **3** | **3** | **3** | | **3** | 3 | **3** | | **3** | | | **3** |

| 22ITX06 - ETHICS OF AI<br>*(Common to 22AIX06,22CSX06,22CIX17)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE : NIL** | | | | | |
| **Course Objective:** | To Learn about the Ethical initiatives in the field of artificial intelligence and reach AI standards and Regulations | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply about morality and ethics in AI | Ap | 20% |
| CO2 | Evaluate the knowledge of real time application ethics, issues and its challenges. | Ap | 20% |
| CO3 | Analysis the ethical harms and ethical initiatives in AI | An | 20% |
| CO4 | Apply AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems | Ap | 20% |
| CO5 | Apply the societal issues in AI with National and International Strategies on AI | Ap | 20% |

| **UNIT I –INTRODUCTION** | **9** |
|---|---|
| Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust. | |
| **UNIT II –ETHICAL INITIATIVES IN AI** | **9** |
| International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization. | |
| **UNIT III – AI STANDARDS AND REGULATION** | **9** |
| Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems | |
| **UNIT IV – ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS** | **9** |
| Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility Roboethics Taxonomy. | |
| **UNIT V – AI AND ETHICS- CHALLENGES AND OPPORTUNITIES** | **9** |
| Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI. Chat gpt basics, prompt engineering. | |
| **TOTAL= 45 PERIODS** | |

**TEXT BOOKS**


1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.


**REFERENCES**


1. Paula Boddington ,"Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms)" , November 2017
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020


**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | | | | | | | | 3 | | | | | | 3 |
| 2 | 2 | | | | | | 2 | 3 | | | | | | 3 |
| 3 | | | | | | | 2 | 3 | | | | | | 3 |
| 4 | 3 | | | | | 2 | | 3 | | | | | | 3 |
| 5 | | | | | | | | 3 | | | | | | 3 |
| **CO (W.A)** | **2.5** | | | | | **2** | **2** | **3** | | | | | | **3** |

| 22ITX07 - BUSINESS INTELLIGENCE<br>*(Common to 22AIX07,22CSX07,22CCX28)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE : NIL**

| **Course Objective:** | To understand the effect of Business Intelligence (BI) on an organization |
|---|---|

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Use of the knowledge of Business Intelligence in solving problems. | U | 20% |
| CO2 | Apply the concepts of Data visualization and Visual analytics. | Ap | 20% |
| CO3 | Able to apply data mining tools. | Ap | 20% |
| CO4 | Demonstrate the text analytics, text mining and sentiment analysis. | An | 20% |
| CO5 | Develop web mining. | C | 20% |

| **UNIT I –BUSINESS INTELLIGENCE – INTRODUCTION** | **9** |
|---|---|
| A Frame work for Business Intelligence (BI)- The Architecture of BI - Benefits of business intelligence- Business intelligence VS competitive intelligence and knowledge management. Data Warehousing- Characteristics of Data Warehousing- Data Marts- Data warehousing process- Data warehousing Architectures – Data Integration and the Extraction, Transformation and Load (ETL) Process OLAP Versus OLTP- Data warehousing implementation issues – Real time data warehousing. | |
| **UNIT II – BUSINESS REPORTING, VISUAL ANALYTICS AND BUSINESS PERFORMANCE MANAGEMENT** | **9** |
| Data and Information Visualization – Different types of Charts and Graphs- Emergence of Data visualization and Visual analytics - Performance Dashboard - Balance Score Cards – Dashboards Versus Scorecards - Six Sigma as a performance measurement system. | |
| **UNIT III – DATA MINING – SUPERVISED LEARNING, AND UNSUPERVISED LEARNING** | **9** |
| Data mining concepts and applications – Data mining process – Data mining methods – Classification techniques – Decision trees, Case studies. Cluster Analysis – Partition and Hierarchical methods, Association rule mining –Data mining software Tools - Case studies. | |

| UNIT IV – TEXT ANALYTICS, TEXT MINING AND SENTIMENT ANALYSIS | 9 |
|---|---|
| Text analytics and Text mining concepts and definition – Text Mining Applications - Text mining process – Text mining tools – Sentiment analysis overview – Sentiment analysis applications – Sentiment analysis process, Sentiment Analysis and Speech Analytics. | |
| **UNIT V – WEB MINING** | **9** |
| Web mining overview – Web content and Web structure mining – Search Engines - Search Engine Optimization – Web usage mining – Web analytics maturity model and web analytics tools – Social analytics and social network analysis- Social Media Definitions and Concepts- Social Media Analytics. | |
| **TOTAL = 45 PERIODS** | |

**TEXT BOOKS**

1. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence and Analytics", Pearson 10th edition, 2018

**REFERENCES**

1. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence, Analytics, and Data Science: A Managerial Perspective", 4th Edition, Pearson, 2017
2. David Loshin Morgan, Kaufman,"Business Intelligence: The Savvy Manager"s Guidell", Second Edition, 2012.

**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | 2 | | | | 3 | | | | | | | | 3 | |
| 3 | | | 2 | | 3 | | | | | | | | 3 | |
| 4 | | | 3 | | 2 | | | | | | | | 3 | |
| 5 | | | 3 | | 2 | | | | | | | | 3 | |
| **CO (W.A)** | **3** | | **3** | | **3** | | | | | | | | **3** | |

| 22ITX08 - ROBOTICS PROCESS AUTOMATION<br>*(Common to 22AIX08,22CSX08,22CIX18,22CCX38)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE : NIL**

| **Course Objective:** | To implement the fundamental concepts of AI in robotics and the major paradigms for achieving it. |
|---|---|

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Interpret features of an Industrial robot with end effectors | AP | 20% |
| CO2 | Identify the characteristics of Autonomy robot and use Hierarchical Paradigm for organizing intelligence in Robots. | AP | 20% |
| CO3 | Apply reactive paradigm for AI Robots | AP | 20% |
| CO4 | The students able to know the various potential areas of automation and material handling | U | 20% |
| CO5 | Design sensor and vision system for robots | An | 20% |

| **UNIT I – FUNDAMENTALS OF ROBOTICS** | **(9)** |
|---|---|
| Automation and Robotics, A brief history of Robotics, The robotics market and the future prospects, Robot anatomy, Robot drive systems, Precision of Movement, Robotic sensors, Robot programming and work cell control, Robot applications | |
| **UNIT II – ROBOT TECHNOLOGY** | **(9)** |
| Basic control systems concepts and models, Controllers, Control system analysis, Robot sensors and actuators, Velocity sensors, Actuators, Power transmissions systems, Modeling and control of a single joint robot, Robot motion analysis and control. | |
| **UNIT III –ROBOT END EFFECTORS AND SENSORS** | **(9)** |
| Types of end effectors, Mechanical grippers, other types of gripper, Tools as end effectors, The robot/end effectors interface, Considerations in gripper selection and design, Transducers and sensors, Sensors in robotics, Tactile sensors, Proximity and range sensors | |

| UNIT IV –MACHINE VISION AND ARTIFICIAL INTELLIGENCE | (9) |
|---|---|
| Introduction to machine vision, The sensing and digitizing functions in machine vision, Image processing analysis, Training the vision system, Robotic applications, Introduction to AI, Goals of AI research, AI techniques, AI and Robotics | |
| **UNIT V- ROBOT APPLICATIONS IN MANUFACTURING** | **(9)** |
| Material transfer and machine loading/unloading, Processing operations – spot welding, continuous arc welding, spray coating, other processing operations using robots, Assembly and Robotic assembly automation, Designing for robotic assembly, Inspection automation | |
| **TOTAL (L: 45) = 45 PERIODS** | |

**TEXT BOOK:**

1. M.P.Groover et al ,"Industrial robotic technology-programming and application" , Mc Grawhill 2008

**REFERENCES:**

1. Richared D.Klafter,Thomas Achmielewski and Mickael Negin," Robotic Engineering an Integrated approach"prentice hall India- newdelhi-2001
2. S.R. Deb, Dr Sankha Deb ,"Robotics technology and flexible automation" ,Tata McGraw-Hill Education ,2009
3. https://www.robots.com/applications

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | | | | | | | | | | | | | | |
| 2 | | 3 | | | | | | | | | | | | |
| 3 | 3 | | | | | 3 | | | | | | | | 3 |
| 4 | | | | | 3 | | | | | | 3 | | | |
| 5 | | | 3 | | | | | | 3 | | | | 3 | |
| CO (W.A) | 3 | 3 | 3 | | 3 | 3 | | | 3 | | 3 | | 3 | 3 |

| 22ITX11 - PATTERN RECOGNITION<br>*(Common to 22AIX11,22CSX11,22CIX21,22CCX24)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE :NIL** | | | | |
| **Course Objective:** | • To impart knowledge for solving real-world problems in fields such as computer vision, speech recognition, and bioinformatics.<br>• To enrich the proficiency of the students in evaluating and selecting appropriate pattern recognition models based on performance metrics and domain-specific requirements. | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply advanced probabilistic models and decision theory concepts to optimize inference. | Ap | 30% |
| CO2 | Apply supervised learning algorithms for solving problems. | An | 20% |
| CO3 | Interpret unsupervised learning techniques for clustering data. | Ap | 30% |
| CO4 | Apply graphical models and sequential data techniques to solve complex problems such as plant disease diagnosis. | Ap | 20% |
| CO5 | Evaluate proficiency in designing, training, and optimizing neural networks | E | Internal Assessment |

| **UNIT I – INTRODUCTION** | **(9)** |
|---|---|
| Probability Theory:Probability densities-Bayesian probabilities-The Gaussian distribution-Bayesian curve fitting-Model Selection-The Curse of Dimensionality-Decision Theory: Minimizing the misclassification rate-Minimizing the expected loss-The reject option-Inference and decision-Loss functions for regression-Information Theory. | |
| **UNIT II –PROBABILITY DISTRIBUTION AND LINEAR MODELS FOR REGRESSION** | **(9)** |
| Binary Variables-Multinomial Variables-The Gaussian Distribution-Linear Basis Function Models-Bayesian Linear Regression:Parameter distribution-Predictive distribution-Bayesian Model Comparison-The Evidence Approximation:Evaluation of the evidence function-Maximizing the evidence function-Effective number of parameters-Limitations of Fixed Basis Functions. | |
| **UNIT III –LINEAR MODELS FOR CLASSIFICATION** | **(9)** |
| Discriminant Functions-Probabilistic Generative Models-Probabilistic Discriminative Models:Logistic regression-Multiclass logistic regression-Probit regression-The Laplace Approximation-Bayesian Logistic Regression:Laplace approximation-Predictive distribution | |

| UNIT IV –NEURAL NETWORKS AND KERNEL METHODS | (9) |
|---|---|
| Feed-forward Network Functions-Network Training-Error Backpropagation-The Hessian Matrix-Regularization in Neural Networks-Mixture Density Networks-Bayesian Neural Networks-Constructing Kernels-Radial Basis Function Networks:Nadaraya-Watson model-Gaussian Processes | |
| **UNIT V –GRAPHICAL MODELS AND SEQUENTIAL DATA** | **(9)** |
| Bayesian Networks-Conditional Independence-Markov Random Fields-Inference in Graphical Models-Markov Models-Hidden Markov Models-Case study on Plant Disease Diagnosis in Random Forest - Conditional Mixture Models. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS**

1. Christopher M. Bishop "Pattern Recognition and Machine Learning", Springer, Second edition 2021.
2. David G.Stork,PeterE.Hart,and Richard O.Duda"PatternClassification",published by Wiley in recent edition in 2022.

**REFERENCES**

1. Sergios Theodoridis and Konstantinos Koutroumbas, "Machine Learning: A Bayesian and Optimization Perspective", Academic Press,2022.
2. David J.C. MacKay,"Information Theory, Inference, and Learning Algorithms" Cambridge University Press, 2003.
3. David Barber, "Bayesian Reasoning and Machine Learning",Cambridge University Press, 2012.
4. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "DeepLearning", MIT Press, 2016.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | | | | | 3 | | | | | | | | | |
| 2 | | 3 | | | | | | | | | | | 3 | |
| 3 | | | | 3 | | | | | | | | | 2 | |
| 4 | | | | | 3 | | | | | | | | | 2 |
| 5 | | | | | | | 2 | 3 | 3 | 2 | 2 | | | 3 |
| CO (W.A) | | 3 | | 3 | 3 | | 2 | 3 | 3 | 2 | 2 | | 2.5 | 2.5 |

## 22ITX12 - TEXT AND SPEECH ANALYTICS

***(Common to 22AIX12,22CSX12,22CIX22),***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE-REQUISITE : NIL**

| | |
|---|---|
| **Course Objective:** | • To understand natural language processing basics.<br>• To apply classification algorithms to text documents, question-answering and dialogue systems to develop a speech recognition system & speech synthesizer. |

| **Course Outcomes** The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Examine the foundations of natural language processing and speech analysis | An | 20% |
| CO2 | Apply classification algorithms to text documents | Ap | 20% |
| CO3 | Analysis question-answering and dialogue systems | Ap | 20% |
| CO4 | Apply deep learning models for building speech recognition and text-to-speech systems | Ap | 20% |
| CO5 | Evaluate coreference and coherence for text processing | Ap | 20% |

| **UNIT I –INTRODUCTION** | **(9)** |
|---|---|
| Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stopwords – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF mode | |
| **UNIT II –TEXT CLASSIFICATION** | **(9)** |
| Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Deep Learning models for text classification– Recurrent Neural Networks (RNN) – Transformers –Text summarization and Topic Models | |
| **UNIT III – QUESTION ANSWERING AND DIALOGUE SYSTEMS** | **(9)** |
| Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -– evaluating dialogue systems | |
| **UNIT IV – TEXT-TO-SPEECH SYNTHESIS** | **(9)** |
| Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility-Roboethics Taxonomy. | |

| UNIT V – AUTOMATIC SPEECH RECOGNITION | (9) |
|---|---|
| Named Entity Recognition (NER)-Coreference resolution-Text coherence and cohesion-Advanced sentiment analysis-Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems | |
| **TOTAL= 45 PERIODS** | |

**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, 2022.

**REFERENCES**


1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018.
2. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY


**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | | 3 | | | | | | | | | | | 3 | |
| 2 | 3 | | | | | | | | | | | | 3 | |
| 3 | | 3 | | | | | | | | | | | | 3 |
| 4 | 3 | | | | 3 | | | | | | | | 3 | |
| 5 | | 3 | | | 3 | | | | | | | | | 3 |
| CO (W.A) | 3 | 3 | | | 3 | | | | | | | | 3 | 3 |

| 22ITX13 - BIG DATA ANALYTICS<br>*(Common to 22AIC16,22CSX13,22CIX12,22CCX25)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE : NIL**

| | |
|---|---|
| **Course Objective:** | • Acquire a deep understanding of big data and NoSQL.<br>• Develop expertise in map reduce analytics using Hadoop and related tools<br>• Explore the Hadoop related tools for Big Data Analytics. |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Real-world datasets can be analyzed using various big data analytics tools and approaches. | An | 20% |
| CO2 | Analyze the effectiveness of numerous NoSQL databases under different loads. | An | 20% |
| CO3 | Analyze Hadoop's architecture, notably HDFS, and use this information to develop a distributed computing environment | An | 20% |
| CO4 | To address certain data processing issues, use customized mappers and reducers. | Ap | 20% |
| CO5 | Analyze data processing jobs and determine a suitable tool (Pig or Hive) based on the task criteria. | An | 20% |

| **UNIT I – UNDERSTANDING BIG DATA** | **(9)** |
|---|---|
| Introduction To Big Data – Sudden Hype Around Big Data Analytics - Classification Of Analytics – Top Challenges Facing Big Data –Importance Of Big Data Analytics - Challenges Posed By Big Data - Terminologies Used In Big Data Environments – Basically Available Soft State Eventual Consistency(BASE) – Few Top Analytics Tools | |
| **UNIT II – NOSQL DATA MANAGEMENT** | **(9)** |
| Introduction To Nosql – Types Of Nosql Database – Use Of Nosql In Industry – Nosql Vendors – SQL Vs Nosql – Newsql – Comparison Of SQL,Nosql And Newsql - Introduction To Cassandra - Features Of Cassandra – CQL Data Types – CQLSH – CRUD – Collections – Time To Live(TTL) – Alter Commands – Import And Export – Querying System Tables | |
| **UNIT III – BASICS OF HADOOP** | **(9)** |
| Hadoop – Features Of Hadoop - Versions Of Hadoop – Hadoop Distributions – Hadoop Vs SQL –Cloud Based Hadoop Solution - Hadoop Introduction – RDBMS Vs Hadoop - Hadoop Overview – Use Case Of Hadoop – Hadoop Distributions – Processing Data With Hadoop – Interacting With Hadoop Ecosystem | |
| **UNIT IV – MAP REDUCE APPLICATIONS** | **(9)** |
| Introduction To Map Reduce –The Configuration API – Setting Up The Development Environment – Writing A Unit Test With MRUnit – Running On A Cluster- – Map Reduce Workflows–How Map Reduce Works Anatomy Of Map Reduce Job Run – Failures – Shuffle And Sort – Task Execution– Map Reduce Types And Formats - Input And Output Format – Map Reduce Features | |

| UNIT V – HADOOP RELATED TOOLS | (9) |
|---|---|
| Pig – Installing And Running Pig – Comparison With Databases – Pig Latin – User Defined Functions – Data Processing Operators – Hive – HiveQL – Tables – Querying Data – User-Defined Functions –Data Analytics – Multimedia - Streaming of data - Case Study: Analyzing Social Media Data | |
| **TOTAL (L:45):45 PERIODS** | |

**TEXT BOOKS**

1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", 2nd Edition, Wiley, 2019. (Unit 1-4).
2. Tom White, "Hadoop: The Definitive Guide", O'Reilly Media, Inc., Fourth Edition, 2015. (Unit 5).

**REFERENCES**

1. EMC Education Services,"Data science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley and Sons, 2015.
2. Alan Gates, " Programming Pig Dataflow Scripting with Hadoop", O'Reilly Media, Inc, 2011.

**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | 3 | 3 | | 3 | | | | | | | | 3 | |
| 2 | 3 | 3 | | | 3 | | | | | | | | | 3 |
| 3 | | | 3 | 3 | | | | | | | | | 3 | |
| 4 | | 3 | | 3 | | | | | | | | | 3 | |
| 5 | | | | 3 | 3 | | | | | | | | | 3 |
| CO (W.A) | 3 | 3 | 3 | | 3 | | | | | | | | 3 | 3 |

## 22ITX14 - HEALTH CARE ANALYTICS

***(Common to 22Aix14,22CSX14,22CIX24,22CCX26)***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE-REQUISITE : NIL**

| | |
|---|---|
| **Course Objective:** | To impart knowledge on health care analytics using machine learning concepts. |

| **Course Outcomes** The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply machine learning and deep learning in health care analysis. | Ap | 40% |
| CO2 | Identify the appropriate selection of data using feature selection to train a model. | Ap | 20% |
| CO3 | Develop a database for clinical support and retrieving data using NoSQL database | An | 20% |
| CO4 | Visualize preprocessing data using smart sensors. | An | 20% |
| CO5 | Prepare a mini project to predict healthcare and data analysis. | C | Internal Assessment |

| **UNIT I – INTRODUCTION TO HEALTHCARE ANALYSIS** | **(9)** |
|---|---|
| Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, weighted sum approach. | |
| **UNIT II – ANALYTICS ON MACHINE LEARNING** | **(9)** |
| Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves – Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit – Learn : Preprocessing , Feature Selection. | |
| **UNIT III – HEALTH CARE MANAGEMENT** | **(9)** |
| IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare. | |
| **UNIT IV – HEALTHCARE AND DEEP LEARNING** | **(9)** |
| Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System. | |

| UNIT V – CASE STUDIES | (9) |
|---|---|
| Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.

**REFERENCES:**

1. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
2. Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition,Wiley, 2016.
3. Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.

**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | 3 | 3 | | | 3 | | | | | | | | | 3 |
| 3 | 3 | | 3 | | | | | | | | | | | |
| 4 | | 3 | 3 | | 3 | | | | | | | | 3 | |
| 5 | 3 | | | | 3 | | | | 3 | 3 | | | | |
| CO (W.A) | 3 | 3 | 3 | | 3 | | | | | 3 | | | 3 | 3 |

| 22ITX15 - PREDICTIVE ANALYTICS<br>*(Common to 22AIC15,22CSX15,22CIX25)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PREREQUISITE :** | | | | | |
| **Course Objective:** | Proficient in different predictive modeling approaches, such as regression analysis, classification, and clustering. | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Analyze the performance of predictive analytics using appropriate metrics and understand the implications of these metrics. | An | 20% |
| CO2 | Apply data preparation and rules in predictive analytics to interpret the results in meaningful ways. | Ap | 20% |
| CO3 | Analyze and interpret the outputs of predictive models to generate actionable insights | An | 20% |
| CO4 | Analyze different predictive models to determine the most suitable model for a given problem based on performance metrics | An | 20% |
| CO5 | Apply techniques to collect text data from various sources of text mining | Ap | 20% |

| **UNIT I –INTRODUCTION TO PREDICTIVE ANALYTICS** | **(9)** |
|---|---|
| Overview of Predictive Analytics-Setting Up the Problem-Data Understanding-Single Variable Summaries - Data Visualization in One Dimension, Two or Higher Dimensions-The Value of Statistical Significance-Pulling it all together into a Data Audit | |
| **UNIT II –DATA PREPARATION AND ASSOCIATION RULES** | **(9)** |
| Data Preparation-Variable Cleaning-Feature creation-Item sets and Association rules-Terminology-Parameter settings-How the data is organized-Measures of Interesting rules-Deploying Association rules-Problems with Association rules-Building Classification rules from Association rules | |
| **UNIT III – MODELING** | **(9)** |
| Descriptive Modeling-Data Preparation issues with Descriptive modeling-Model Selection-Principal Component analysis-Clustering algorithms-Interpreting Descriptive models-Standard cluster model interpretation | |
| **UNIT IV – PREDICTIVE MODELLING** | **(9)** |
| Decision Trees-Logistic Regression-Neural Network Model-K-Nearest Neighbors-Naive Bayes -Regression Models- Linear Regression-Building Neural Networks using XLMiner-Other Regression Algorithms | |

| UNIT V – TEXT MINING | (9) |
|---|---|
| Motivation for Text Mining-A Predictive modeling approach to Text Mining-Structured vs. Unstructured data-Why Text mining is hard-Data Preparation steps-Text mining features-Modeling with Text mining features-Regular Expressions - Web mining - Text Mining vs. Web Mining - Case studies:-Survey Analysis | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOKS**

1. Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", Wiley, 2014.(Unit 1-5)
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012

**REFERENCES**

1. Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st Edition, Que Publishing, 2012.
2. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014
3. Anasse Bari, Mohamed Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, Wiley, 2017.

**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | 3 | | | | | | | | | | | | |
| 2 | | 3 | 3 | | | | | | | | | | | 3 |
| 3 | | 3 | 3 | 3 | | | | | | | | | 3 | |
| 4 | | 3 | 3 | 3 | | | | | | | | | 3 | |
| 5 | 3 | | | | | | | | 3 | | | | | |
| CO (W.A) | 3 | 3 | 3 | | 3 | | | | | 3 | | | 3 | 3 |

| 22ITX16 - IMAGE AND VIDEO ANALYTICS<br>*(Common to 22AIX16,22CSX16,22CIX26,22CCX27)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE : Nil**

| **Course Objective:** | To provide a broad view on processing and analyzing images and videos. |
|---|---|

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply the image processing techniques for image and video analysis. | Ap | 20% |
| CO2 | Use image pre-processing techniques for object detection. | Ap | 20% |
| CO3 | Apply the various levels of segmentation and interpret the results for object detection. | Ap | 20% |
| CO4 | Apply recognition and machine learning techniques. | Ap | 20% |
| CO5 | Make use of video analysis for real time case studies. | An | 20% |

| **UNIT I - INTRODUCTION** | **(9)** |
|---|---|
| Computer Vision – Image representation and image analysis tasks - Image representations – Digitization- Digital image properties- color images- Linear integral transforms- Images as stochastic processes- Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures. | |
| **UNIT II - IMAGE PRE-PROCESSING** | **(9)** |
| Pixel brightness transformations – Geometric transformations-Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-spectral images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration. | |
| **UNIT III - OBJECT DETECTION USING MACHINE LEARNING** | **(9)** |
| Object detection– Object detection methods – Deep Learning framework for Object detection– Bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-Fast R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Single Shot MultiBox Detector(SSD)-Transfer Learning-Python Implementation. | |
| **UNIT IV - FACE RECOGNITION AND GESTURE RECOGNITION** | **(9)** |
| Face Recognition- Applications of Face Recognition-Process of Face Recognition-Deep Face solution by Face book- FaceNet for Face Recognition- Python Implementation using FaceNet-Python Solution for Gesture Recognition. | |

| UNIT V - VIDEO ANALYTICS | (9) |
|---|---|
| Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-ResNet architecture- ResNet and skip connections-Inception Network- GoogLENet architecture-Improvement in Inception v2-Video analytics-Python Solution using ResNet and Inception v3. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th edition, Thomson Learning, 2013. (UNIT-I and II)
2. Vaibhav Verdhan," Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras", Apress 2021(UNIT-III,IV and V)

**REFERENCES:**

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
4. E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press.

**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | 3 | | | | 3 | | | | | | | | 3 | |
| 3 | 3 | | | | | | | | | | | | 3 | |
| 4 | 3 | | | | | | | | | | | | | 3 |
| 5 | | 3 | 3 | | 3 | | | | | | | | | 3 |
| CO (W.A) | 3 | 3 | 3 | | 3 | | | | | | | | 3 | 3 |

| 22ITX17 - NATURAL LANGUAGE PROCESSING<br>*(Common to 22AIX17,22CSX17,22CIX27)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE :** | | | | |
| **Course Objective:** | To learn and understand syntactic and semantic elements of NLP and knowledge representation and interface. | | | |

| **Course Outcomes**<br>**The Students will be able to** | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Summarize the concepts in speech and language processing and utilize regular expressions and other statistical methods to create Language Models. | Ap | 20% |
| CO2 | Apply Vector Embedding to words and build Neural Language models. | Ap | 20% |
| CO3 | Solve sequence labeling problems (Named Entity Tagging and POS tagging) using RNN and LSTM. | An | 20% |
| CO4 | Apply the Machine translation model to dialogue systems. | Ap | 20% |
| CO5 | Illustrate the working of Automatic speech recognition and information retrieval. | Ap | 20% |

| **UNIT I –FUNDAMENTALS OF NATURAL LANGUAGE PROCESSING** | **(9)** |
|---|---|
| Regular Expressions, Text normalization, Edit Distance-.N-gram language models:N-grams-Evaluating language models: training and test sets-perplexity-Sampling sentences from a language model-Generalization and Zeros-Smoothing-Native bayes,text classification and sentiment-Logistic regression | |
| **UNIT II –VECTOR SEMANTICS AND NEURAL NETWORK MODELS** | **(9)** |
| Lexical Semantics – Vector Semantics – Words and Vectors – Cosine for measuring similarity – TF-IDF: weighing terms in vectors – pointwise Mutual Information (PMI) – Applications of TF-IDF and PPMI – Visualizing embeddings-Neural Network Language Models – Units – XOR problem – Feed Forward Neural Networks – Training Neural Nets – Neural Language Models. | |
| **UNIT III – SEQUENCE LABELING AND DEEP LEARNING ARCHITECTURES** | **(9)** |
| English word classes –Part-of-Speech (PoS) Tagging – Named Entities and Named Entities Tagging – HMM PoS – Conditional Random Fields – Evaluation of Named Entity Recognition-RNN and LSTMs-.Transformers and large language models-Fine tuning and masked language models. | |
| **UNIT IV – MACHINE TRANSLATION (MT) AND DIALOGUE SYSTEMS** | **(9)** |
| Language divergences and Typology – Machine translation using Encoder-Decoder model –Encoder-Decoder–Beam search-Translating in low resource situations- MT evaluation – Bias and ethical issues-properties of human conversations-Frame based dialogue systems-Dialogue acts and dialogue state. | |

| UNIT V –AUTOMATIC SPEECH RECOGNITION AND INFORMATION RETRIEVAL | (9) |
|---|---|
| The Automatic Speech Recognition Task -Feature Extraction for ASR: Log Mel Spectrum -Speech Recognition Architecture-CTC and TTS -Information Retrieval -Information Retrieval with Dense Vector-Evaluating Retrieval-based Question Answering-Context free grammars and constituency parsing-Dependency parsing-Information extractions-Semantic role labeling. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS**

1. Daniel Jurafsky and James H.Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition" (Prentice Hall Series in Artificial Intelligence), 2020
2. Christopher D. Manning and Hinrich Schuetze ,"Foundations of Statistical Natural Language Processing", MIT Press, 2018

**REFERENCES**

1. Jacob Eisenstein. "Natural Language Processing ", MIT Press, 2019
2. Samuel Burns "Natural Language Processing: A Quick Introduction to NLP with Python and NLTK", 2019

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | 3 | 3 | | | 3 | | | | | | | | | 3 |
| 3 | 3 | | 3 | | | | | | | | | | | |
| 4 | | 3 | 3 | | 3 | | | | | | | | 3 | 3 |
| 5 | 3 | | 3 | | 3 | | | | 3 | 3 | | | | |
| CO (W.A) | 3 | 3 | 3 | | 3 | | | | | 3 | | | 3 | 3 |

| 22ITX18 - AUGUMENTED REALITY AND VIRTUAL REALITY<br>*(Common to 22AIX18,22CSX18,22CIX28)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PREREQUISITE :NIL**

| **Course Objective:** | To impart the knowledge of Exploring the design, development, and applications of augmented reality and virtual reality technologies. |
|---|---|

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply principles of virtual reality and commercial VR technologies. | Ap | 30% |
| CO2 | Analyze the classic components of a VR system through hands-on experimentation and simulation. | An | 20% |
| CO3 | Make use of diverse modeling techniques with real-world sensor data. | Ap | 30% |
| CO4 | Evaluate the solution to enhance VR user experience and safety in diverse fields. | E | 20% |
| CO5 | Create VR applications by utilizing VR programming tools. | C | Internal Assessment |

| **UNIT I - INTRODUCTION** | **(9)** |
|---|---|
| The three I's of virtual reality, commercial VR technology and the five classic components of a VR system, Augmented Reality and Tele presence. | |
| **UNIT II -INPUT AND OUTPUT DEVICES** | **(9)** |
| 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 III –MODELING** | **(9)** |
| Geometric modelling, kinematics modelling, physical modelling, behaviour modelling, model management and Modelling real-life from sensors. | |
| **UNIT IV - HUMAN FACTORS** | **(9)** |
| Methodology and terminology, user performance studies, VR health and safety issues. Applications: Medical applications, military applications, robotics applications, Virtual product design (CAD display, process simulation, virtual prototyping) ,Enhancing Training and Skill Development in Healthcare Using AR and VR: A Case Study on Simulation-Based Learning | |

| UNIT V -VR PROGRAMMING | (9) |
|---|---|
| VR Programming-I: Introducing Unity 3D, Project panel, Scene hierarchy, Simple game object, Scene editor: A case study on Developing and Evaluation of a Simple Game Object and Scene Editor for Indie Game Developers VR Programming-II: Middle VR, device management, graphics card limitation, 3D user interactions, deployment, VR software: A case study on the Impact of Unreal Engine in Architectural Visualization: A Case Study of VR Integration in Real Estate Marketing. | |

**TOTAL (L: 45) = 45 PERIODS**

**TEXT BOOK:**

1. Gregory C. Burdea& Philippe Coiffet, "Virtual Reality Technology", John Wiley & Sons, Inc., Second Edition,2006

**REFERENCES:**


1. Grigore C. Burdea and Philippe Coiffet ,"Virtual Reality Technology",January 2022.
2. Harry F. Shneider ,"Virtual Reality Technology and Applications",FirstEdition,2018.
3. Philippe Fuchs, Pascal Guitton, and Guillaume Moreau ,"Virtual Reality: Concepts and Technologies", First Edition,2011.
4. Philippe Fuchs, Patrick Reignier, and Fabien Lotte ,"Human Factors in Augmented Reality Environments", First Edition,2020.
5. Jessica Plowman ,"Unreal Engine Virtual Reality Quick Start Guide: Design and Develop immersive virtual reality experiences with Unreal Engine 4", First Edition,2019


**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | | 3 |
| 2 | | 3 | | | | | | | | | | | 3 | |
| 3 | | | 3 | | 3 | | | | | | | | 3 | |
| 4 | | | 3 | | | | | | | | | | 3 | |
| 5 | | | | | 3 | | 3 | | 3 | 2 | | 3 | | 3 |
| CO (W.A) | 3 | 3 | 3 | | 3 | | 3 | | 3 | 2 | | 3 | 3 | 3 |

| 22ITX21 - FUNDAMENTALS OF CRYPTOGRAPHY AND NETWORK SECURITY<br>*(Common to 22CSX21)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE : 22ITC07** | | | | | |
| **Course Objective:** | To understand basics of Cryptography and Network Security and to learn about how to maintain the Confidentiality, Integrity and Availability of a Data. | | | | |
| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** | | |
| CO1 | Interpret the basic principles of cryptography and general cryptanalysis | Ap | 20% | | |
| CO2 | Classify the encryption techniques and identify the use of public key encryption, digital signatures, and key establishment. | An | 20% | | |
| CO3 | Design a model for achieving Data Integrity using key management techniques and authentication. | Ap | 20% | | |
| CO4 | Describe how trust can be demonstrated in the underlying protocols of modern systems and evaluate the security techniques | An | 40% | | |
| CO5 | Apply security practices for real time applications. | Ap | Internal Assessment | | |

| **UNIT I - INTRODUCTION TO CRYPTOGRAPHY** | (9) |
|---|---|
| Introduction to Cryptography, Security Threats, Vulnerability, Services, Mechanisms and attacks – the OSI security architecture – Network Security model- Conventional Encryption Model- CIA model - Classical Cryptography: Dimensions of Cryptography, - Classical Encryption techniques (Symmetric cipher, Substitution techniques, transposition techniques, Stegnography). | |
| **UNIT II - SYMMETRIC AND ASYMMETRIC CIPHERS** | (9) |
| Block Ciphers (DES, AES): Feistal Cipher Structure, Simplifies DES, DES, Double and Triple DES, Block Cipher design Principles, AES, Modes of Operations- Public-Key Cryptography: Principles of Public-Key Cryptography, RSA Algorithm, Key Management, Diffie- Hellman Key Exchange. | |
| **UNIT III – CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS** | (9) |
| Hash and MAC Algorithms: Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security of Hash Functions And Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures | |
| **UNIT IV - MUTUAL TRUST AND USER AUTHENTICATION** | (9) |
| Key Management and Key Distribution: Symmetric Key distribution using symmetric and asymmetric encryption – Distribution of Public keys – x.509 certificate – Public key Infrastructure – remote user authentication Principles – remote user authentication using Symmetric and Asymmetric encryption- Kerberos – Federated Identity Management – Personal Identity Verification. | |

| UNIT V - SECURITY IN NETWORKS | (9) |
|---|---|
| IP Security and Key Management-Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management. Web and System Security-Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. William Stallings, "Cryptography and Network Security",7th Edition ,Pearson Education, New Delhi, 2017.

**REFERENCES:**

1. Behrouz A. Ferouzan , Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw-Hill Education, India, 2015.
2. Charles P. Fleeger, "Security in Computing" ,5th Edition, Prentice Hall of India, New Delhi 2015.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | | 3 | | | | | | | | | | | 3 | |
| 3 | | | 3 | | 3 | | | | | | | | | 3 |
| 4 | | | | 3 | | | | | | | | | 3 | |
| 5 | | | | | | 3 | | | | | | 3 | | 3 |
| CO (W.A) | 3 | 3 | 3 | | | | 3 | | | | | | 3 | 3 |

## 22ITX22 – ETHICAL HACKING

***(Common to 22CSX22,22CIX32,22CCC14)***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE-REQUISITE :NIL**

| | |
|---|---|
| **Course Objectives :** | • To provide a comprehensive understanding of computer-based vulnerabilities, including various kinds of malware and attacks, and to explore tools and techniques for foot printing, social engineering, port scanning, and ping sweeping.<br>• The course aims to equip students with practical skills in ethical hacking to identify and expose system vulnerabilities. |

| **Course Outcomes** The student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Analyze and gain knowledge on the basics of computer- based vulnerabilities | Ap | 20% |
| CO2 | Demonstrate and analyze the network and vulnerability attacks in system. | An | 20% |
| CO3 | Investigation about foot printing, reconnaissance and scanning methods using tools | Ap | 20% |
| CO4 | Analyze the basics of scanning methodologies and exploitation techniques using modern tools | An | 20% |
| CO5 | Perform in a team to identify the options for network protection and firewall protection in ethical hacking. | Ap | 20% |

| **UNIT I - INTRODUCTION** | **(9)** |
|---|---|
| Ethical Hacking Overview - Role of Security and Penetration Testers - Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer- The Internet Layer - IP Address | |
| **UNIT II - NETWORK AND COMPUTER ATTACKS** | **(9)** |
| Network and Computer Attacks - Malware - Protecting Against Malware Attacks. - Intruder Attacks -Denial-of-Service Attacks- Distributed Denial-of-Service Attacks-- Buffer Overflow Attacks- Ping of Death Attacks - Session Hijacking-Addressing Physical Security- Key loggers | |
| **UNIT III - FOOT PRINTING AND SOCIAL ENGINEERING** | **(9)** |
| Web tools for Foot printing , Competitive Intelligence - Analyzing a Company's Web Site-Using Other Foot printing Tools-Using E-mail Addresses-Using HTTP Basics-Other Methods of Gathering Information-Using Domain Name System Zone Transfers .-Introduction to Social Engineering-The Art of Shoulder Surfing-The Art of Dumpster Diving-The Art of Piggybacking-Phishing | |

| UNIT IV - PORT SCANNING | (9) |
|---|---|
| Introduction to Port Scanning- Types of Port Scans - Port-Scanning Tools – N map- Unicorns can — Nessus and Open VAS-Ping Sweeps - Fping - Hoping-Crafting IP Packets | |
| **UNIT V - DESKTOP AND SERVER OS VULNERABILITIES** | **(9)** |
| Windows OS Vulnerabilities-Windows File Systems-Remote Procedure Call—NetBIOS-Server Message Block-Common Internet File System-Null Sessions-Web Services-SQL Server-Buffer Overflows-Passwords and Authentication-Tools for Identifying Vulnerabilities in Windows-Best Practices for Hardening Windows Systems | |
| **TOTAL (L:45) :45 PERIODS** | |

**TEXT BOOKS:**

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.

**REFERENCES:**

1. Dr. John Smith, Dr. Emily Johnson, Dr. Mohammad Khan, A Survey of Ethical Hacking Techniques and Tools for Penetration Testing,2020
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| **1** | 3 | 3 | | | | | | | | | | | 3 | 3 |
| **2** | | 3 | | 3 | | | | | | | | | 3 | 3 |
| **3** | | | | 3 | 3 | | | | | | | | 3 | 3 |
| **4** | | 3 | | | 3 | | | | | | | | 3 | 3 |
| **5** | | 2 | | | | | | 3 | 3 | | | | 3 | 3 |
| **CO (W.A)** | **3** | **2.2** | | **3** | **3** | | | **3** | **3** | | | | **3** | **3** |

| 22ITX23 – CLOUD SECURITY<br>*(Common to 22AIX23,22CSX23,22CCX04)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE :NIL**

| | |
|---|---|
| **Course Objectives :** | • To introduce the fundamental concepts and architecture of cloud computing.<br>• To understand and address security concerns, risks, and legal aspects.<br>• To explore data security strategies and best practices for securing data in the cloud<br>• To evaluate security criteria for building and managing private clouds and selecting external cloud service providers.<br>• To assess and evaluate cloud security through comprehensive frameworks |

| **Course Outcomes**<br>The student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| **CO1** | Analyze various the concepts of cloud computing, policy and compliance in cloud environment. | An | 20% |
| **CO2** | Develop and implement secure cloud architectures, security patterns, and strategies for secure cloud operations. | Ap | 20% |
| **CO3** | Apply key strategies and best practices for managing cloud data security risks and monitoring security controls | Ap | 20% |
| **CO4** | Apply the fundamental concepts in infrastructure security facilities in cloud computing. | Ap | 20% |
| **CO5** | Implement security operations activities and architectures for efficient and secure cloud management | Ap | 20% |

| **UNIT I - INTRODUCTION** | **(9)** |
|---|---|
| Introduction to Cloud computing and security: Understanding cloud computing – The IT foundation for Cloud. An historical view: Roots of Cloud computing – A brief primer on architecture. Security architecture: Cloud computing architecture – Cloud reference architecture – Control over security in the cloud model – Making sense of cloud deployment – Making sense of services models – Real- world cloud usage scenarios. | |
| **UNIT II - SECURING THE CLOUD** | **(9)** |
| Security concerns – Risk issues and legal aspects – Security concerns –Assessing risk tolerance in Cloud Computing–Legal and regulatory issues–Securing the Cloud: Architecture–Security patterns and architectural element – Cloud security architecture –Planning key strategies for secure operation. | |
| **UNIT III - CLOUD DATA SECURITY** | **(9)** |
| Securing the cloud: Data security – Overview of data security in Cloud Computing. Data encryption: Applications and limits – Cloud data security – Sensitive data categorization – Cloud data storage – Cloud lock-in (the Roach Motel Syndrome). Securing the cloud: Key strategies and Best practices–Overall strategy–Effectively managing risk –Overview of security controls –The limits of security controls – Best practices – Security monitoring. | |

| UNIT IV - SECURITY CRITERIA | (9) |
|---|---|
| Security criteria: Building an internal cloud – Private clouds – Motivation and overview – Security criteria for ensuring a private cloud – Security criteria – Selecting an external cloud provider – Selecting a CSP – Overview of assurance – Selecting a CSP – Overview of risks – Selecting a CSP | |
| **UNIT V – EVALUATING CLOUD SECURITY** | **(9)** |
| Security criteria – Evaluating cloud security – An information security framework – Evaluating cloud security – Checklists for evaluating cloud security – Metrics for the checklists – Operating a cloud – Architecture to efficient and secure operations – Security operations activities. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Raghuram Yeluri and EnriqueCastro-Leon, Building the Infrastructure for Cloud Security: A Solutions View, A press, First Edition,2014
2. Ronald L Krutz and Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley, First Edition,2010

**REFERENCES:**

1. Chris Dotson, Practical Cloud Security A Guide for Secure Design and Deployment, O'Reilly Media, First Edition,2019
2. Raymond Choo and Ryan Ko, The Cloud Security Ecosystem Technical, Legal, Business and Management Issues, Elsevier Science, First Edition,2015

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | | 3 | | | | | | | | | | | 3 | 3 |
| 2 | | | 3 | | | | | | | | | | 3 | 3 |
| 3 | 3 | | | 3 | | | 3 | | | | | | 3 | 3 |
| 4 | 3 | | | | | | | | | | | | 3 | 3 |
| 5 | | | | 3 | | 3 | | | | | | | 3 | 3 |
| CO (W.A) | 3 | 3 | 3 | 3 | | 3 | 3 | | | | | | 3 | 3 |

| 22ITX24 - INFORMATION SYSTEM SECURITY MANAGEMENT<br>*(Common to 22CSX24,22CCX16)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PREREQUISITE: Nil** | | | | | |
| **Course Objective:** | To focuses on the strategies and practices required to protect information systems and manage security effectively within an organization. | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply theoretical knowledge to practical problems, demonstrating the ability to develop and implement security solutions based on frameworks. | Ap | 20% |
| CO2 | Analyze and explore the information security controls | An | 20% |
| CO3 | Assess and evaluate the risk management practices of information security. | Ap | 20% |
| CO4 | Identify the disasters and recovering from them with appropriate decisions. | An | 20% |
| CO5 | Apply various recovery strategies, such as data backup and restoration, alternative site arrangements, and failover solutions, to ensure effective recovery. | Ap | 20% |

| **UNIT I - INFORMATION SECURITY PRINCIPLES AND FRAMEWORK** | **(9)** |
|---|---|
| Information Security- Assets and Types - Threat, Vulnerability, Risk and Impact - Information Security Policy Concepts - Need for Information Security. Organization and Responsibilities: Organizational Policy, Standards and Procedures - Information Security Governance - Information Assurance Programme Implementation - Security Incident Management - Legal Framework: Security Standards and Procedures. | |
| **UNIT II - SECURITY LIFE CYCLE AND CONTROLS** | **(9)** |
| Information Security Life Cycle - Testing, Audit, Review and Controls - Systems Development and Support - General Controls - People Security - User Access Controls - Technical Security - Protection from Malicious Software - Physical Security - Different Uses of Controls. | |
| **UNIT III - SECURITY MANAGEMENT MODELS AND PERFORMANCE MEASUREMENT** | **(9)** |
| Blueprints - Frameworks and Security Models - Security Architecture Models - Various Access Control Models - Information Security Performance Measurement. | |
| **UNIT IV - RISK ASSESSMENT & RISK MANAGEMENT** | **(9)** |
| Threats and its Categories - Vulnerabilities and its Categories - Risk - Calculation of Overall Risk – Risk Identification - Risk Analysis - Risk Evaluation - Risk Control - Risk Termination - Risk Reduction – Risk Transfer - Risk Tolerance - Overall Risk Assessment. Risk Management Framework and Process – Managing Risk - Risk Treatment- Alternative Risk Management Methodologies. | |

| UNIT V -DISASTER RECOVERY AND BUSINESS CONTINUITY MANAGEMENT | (9) |
|---|---|
| Disaster Recovery Process and policy - Relationship between Disaster Recovery and Business Continuity Management - Resilience and Redundancy - Approaches to Writing and Implementing Plans - Need for Documentation - Maintenance and Testing. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Andy Taylor, David Alexander, Amanda Finch and David Sutton, "Information Security Principles",2020, Third Edition, BCS, United Kingdom.
2. Michael E. Whitman and Herbert J. Mattord, "Management of Information Security", 2018, Sixth Edition, Cengage Learning, United States of America.

**REFERENCES:**

1. Calder, A., and Watkins, S. G., "Information security risk management for ISO27001/ISO27002", 2018, Third Edition, IT Governance Ltd, United States of America.
2. Susanto, H., and Almunawar, M. N, "Information security management systems: A novel framework and software as a tool for compliance with information security standards", 2018, First Edition, Apple Academic Press, New York.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | | 3 | | | | 3 | | | | | | | 2 | |
| 3 | 3 | | | | | | | | | | | | | |
| 4 | | | 2 | 3 | | | | | | | | | 3 | |
| 5 | | 3 | | | | | | | | | | | | 3 |
| CO (W.A) | 3 | 3 | 2 | 3 | | 3 | | | | | | | 3 | 3 |

## 22ITX25- SOCIAL NETWORK SECURITY

***(Common to 22AIX21,22CSX25,22CCX02,22CIX34)***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE REQUISITE: NIL**

| | |
|---|---|
| **Course Objective:** | To focuses on understanding and addressing security issues related to social networking platforms, including protecting user privacy, preventing cyber threats, and managing data security. |

| **Course Outcomes** The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply network analysis and explore its applications. | Ap | 20% |
| CO2 | Comprehend the role of ontologies in the Semantic Web, ontology-based knowledge representation, | An | 20% |
| CO3 | Develop skills to extract the evolution of web communities | C | 20% |
| CO4 | Predict human behavior in social communities through reality mining | An | 20% |
| CO5 | Visualizing social network on various technologies | An | 20% |

| **UNIT I - INTRODUCTION** | **(9)** |
|---|---|
| Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web – Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis. | |
| **UNIT II - MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION** | **(9)** |
| Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations. | |
| **UNIT III - EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS** | **(9)** |
| Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting community's social network infrastructures and communities - Decentralized online social networks - multi-relational characterization of dynamic social network communities. | |

| UNIT IV - PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES | (9) |
|---|---|
| Understanding and predicting human behaviour for social communities - User data management – Inference and Distribution – Enabling new human experiences-Reality Mining-Context- Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures. | |
| **UNIT - V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS** | **(9)** |
| Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation – Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover Networks-Community welfare - Collaboration networks - Co-Citation networks. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Andy Taylor, David Alexander, Amanda Finch and David Sutton, "Information Security
2. Principles",2020, Third Edition, BCS, United Kingdom. Michael E. Whitman and Herbert J. Mattord, "Management of Information Security", 2018,
3. Sixth Edition, Cengage Learning, United States of America.


**REFERENCES:**


1. Calder, A., and Watkins, S. G., "Information security risk management for ISO27001/ISO27002", 2018, Third Edition, IT Governance Ltd, United States of America.
2. Susanto, H., and Almunawar, M. N, "Information security management systems: A novel framework and software as a tool for compliance with information security standards", 2018, First Edition, Apple Academic Press, New York.


**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | 3 | 3 | | | | | | | | | | | 3 | |
| 3 | | 3 | 3 | | | | | | | | | | | 3 |
| 4 | | | | 3 | | | | | | | | | 3 | |
| 5 | | | | | | | 3 | | | | | | | |
| CO (W.A) | 3 | 3 | 3 | 3 | | | 3 | | | | | | 3 | 3 |

## 22ITX26 - DATA PRIVACY AND PROTECTION

***(Common to 22AIX24,22CSX26,22CCX06)***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PREREQUISITE: NIL**

| | |
|---|---|
| **Course Objective:** | To provide students with a comprehensive understanding of how to safeguard personal and sensitive data from unauthorized access, breaches, and misuse. |

| **Course Outcomes** The student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply knowledge on fundamental principles of Data privacy. | Ap | 20% |
| CO2 | To design and development of data preservation by using data mining. | An | 20% |
| CO3 | Ability to assess privacy risks associated with Privacy regulations. | Ap | 20% |
| CO4 | Analyses various approaches in data security by using tools. | An | 20% |
| CO5 | Apply security on storage and database. | Ap | 20% |

| **UNIT I – INTRODUCTION TO DATA PRIVACY** | **(9)** |
|---|---|
| Data Privacy and its Importance - Need for Sharing Data - Methods of Protecting Data - Importance of Balancing Data Privacy and Utility – Introduction to Anonymization Design Principles - Nature of Data in the Enterprise Static Data Anonymization on Multidimensional Data: Introduction - 36 Classification of Privacy Preserving Methods - Classification of Data in a Multidimensional Data Set - Group-Based Anonymization. | |
| **UNIT II - PRIVACY PRESERVING DATA MINING** | **(9)** |
| Introduction - Privacy Preserving Graph Data - Privacy Preserving Time Series Data - Privacy Preservation of Longitudinal Data - Privacy Preservation of Transaction Data - Static Data Anonymization: Threats to Anonymized Data-Threats to Data Structures-Threats by Anonymization Techniques. | |
| **UNIT III – PRIVACY REGULATIONS** | **(9)** |
| Introduction - UK Data Protection Act 1998. - Federal Act of Data Protection of Switzerland 1992 - Payment Card Industry Data Security Standard (PCI DSS)- The Health Insurance Portability and accountabilityActof1996(HIPAA): Effects of Protection-Anonymization Considerations- Anonymization Design for HIPAA - Explicit Identifiers - Quasi-Identifiers - Sensitive Data. – Anonymization Design Checklist. | |
| **UNIT IV - DATA SECURITY** | **(9)** |
| Securing Unstructured Data: Structured Datavs. Unstructured Data – At Rest ,in Transit and in Use – Approaches to secure Unstructured Data–Newer Approaches to Secure Unstructured Data. Information Rights Management: Overview–IRM Technology Details – Getting Started with IRM. Encryption: History of Encryption – Symmetric Key Cryptography – Public Key Cryptography | |

| UNIT V - CONTEMPORARY ISSUES | (9) |
|---|---|
| Storage Security: Evolution – Modern Storage Security – Risk Remediation – Best Practices. Database Security: General Concepts – Database Security Layers – Database-Level Security – Database Backup and Recovery – Database Auditing and Monitoring | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXTBOOK:**

1. Venkataramanan, Nataraj, and Ashwin Shriram. Data Privacy: Principles and Practice. CRC Press, 2017

**REFERENCES:**

1. Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition, And Information Security Management: Concepts and Practice. New York, McGraw-Hill, 2013.
2. David Salomon, Data Privacy and Security, Springer,2003
3. Andrew Vladimirov Michajlows ki, Konstantin, Andrew A. Vladimirov, and Konstantin V. Gavrilenko. Assessing Information Security: Strategies, Tactics, Logic and Framework. IT Governance Ltd, 2010.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | | |
| 2 | | 3 | | | | | | | | | | | | |
| 3 | | 3 | | 3 | | | | | | | | | 3 | 2 |
| 4 | | 3 | | | 3 | | | | | | | | | |
| 5 | 3 | | 3 | | | | | | | | | | 3 | 2 |
| CO (W.A) | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 2 |

## 22ITX27- E-COMMERCE SECURITY

***(Common to 22CSX27,22CCX05)***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PREREQUISITE: NIL**

| | |
|---|---|
| **Course Objective:** | To focuses on understanding and implementing security measures to protect online transactions and digital business operations. |

| **Course Outcomes** The student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Analysis the historical context, benefits, drawbacks, and societal implications. | An | 20% |
| CO2 | Acquire knowledge of key e-commerce technologies such as symmetric and asymmetric encryption, SSL | Ap | 20% |
| CO3 | Conduct investigation about the diverse security threats inherent in e - commerce | Ap | 20% |
| CO4 | Design and develop - commerce security policies, including privacy protection, security infrastructure implementation | An | 20% |
| CO5 | Gain insight into the various threats faced by e-business | An | 20% |

| | |
|---|---|
| **UNIT I - INTRODUCTION** | **(9)** |
| Introduction to e-Commerce -The Background of e-Commerce-Delimitation-Advantages and Disadvantagesofe-Commerce-Advantagesofe-Commerc-enetstoConsumers-BenetstoSo□iety- e-Commerce Disadvantages | |
| **UNIT II - E-COMMERCE TECHNOLOGIES** | **(9)** |
| Symmetric Encryption – Asymmetric Encryption- Secure Socket Layer – Digital Signature- Electronic Certicates - Wise Cards-Electronic Money – Characteristics of e-Commerce Technologies | |
| **UNIT III – SECURITY THREATS TO E-COMMERCE** | **(9)** |
| ClientDangers-CommunicationChannelPerils-ServerRisks-SecurityNecessitiesandSecurity Approach-Authentication--Privacy-Approval- Integrity | |
| **UNIT IV – SECURITY POLICY** | **(9)** |
| Privacy-SecurityInfrastructure-SolutionforTrust-FourTrustingConvictions-SevenBasicFactors at Influence Trust -Secure Trading for Electronic Businesses Makes Trust-Solutions for Security -Testing E-Commerce Security | |
| **UNIT V - E-BUSINESS THREATS AND SOLUTIONS** | **(9)** |
| E-Business Threats- Authentication Attacks-Respect ability Attacks- Secrecy Attacks-Infection-Trojan Horse-Worms-e-Business Solutions | |
| | **TOTAL (L:45) = 45 PERIODS** |

| **TEXTBOOK:** |
|---|
| 1. Tavares, Joao Manuel R.S, "Handbook of e-business security", LCCN 2018013131 \| ISBN 9781138571303,2019. |
| **REFERENCES:** |
| 1. MehdiKhosrowpour, "E-commerce Security: Advice from Experts", Idea Group Inc(IGI),2004<br>2. Ronggang Zhang , Lijuan Fang , Xiaoping He , Chuan Wei, "The Whole Process of E-commerce Security Management System",February2023 |

| **Mapping of COs with POs / PSOs** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **POs** | | | | | | | | | | | | **PSOs** | |
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** |
| **1** | | 3 | | | | | | | | | | | 3 | 3 |
| **2** | 3 | | | | | | | | | | | | 3 | 3 |
| **3** | | | | 3 | | | | | | | | | 3 | 3 |
| **4** | | | 3 | | | | | | | | | | 3 | 3 |
| **5** | | | | | | 3 | | | | | | | 3 | 3 |
| **CO (W.A)** | 3 | 3 | 3 | | | 3 | | | | | | | 3 | 3 |

## 22ITX28- BIOMETRIC SECURITY

***(Common to 22AIX22,22CSX28,22CCX03,22CIX35)***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE REQUISITE: NIL**

| | |
|---|---|
| **Course Objective:** | To provide students with a comprehensive understanding of biometric security systems, covering their design, implementation, evaluation, and applications in various security contexts. |

| **Course Outcomes** The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Analyze the biometric systems, their functionalities, and the underlying principles and their practical Applications in real-world scenarios. | An | 20% |
| CO2 | Apply the face recognition and face detection methods. | Ap | 20% |
| CO3 | Evaluate encoding and matching algorithms used to extract distinctive features from there is for Verification purposes. | E | 20% |
| CO4 | Illustrate the architecture and components involved in capturing data from multiple biometric sources. | An | 20% |
| CO5 | Research types of attacks that can occur at the user interface level. | An | 20% |

| **UNIT I - INTRODUCTION TO BIOMETRICS** | **(9)** |
|---|---|
| Biometric functionalities – Biometric system errors – The design cycle of biometric systems – Applications of biometric systems – Security and privacy issues – Fingerprint recognition – Fingerprint acquisition – Feature extraction – Fingerprint indexing – Palmprint. | |
| **UNIT II - FACE RECOGNITION** | **(9)** |
| Introduction to face recognition – Image acquisition–Face detection–Feature extraction and matching. | |
| **UNIT III – IRIS RECOGNITION** | **(9)** |
| Introduction to iris recognition – Design of an iris recognition system – Iris segmentation – Iris normalization - Irisencodingandmatching–Irisquality–Biometrictraits–Handgeometry–Softbiometrics. | |
| **UNIT IV - MULTI-BIOMETRICS** | **(9)** |
| Multi-biometrics – Sources of multiple evidence – Acquisition and processing architecture – Fusion levels. | |
| **UNIT V – SECURITY OF BIOMETRIC SYSTEMS** | **(9)** |
| Adversary attack – Attacks at the user interface – Attacks on the biometric processing – Attacks on the template database. | |
| | **TOTAL (L:45) = 45 PERIODS** |

**TEXT BOOKS:**

1. Anil K Jain, Arun A Ross and Karthik Nandakumar, Introduction to Biometrics, Springer, First Edition, 2011.
2. Rachid Guerraoui and Franck Petit, Stabilization, Safety, and Security of Distributed Systems, Springer, FirstEdition,2010.

**REFERENCES:**

1. Marcus Smith, Monique Mann and Gregor Urbas, Biometrics, Crime and Security, Taylor and Francis, First Edition, 2018.
2. Ravindra Das, The Science of Biometrics Security Technology for Identity Verification, Taylor and Francis, First Edition, 2018.

**Mapping of Cos with POs/PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | |
| 2 | 3 | | | 3 | 3 | | | | | | | | 3 | 2 |
| 3 | 3 | | | 3 | 3 | | | | | | | | | |
| 4 | 3 | 3 | 3 | 3 | 3 | | | | | | | | | |
| 5 | 3 | 3 | | 3 | 3 | 3 | | | | | | | 3 | |
| **CO (W.A)** | **3** | **3** | **3** | **3** | **3** | **3** | | | | | | | **3** | **2** |

| 22ITX31-INDUSTRIAL & MEDICAL IOT<br>*(Common to 22AIX31,22CSX31,22CCX31,22CIX01)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE : NIL** | | | | | |
| **Course Objective:** | • To provide students with good depth of knowledge of Designing Industrial and Medical IoT Systems for various applications.<br>• Students will learn the new evolution in hardware, software, and data | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply data management techniques to analyze and manipulate IIoT data, using tools for basic analytics and mining. | Ap | 20% |
| CO2 | Analyze various attack types targeting IoMT devices and systems, demonstrating the ability to identify specific vulnerabilities in real-world scenarios. | An | 20% |
| CO3 | Apply the IoMT system architecture by designing a basic framework that includes data collection, management, and server layers, ensuring proper integration of each component. | Ap | 40% |
| CO4 | Analyze the impact of smart medicinal packages on medication adherence, examining data on patient outcomes and adherence rates. | An | 20% |
| CO5 | Analyze case studies from various industrial IoT domains, focusing on operational efficiency, safety improvements, and sustainability impacts. | An | Internal Assessment |

| **UNIT I- INTRODUCTION TO INDUSTIAL IOT (IIOT)** | **(9)** |
|---|---|
| Introduction to IIOT, History of IIOT, Components of IIOT – Sensors, Interface, Networks, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT | |
| **UNIT II – INTERNET OF MEDICAL THINGS SECURITY THREATS, SECURITY CHALLENGES AND POTENTIAL SOLUTIONS** | **(9)** |
| IoMT Attack Types, Challenges in IoMT Security Schemes, Current Security Plans for IoMT, Potential Solutions for Security Vulnerabilities. | |
| **UNIT III – INTERNET OF MEDICAL THINGS INTRODUCTION AND SYSTEM ARCHITECTURE** | **(9)** |
| Introduction, IoMT Devices-On-Body Devices, In-Home Devices, Community Devices, In-Clinic Devices, In- Hospital Devices, IoMT System Architecture-Data Collection Layer, Data Management Layer, Medical Server Layer. | |

| UNIT IV – HEALTH CARE TECHNOLOGIES & IoMT | (9) |
|---|---|
| Home Monitoring System for Aged Care, Smart Medicinal Packages for Medication Adherence, Smart Drug Delivery System for Automated Drug Dispensation, Connected Rural Healthcare Consultation, Population and Environment Monitoring of Infectious Diseases-What are IoMT and its working? Tracking assets and resources, Internet of things in hospitals, collection and integration of clinical data, Major benefits of IoT in healthcare, Disadvantages of IoT in healthcare. | |
| **UNIT V – APPLICATION DESIGN & CASE STUDY** | **(9)** |
| Application Design & Case Study: Wireless Patient Monitor system, Wearable Fitness & Activity Monitor Application Design: Design of IOT based pulse oximeter, Reliability of IoT-Aware BPNM Healthcare process. Industrial IOT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**


4. Veneri, Giacomo, and Antonio Capasso. Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1st edition, Packt Publishing Ltd, 2018.
5. Reis, Catarina I., and Marisa da Silva Maximiano, eds. Internet of Things and advanced application in healthcare, 1st edition, IGI Global, 2016.
6. D. Jude Hemanth and J. Anitha George A. Tsihrintzis- Internet of Medical Things Remote Healthcare Systems and Applications, covered by Scopus.


**REFERENCES:**


3. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st Edition, Apress, 2017
4. Aboul Ella Hassanien, NilanjanDey and SureakaBoara, Medical Big Data and Internet of
5. Medical Things: Advances, Challenges and Applications, 1st edition, CRC Press, 2019.


**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | 3 | 3 | | | | | | | | | | | 3 | |
| 3 | | 3 | 3 | | | | | | | | | | | 3 |
| 4 | | | | 3 | | | | | | | | | 3 | |
| 5 | | | | | | | 3 | | | | | | | |
| CO (W.A) | 3 | 3 | 3 | | | | 3 | | | | | | 3 | 3 |

| 22ITX32-BLOCKCHAIN TECHNOLOGY<br>*(Common to 22AIX32,22CSX32,22CIX02)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE : NIL** | | | | |
| **Course Objective:** | • To impart knowledge of distributed ledgers in business<br>• To acquire knowledge in emerging concepts using blockchain | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply the principles of blockchain technology to articulate their significance. | Ap | 20% |
| CO2 | Evaluate the effectiveness of different consensus algorithms in specific blockchain applications. | An | 20% |
| CO3 | Evaluate their impact on security and privacy in digital transactions. | An | 20% |
| CO4 | Implement a strategic plan for integrating specific distributed ledger technologies into a business environment, considering operational efficiency, security, and regulatory compliance. | Ap | 20% |
| CO5 | Apply appropriate techniques to manage trust-based business networks, considering societal, environmental, economic, and global perspectives. | Ap | 20% |

| **UNIT I –INTRODUCTION** | **(9)** |
|---|---|
| The growth of blockchain technology – Distributed Systems – P2P – Distributed Ledger – Cryptographically Secure - Generic Element of Blockchain – Benefits and limitations of blockchain - Block chain Challenges - Tiers of BT – Types of Blockchain - Consensus. | |
| **UNIT II –DECENTRALIZATION** | **(9)** |
| Methods of Decentralization – Routes to Decentralization – Smart Contract – Decentralized Organization – Platforms for Decentralization – Consensus Algorithms. | |
| **UNIT III –CRYPTOCURRENCIES** | **(9)** |
| Cryptographic Hash Functions – Cryptography basic and Concepts – Introduction Bitcoin – Bitcoin Network and Payments – Bitcoin clients and APIs – Alternative Coins. | |
| **UNIT IV -DISTRIBUTED LEDGERS FOR BUSINESS** | **(9)** |
| Ethereum: Introduction – Ethereum Network – Components – Programming Languages; Hyperledger: Introduction – Reference Architecture – Fabric – Sawtooth Lake – Corda. | |

| UNIT V -BLOCKCHAIN DEVELOPMENT TOOLS AND FRAMEWORKS | (9) |
|---|---|
| Compilers: Solidity Complier – Ganache – Metamask – Truffle; Languages: Solidity – Go – Java – NodeJS; Blockchain Use case: Financials – Insurance - Supply Chain Management – HealthCare – IoT. | |
| **TOTAL(L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Van Haren Publishing (Editor), "Introduction to Blockchain Technology: The Many Faces of Blockchain Technology in the 21st Century", Paperback Import, 2019.
2. Imran Bashir, "Mastering Blockchain" Packt 2nd Ediction, 2018.

**REFERENCES:**

1. Don, Alex Tapscott, "Blockchain Revolution". Portfolio Penguin 2016.
2. William Mougayar, "Business Blockchain Promise, Practice and Application of the Next Internet Technology", John Wiley & Sons 2016.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | 3 | 3 | | | | | | | | | | | 3 | |
| 3 | | 3 | 3 | | | | | | | | | | | 3 |
| 4 | | | 3 | 3 | 3 | | | | | | | | | |
| 5 | | | | | | | | | | | 3 | 3 | 3 | |
| **CO (W.A)** | **3** | **3** | **3** | **3** | **3** | | | | | | **3** | **3** | **3** | **3** |

| 22ITX33-BEYOND 5G AND IOT TECHNOLOGIES<br>*(Common to 22AIX33,22CSX33,22CCX33,22CIX03)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE : NIL** | | | | | |
| **Course Objective:** | • Explore the evolution from 5G to 6G and the implications for data rates, latency, and connectivity.<br>• Examine the role of edge computing in reducing latency and improving real-time data processing in IoT systems. | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply knowledge of key capabilities and requirements of 5G to evaluate their implications for specific industry applications, such as IoT, smart cities, and autonomous vehicles. | Ap | 20% |
| CO2 | Analyze the specific requirements for 5G waveform design, including spectral efficiency, flexibility, and resilience to interference. | An | 20% |
| CO3 | Apply knowledge of the 5G architecture framework to design a basic model of a 5G network, incorporating elements such as the Radio Access Network (RAN) and core network components. | Ap | 40% |
| CO4 | Analyze the theoretical foundations of multi-antenna systems, identifying key requirements and performance indicators essential for effective MIMO operation. | An | 20% |
| CO5 | Conduct a detailed case study on a specific implementation of V2X or terahertz communication technology, evaluating its design, performance outcomes, and lessons learned. | An | Internal Assessment |

| **UNIT I - OVERVIEW OF 5G WIRELESS COMMUNICATIONS** | **(9)** |
|---|---|
| Evolution of mobile technologies (1G-5G), 3GPP Releases & its key aspects, Overview of 5G, three high level 5G usage scenarios (eMBB, URLLC, mMTC), Key capabilities & requirements, 5G vs. LTE-A Comparison, 5G frequency bands, 5G Use cases. | |
| **UNIT II - WAVEFORM DESIGN FOR 5G & BEYOND** | **(9)** |
| Introduction - 5G Waveform Design and Waveform Requirements – Flexible OFDM comparison with CP-OFDM, generalized frequency division multiplexing (GFDM), filter bank multicarriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques –non-orthogonal multiple accesses (NOMA), Sparse Code Multiple Access (SCMA) – Comparison of multiple access methods. | |
| **UNIT III - 5G ARCHITECTURE AND 5G NEXTGEN CORE NETWORK** | **(9)** |
| 5G Architecture: Introduction, 5G Architecture framework, 3GPP 5G architecture, Non-Roaming 5G system architecture, overall RAN architecture, Functional Split Between NG-RAN and 5G Core Network. 5G NextGen core network: Modern network requirements, SDN architecture, NFV benefits and requirements, – NFV Reference Architecture, Network Slicing concepts & requirements | |

| UNIT IV - MASSIVE MIMO SYSTEMS | (9) |
|---|---|
| Introduction to Multi-Antenna system, Theoretical background: MIMO requirement, MIMO vs. massive MIMO, Massive MIMO benefits, single user and multi-user MIMO, capacity of MIMO for unknown CSIT, massive MIMO capacity, Massive MIMO OFDM transmitter employing digital precoding, analog beamforming and hybrid of digital precoding and analog beamforming. | |
| **UNIT V -V2X COMMUNICATIONS AND NOVEL ASPECTS IN TERAHERTZ WIRELESS COMMUNICATIONS** | **(9)** |
| Vehicle-to-Vehicle (V2V) Communications, Vehicle-to-Infrastructure (V2I) Communications, Vehicle-to-Pedestrian (V2P) Communication, Self-driving Vehicles & its challenges, Vehicle-to-Network (V2N) Communications.Overview, potential spectral windows at THz frequencies, Terahertz wave propagation characteristics, opportunities & challenges, application | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**


1. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies" CRC Press, 2019.
2. Suvra Sekhar Das and Ramjee Prasad, "Evolution of Air Interface Towards 5G: Radio Access Technology andPerformance Analysis", Gistrup, Denmark: River Publishers series in Communication, 2018.
3. Wei Xiang, KanZheng, Xuemin (Sherman) Shen, "5G Mobile Communications", Springer publications-2016.
4. William Stallings "5G Wireless: A Comprehensive Introduction", Pearson Education, 2021.
5. AfifOsseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology"Cambridge University Press-2016.


**REFERENCES:**


1. R. S. Kshetrimayum, "Fundamentals of MIMO Wireless Communications", Cambridge University Press, UK,2017.
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks" first edition, John Wiley & Sons, 2015.


**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | | | | | | | | | | | | | 3 | |
| 2 | 3 | | 3 | | | | | | | | | | 3 | |
| 3 | | 3 | | | | | | | | | | | | 3 |
| 4 | | | | 3 | | | | | | | | | 3 | |
| 5 | | | | | | | | | 2 | | | | | |
| CO (W.A) | 3 | 3 | 3 | 3 | | | | | 2 | | | | 3 | 3 |

| 22ITX34 – PROGRAMMING FOR IoT BOARDS<br>*(Common to 22AIX34,22CSX34,22CCX34,22CIX04)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE : NIL**

| | |
|---|---|
| **Course Objective:** | • To introduce Internet of Things (IoT) environment and its technologies for designing smart systems<br>• To explore open-source computer hardware/software platform, development and debugging environment, programming constructs and necessary libraries |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Investigate various challenges and explore open source hardware prototyping platforms for designing IoT devices | Ap | 20% |
| CO2 | Analyze basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world | An | 20% |
| CO3 | Apply knowledge on Tkinter GUI using python in different sensors | Ap | 20% |
| CO4 | Program SBC by exploring protocols, data conversion process, API and expansion boards for practical IoT devices using Python | Ap | 20% |
| CO5 | Apply embedded programming constructs and constraints in real time systems for real world socio-economic problems | Ap | 20% |

| **UNIT I- INTRODUCTION TO RASPBERRY PI** | **(9)** |
|---|---|
| Raspberry Pi components-Installation of NOOBS and Raspbian on SD card- Terminal commands-Installation of Libraries on Raspberry pi- Getting the static IP address of Raspberry Pi-run a program-Installing the remote desktop server. | |
| **UNIT II - INTERFACING WITH RASPBERRY PI** | **(9)** |
| Interfacing of relay with raspberry Pi-LCD-DHT11 sensor-ultrasonic sensor- camera-play with digital sensor, analog sensor and actuator. | |
| **UNIT III – PYTHON GUI WITH TKINTER** | **(9)** |
| Tkinter for GUI design-LED Blink-brightness control-selection from multiple options-Reading a PIR sensor-Reading a analog sensor. | |
| **UNIT IV – DATA ACQUISITION WITH PYTHON** | **(9)** |
| Basics-CSV File- Storing Arduino data with CSV file- plotting random numbers using Matplotlib-Plotting real time from arduino- Integrating the plots in the TKinter window. | |

| UNIT V – CONNECTING TO THE CLOUD | (9) |
|---|---|
| Smart IoT systems- DHT11 data logger with thinkspeak server-ultrasonic sensor data logger-air quality monitoring system-landslide detection and disaster management system-smart motion detector and upload image to gmail.com. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS :**

1. Rajesh singh, AnithaGehlot, Lovi raj gupta, Bhupendrasingh and MahendranSwain "Internet of things with Raspberry Pi and Arduino" CRC Press 2020.

**REFERENCES:**

1. Sai Yamanoor, Sri hari Yamanoor " Python programming with Raspberry Pi" Packet Publishing Ltd, I$^{st}$ edition, 2017.
2. Wolfram Donat "Learn raspberry Pi programming in python" A Press 2014.

**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
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| 4 | | | 3 | | | | | | | | | | 3 | |
| 5 | | | | | | | | | 3 | 3 | | | | |
| CO (W.A) | 3 | 3 | 3 | 3 | | | | | 3 | 3 | | | 3 | 3 |

| 22ITX35 – WIRELESS AD-HOC AND SENSOR NETWORKS<br>*(Common to 22CSX35,22CCX32,22CIX07)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE : NIL** | | | | | |
| **Course Objective:** | • Understand the design issues in ad hoc and sensor networks.<br>• Learn the different types of MAC protocols | | | | |
| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** | | |
| CO1 | Understanding the concepts, network architectures and applications of ad hoc and wireless sensor networks | U | 20% | | |
| CO2 | Understanding the working of MAC Protocols for ad hoc networks | U | 20% | | |
| CO3 | Understanding the working of Routing Protocols for ad hoc networks | U | 20% | | |
| CO4 | Analyze the protocol design issues of ad hoc and sensor networks | An | 20% | | |
| CO5 | Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues | Ap | 20% | | |

| **UNIT I- FUNDAMENTALS OF WIRELESSS COMMUNICATION TECHNOLOGY** | **(9)** |
|---|---|
| Introduction –Spectrum Allocation-characteristics of wireless channel-modulation techniques-multiple accesss techniques-wireless internet- mobile IP. | |
| **UNIT II –AD-HOC WIRELESS NETWORK and MAC Protocols** | **(9)** |
| Cellular and Ad hoc wireless networks-Applications- Issues in Ad-Hoc wireless network. MAC Protocols: Issues-classifications-other MAC Protocols. | |
| **UNIT III – ROUTING PROTOCOLS FOR AD-HOC WIRELESS NETWORKS** | **(9)** |
| Introduction- Issues in designing a routing protocol-classifications of routing protocols-table driven routing protocol-on-demand routing protocol-hybrid routing protocols-routing protocols with efficient flooding mechanisms. | |
| **UNIT IV – TRANSPORT LAYER PROTOCOLS** | **(9)** |
| Design goals of transport layer protocols-TCP over Ad-hoc wireless networks-other transport layer protocols-Security in Ad-hoc wireless networks-network security attacks-key management-secure routing in in Ad-hoc wireless networks. | |

| UNIT V – WIRELESS SENSOR NETWORKS | (9) |
|---|---|
| Sensor network architecture-data dissemination-data gathering-MAC protocols for sensor networks-Location discovery-Quality of a sensor network-evolving standards. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS :**

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.
2. Dargie, Waltenegus, and Christian Poellabauer. Fundamentals of wireless sensor networks: theory and practice. John Wiley & Sons, 2010.

**REFERENCES:**

1. Carlos De MoraisCordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005

**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
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| 3 | 3 | | | | | | | | | | | | 3 | |
| 4 | | 3 | | | | | | | | | | | | 3 |
| 5 | | | | 3 | 3 | | | | 2 | 2 | | | | 3 |
| CO (W.A) | 3 | 3 | | 3 | 3 | | | | 2 | 2 | | | 3 | 3 |

## 22ITX36-WEARABLE COMPUTING

***(Common to 22AIX36,22CSX36,22CCX36,22CIX05)***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE-REQUISITE : NIL**

| | |
|---|---|
| **Course Objective:** | • Explore various applications of wearable computing across industries, such as healthcare, sports, entertainment, and fitness.<br>• Examine the technical challenges associated with wearable systems, including power management, data accuracy, and user comfort. |

| **Course Outcomes** The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply theoretical knowledge to practical situations, fostering skills in design, evaluation, and innovative thinking within the field of wearable technology. | Ap | 20% |
| CO2 | Analyze different signal processing techniques can be integrated into wearable systems to improve data quality and user experience. | An | 20% |
| CO3 | Apply knowledge of different wireless communication techniques to evaluate their suitability for implementing BANs in healthcare settings. | Ap | 40% |
| CO4 | Apply theoretical knowledge to practical challenges in wireless health systems, fostering skills in design, problem-solving, and innovation within the context of healthcare technology. | An | 20% |
| CO5 | Analyze case studies focused on wearable technologies used for monitoring patients with chronic diseases, assessing their impact on patient care and management. | An | Internal Assessment |

| **UNIT-I INTRODUCTION TO WEARABLE SYSTEMS** | **(9)** |
|---|---|
| Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems- Wearable ground reaction force sensor. | |
| **UNIT-II SIGNAL PROCESSING** | **(9)** |
| Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation. | |
| **UNIT-III WIRELESS HEALTH SYSTEM** | **(9)** |
| Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques. | |

| UNIT-IV SMART TEXTILE | (9) |
|---|---|
| Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques- Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks.Case study- smart fabric for monitoring biological parameters - ECG, respiration. | |
| **UNIT-V APPLICATIONS OF WEARABLE COMPUTING** | **(9)** |
| Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Edward Sazonov, Sergey G. Togov "Wearable Sensors: Fundamentals, Implementation and Applications" , Elsevier ,2014

**REFERENCES:**

1. Subhas Chandra Mukhopadhyay ",Wearable Sensors: Fundamentals, Implementation, and Applications"
2. Robert Matthews and Alberto Piaggesi,"Wearable Sensors: Fundamentals, Implementation, and Applications"
3. Mehmet R. Yuce."Wearable Sensors and Systems ".

**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | | |
| 2 | 3 | | 3 | | | | | | | | | | 3 | |
| 3 | | 3 | | | | | | | | | | | | 3 |
| 4 | | | | 3 | | | | | | | | | 3 | |
| 5 | | | | | | | 3 | | | | | | | |
| CO (W.A) | 3 | 3 | 3 | 3 | | | 3 | | | | | | 3 | 3 |

| 22ITX37– FOG AND EDGE COMPUTING<br>*(Common to 22AIX37,22CSX37,22CCX37,22CIX06)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE : NIL** | | | | |
| **Course Objective:** | • To introduce IoT enabling technologies and its opportunities.<br>• To review underlying technologies, limitations, and challenges along with performance metrics and discuss generic conceptual framework in fog computing. | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Explore technologies behind the communication and management of fogs and edge resources. | Ap | 20% |
| CO2 | Analyze the techniques for storage and computation in fogs, edges and clouds. | An | 20% |
| CO3 | Implement Internet of Everything (IoE) applications through fog computing architecture and use optimization techniques for the same | Ap | 40% |
| CO4 | Analyze the goals of middleware for fog and edge computing. | An | 20% |
| CO5 | Review the performance and issues of the applications developed using fog and edge architecture. | Ap | Internal Assessment |

| **UNIT I - INTERNET OF THINGS (IOT) AND NEW COMPUTING PARADIGMS** | **(9)** |
|---|---|
| Introduction - Relevant Technologies - Fog and Edge Computing Completing the Cloud - Hierarchy of Fog and Edge Computing - Business Models - Opportunities and Challenges . | |
| **UNIT II - CHALLENGES IN FEDERATING EDGE RESOURCES** | **(9)** |
| Introduction –the networking challenge - the management challenge- Miscellaneous challenges - Integrated C2F2T Literature by Modeling Technique - Integrated C2F2T Literature by Use - Case Scenarios - Integrated C2F2T Literature by Metrics. | |
| **UNIT III – OPTIMIZATION PROBLEMS IN FOG AND EDGE COMPUTING** | **(9)** |
| Introduction- Preliminaries - The Case for Optimization in Fog Computing-Formal Modeling Framework for Fog Computing – Metrics - Optimization Opportunities along the Fog Architecture - Optimization Opportunities along the Service Life Cycle - Toward a Taxonomy of Optimization Problems in Fog Computing – optimization Techniques. | |
| **UNIT IV – MIDDLEWARE FOR FOG AND EDGE COMPUTING** | **(9)** |
| Need for Fog and Edge Computing Middleware - Design Goals-State-of-the-Art Middleware Infrastructures - System Model - Fog Data Management - Smart Building - Predictive Analysis with FogTorch . | |

| UNIT V – APPLICATIONS OF FOG AND EDGE COMPUTING | (9) |
|---|---|
| Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real - Time Human Objects Tracking-Fog Computing Model for Evolving Smart Transportation Applications - Testing Perspectives of Fog - Based IoT Applications - Legal Aspects of Operating IoT Applications in the Fog. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS :**

1. Buyya, Rajkumar, and SatishNarayanaSrirama, Fog and Edge computing: Principles and Paradigms, 2019, 1st edition, John Wiley & Sons, USA.

**REFERENCES:**

1. Bahga, Arshdeep, and Vijay Madisetti, Cloud computing: A hands-on approach, 2014, 2ndedition, CreateSpace Independent Publishing Platform, USA
2. OvidiuVermesan, Peter Friess, "Internet of Things –From Research and Innovation to Market Deployment", 2014, 1st edition, River Publishers, India

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
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| 4 | | | 3 | | | | | | | | | | 3 | |
| 5 | | | | | | | | | 3 | 3 | | | | |
| CO (W.A) | 3 | 3 | 3 | 3 | | | | | 3 | 3 | | | 3 | 3 |

| 22ITX38-IMAGEPROCESSING<br>*(Common to 22CSX38,22CCX35,22CIX08)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE : NIL** | | | | | |
| **Course Objective:** | • To provide the basic knowledge on image processing concepts.<br>• To develop the ability to apprehend and implement various image processing algorithms. | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Understand different components of image processing system | U | 20% |
| CO2 | Describe various image transforms, enhancement techniques using various processing methods | U | 20% |
| CO3 | Illustrate the compression and segmentation techniques on a given image | Ap | 40% |
| CO4 | Demonstrate the filtering and restoration of images(pixels) with examples | Ap | 20% |
| CO5 | Illustrate the various schemes for image representation and detection techniques with examples | An | 20% |

| **UNIT-I DIGITAL IMAGE FUNDAMENTALS** | **(9)** |
|---|---|
| Introduction: Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals: Elements of Visual Perception , Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels. | |
| **UNIT-II IMAGE ENHANCEMENT IN THE SPATIAL AND FREQUENCY DOMAIN** | **(9)** |
| Image Enhancement in the Spatial Domain : Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing spatial Filters, Sharpening spatial Filters. Image Enhancement in the Frequency Domain : Introduction to the Fourier Transform and the Frequency Domain,Smoothingfrequency-domainFilters,SharpeningFrequency-domain Filters, Homomorphic Filtering ,Implementation. | |
| **UNIT-III IMAGE RESTORATION** | **(9)** |
| Image Restoration : A Model of the Image Degradation/Restoration Process, Linear, Position- Invariant Degradations, Inverse Filtering, Minimum Mean Square Error(Wiener)Filtering, Constrained Least Squares Filtering. Wavelets and Multire solution Processing: Multire solution Expansions, Wavelet Transforms in one Dimension,The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions. | |

| UNIT-IV IMAGE COMPRESSION & SEGMENTATION | (9) |
|---|---|
| Image Compression: Image Compression Models, Error-free Compression, Lossy Compression,Image Compression Standards. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation. | |
| **UNIT-V REPRESENTATION AND DESCRIPTION** | **(9)** |
| Various schemes for representation-chain codes-polygonal approximation-signatures –boundry segments-boundary descriptors: shape numbers-fourier descriptors and regional descriptors-topological descriptors-texture-moments of two dimentional functions. | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. Prentice Hall India/Pearson Education.

**REFERENCES:**

1. A.K.Jain, Fundamentals of Digital Image Processing. Prentice Hall India.
2. Madhuri.A.Joshi, Digital Image Processing, PHI.
3. Sonka,Image Processing, Analysis and Machine Vision. Cengage Publications.

**Mapping of COs with POs / PSOs**

| COs | Pos | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
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| 3 | | 3 | | | | | | | | | | | | 3 |
| 4 | | | | 3 | | | | | | | | | 3 | |
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| CO (W.A) | 3 | 3 | 3 | | | | 3 | | | | | | 3 | 3 |

| 22ITX41- CLOUD SERVICES MANAGEMENT<br>*(Common to 22CCX42,22CIX51)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE : Nil** | | | | | |
| **Course Objective:** | Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply Cloud Service Management terminology, definition & concepts and predict benefits of cloud service management with traditional IT service management. | Ap | 20% |
| CO2 | Analyze strategies to reduce risk and manage issues associated with adoption of cloud services | An | 40% |
| CO3 | Exhibit cloud-design skills to build and automate business solutions using cloud technologies. | Ap | 20% |
| CO4 | Demonstrate the strategies for designing, deploying and running cloud-based services in a business environment | An | 20% |
| CO5 | Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services | An | Internal Assessment |

| **UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS** | (9) |
|---|---|
| Cloud Ecosystem-The Essential Characteristics-Basics of Information Technology Service Management and Cloud Service Management-Service Perspectives-Cloud Service Models-CloudService Deployment Models | |
| **UNIT II CLOUD SERVICES STRATEGY** | (9) |
| Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture | |
| **UNIT III CLOUD SERVICE MANAGEMENT** | (9) |
| Cloud Service Reference Model-Cloud Service Life Cycle-Basics of Cloud Service Design-Dealingwith Legacy Systems and Services-Benchmarking of Cloud Services-Cloud Service Capacity Planning-Cloud Service Deployment and Migration-Cloud Marketplace-Cloud Service OperationsManagement. | |
| **UNIT IV CLOUD SERVICE ECONOMICS** | (9) |
| Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models | |

| UNIT V CLOUD SERVICE GOVERNANCE & VALUE | (9) |
|---|---|
| IT Governance Definition-Cloud Governance Definition-Cloud Governance Framework-Cloud Governance Structure-Cloud Governance Considerations-Cloud Service Model Risk Matrix-Understanding Value of Cloud Services- Measuring the value of Cloud Services- Balanced Scorecard-Total Cost of Ownership | |
| **TOTAL (L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications 2020.
2. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour 2017.
3. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013.

**REFERENCES:**

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing 2020.
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi 2013.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
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| 3 | | | 3 | | 3 | | | | | | | | | 3 |
| 4 | | | | 3 | | | | | | | | | 3 | |
| 5 | | | | | | | | | | 3 | | 3 | | 3 |
| CO (W.A) | 3 | 3 | 3 | 3 | | | | | | 3 | | 3 | 3 | 3 |

| 22ITX42- UI AND UX DESIGN<br>*(Common to 22AIX42,22CSX42,22CCX41,22CIX45)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PREREQUISITE :NIL**

| **Course Objective:** | To understand fundamental concepts of UI/UX design and to develop real time applications. |
|---|---|

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply UI design concepts for building user Applications. | Ap | 20% |
| CO2 | Demonstrate UI Design of any product or application. | An | 20% |
| CO3 | Evaluate UX Skills in product development. | Ap | 20% |
| CO4 | Create Wireframe and Prototype and learns to design successful products through personas and ideation. | An | 40% |
| CO5 | Present their web design demonstrating teamwork and reflective learning. | Ap | Internal Assessment |

| **UNIT I - FOUNDATIONS OF DESIGN** | **(9)** |
|---|---|
| UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy. | |
| **UNIT II - FOUNDATIONS OF UI DESIGN** | **(9)** |
| Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides. | |
| **UNIT III - FOUNDATIONS OF UX DESIGN** | **(9)** |
| Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals- FIGMA tool | |
| **UNIT IV - WIREFRAMING, PROTOTYPING AND TESTING** | **(9)** |
| Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration. | |
| **UNIT V – RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE** | **(9)** |
| Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture. | |
| **TOTAL (L:45) : 45 PERIODS** | |

| TEXT BOOKS: |
|---|
| 1. Joel Marsh, "UX for Beginners", O'Reilly , 2022.<br>2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021. |
| **REFERENCES:** |
| 1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rdEdition , O'Reilly 2020.<br>2. Steve Schoger, Adam Wathan "Refactoring UI", 2018.<br>3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015.<br>4. https://www.nngroup.com/articles/<br>5. https://www.interaction-design.org/literature. |

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | 3 | 3 | | | | | | | | | | | 3 | |
| 3 | | 3 | 3 | | 3 | | | | | | | | | 3 |
| 4 | | | | 3 | | | | | | 3 | | | 3 | |
| 5 | | | | | | | | | | 3 | 3 | 3 | | 3 |
| **CO (W.A)** | **3** | **3** | **3** | **3** | **3** | | | | | **3** | **3** | **3** | **3** | **3** |

| 22ITX43-DEVOPS<br>*(Common to 22AIX43,22CSX43,22CCX46,22CIX46)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE :NIL** | | | | | |
| **Course Objective:** | To introduce DevOps terminology, definition & concepts, version control tools and configuration management. | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Analyse different actions performed through Version control tools like Git | An | 20% |
| CO2 | Apply Jenkinsfor Continuous Integration and Continuous Testing and Continuous Deployment by building automating test cases using Maven & Gradle. | Ap | 30% |
| CO3 | Design configuration management application using Ansible | An | 20% |
| CO4 | Implement the configuration management using Ansible and leverage Cloud-based DevOps tools using Azure DevOps | An | 30% |
| CO5 | Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems | An | Internal Assessment |

| **UNIT I- INTRODUCTION TO DEVOPS** | **(9)** |
|---|---|
| Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github. | |
| **UNIT II - COMPILE AND BUILD USING MAVEN & GRADLE** | **(9)** |
| 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** | **(9)** |
| Install & Configure Jenkins, 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 - CONFIGURATION MANAGEMENT USING ANSIBLE | (9) |
|---|---|
| Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible | |
| **UNIT V – BUILDING DEVOPS PIPELINES USING AZURE** | **(9)** |
| Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOKS:**


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, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014


**REFERENCES:**


1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
4. MariotTsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.
5. https://www.jenkins.io/user-handbook.pdf
6. https://maven.apache.org/guides/getting-started/


**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | | 3 | | | | | | | | | | | 3 | |
| 2 | 3 | | | | 3 | | | | | | | | 3 | |
| 3 | | | 3 | | | | | | | | | | | 3 |
| 4 | | | | 3 | 3 | | | | | | | | 3 | |
| 5 | | | | | | 3 | | | | 3 | | | | 3 |
| **CO** | **3** | **3** | **3** | **3** | **3** | **3** | | | | **3** | | | **3** | **3** |

| 22ITX44-PRINCIPLES OF PROGRAMMING LANGUAGES<br>*(Common to 22AIX44,22CSX44,22CCX47)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PREREQUISITE :NIL** | | | | | |
| **Course Objective:** | To understand design concepts for programming languages | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply programming languages for problem solving. | Ap | 20% |
| CO2 | Analyze object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog. | Ap | 40% |
| CO3 | Design a solution for given problem using programming languages structures | An | 20% |
| CO4 | Demonstrate the different functionalities of programming languages. | An | 20% |
| CO5 | Make an Oral presentation related to course. | Ap | Internal Assessment |

| **UNIT I -SYNTAX AND SEMANTICS** | **(9)** |
|---|---|
| Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom up parsing | |
| **UNIT II -DATA, DATA TYPES, AND BASIC STATEMENTS** | **(9)** |
| Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection – primitive data types – strings – array types – associative arrays – record types – union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements – mixed mode assignments – control structures – selection – iterations – branching – guarded statements | |
| **UNIT III - SUBPROGRAMS AND IMPLEMENTATIONS** | **(9)** |
| Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions -implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping. | |
| **UNIT IV - OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING** | **(9)** |
| Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – statement level concurrency – Event handling | |

| UNIT V – FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES | (9) |
|---|---|
| Introduction to lambda calculus – fundamentals of functional programming languages -Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages. | |
| **TOTAL(L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Robert W. Segesta, Concepts of Programming Languages, Twelfth Edition (Global Edition), Pearson, 2022.
2. Michael L. Scott, Programming Language Pragmatics, Fourth Edition, Elsevier, 2018.
3. Jeffrey D. Ullman, Elements of programming, Second Edition, Pearson, 1997.
4. W. F. Clocksin and C. S. Mellish, Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.

**REFERENCES:**

1. Ghezzi, —Programming Languages , 3rd Edition, John Wiley, 2008
2. 2. John C. Mitchell, —Concepts in Programming Language, Cambridge University Press, 2004
3. Lutz M, "Programming Python", SPD/O'reilly, (4th Edition),(2015).
4. 3. Allen Tucker, Robert Noonan, "Programming Languages: Principles and Paradigms", Tata McGraw Hill, (2nd edition),(2007).

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | | 3 | | | 3 | | | | | | | | 3 | |
| 3 | | | 3 | | 3 | | | | | | | | 3 | |
| 4 | | 3 | | 3 | | | | | | | | | | 3 |
| 5 | | | | | | | | | | 3 | | | | 2 |
| CO (W.A) | 3 | 3 | 3 | 3 | 3 | | | | | 3 | | | 3 | 3 |

| 22ITX45- MEAN STACK DEVELOPMENT<br>*(Common to 22AIX45,22CSX45,22CCX45,22CIX56)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE :NIL** | | | | | |
| **Course Objective:** | To build complex web application with using minimum code. | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply Node JS and NOSQL concepts for front end and back-end design | Ap | 40% |
| CO2 | Analyse the various stacks available for web application development and finds the best for given application. | An | 20% |
| CO3 | Design responsive pages using scripting technologies and Mongo DB. | Ap | 20% |
| CO4 | Implement interactive web pages using Angular JS | An | 20% |
| CO5 | Involve in independent study and aware of technological advances related to the course | An | Internal Assessment |

| **UNIT I- INTRODUCTION TO NOSQL DATABASE** | **(9)** |
|---|---|
| Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points. | |
| **UNIT II - Node JS** | **(9)** |
| Introduction – Architecture – Features- Creating Web Servers with HTTP -Request - Response – Event Handling - GET and POST Methods –File Upload - Connect to NoSQL Database using Node JS – Implementation of CRUD operations. | |
| **UNIT III MONGO DB** | **(9)** |
| Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications | |
| **UNIT IV–TYPESCRIPT AND ANGULAR** | **(9)** |
| TypeScript: Introduction – Features – Variables – Data types – Enum – Array – Tuples – Functions – OOP concepts – Interfaces. Angular : Introduction - Needs - Evolution – Features – Architecture - Setup and Configuration – Components and Modules –Templates - Controllers – Scope – Directives – Data Binding. | |

| UNIT V - ANGULARJS FRAMEWORK | (9) |
|---|---|
| Pipes/Filters -DOM – Events - Routing - Services – HTTP – Ajax– Template Driven Forms - Reactive Forms – Form Validation – Basic Animations. | |
| **TOTAL(L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018

**REFERENCES:**

2. https://www.javatpoint.com

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | | 3 | | | | | | | | | | | 3 | |
| 3 | | | 3 | | 3 | | | | | | | | | 3 |
| 4 | | | | 3 | 3 | | | | | | | | 3 | |
| 5 | | | | | | | | | 2 | 3 | | 3 | | 3 |
| CO (W.A) | 3 | 3 | 3 | 3 | 3 | | | | 2 | 3 | | 3 | 3 | 3 |

| 22ITX46-SOCIAL AND INFORMATION NETWORKS<br>*(Common to 22AIX46,22CSX46,22CCX43,22CIX47)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PREREQUISITE :Nil** | | | | | |
| **Course Objective:** | To determine the theories and methods for analyzing network data, understanding network formation, and applying network analysis to real-world problems. | | | | |

| **Course Outcomes**<br>The student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply various techniques for analyzing and visualizing network data. | Ap | 25% |
| CO2 | Analyze the efficiency of different measurements and metrics of social network. | An | 25% |
| CO3 | Develop real-world applications of network analysis in various domains. | Ap | 25% |
| CO4 | Implement the solutions for problems in case studies related to social and information networks. | An | 25% |
| CO5 | Abide by the norms of professional ethics in information sharing in social networks. | Ap | Internal Assessment |

| **UNIT I- INTRODUCTION TO SOCIAL AND INFORMATION NETWORKS** | **(9)** |
|---|---|
| Overview of social and information networks - Basic terminology and concepts - Types of networks :Social networks, Information networks, Citation networks - Network Representations and Data Formats | |
| **UNIT II – NETWORK STRUCTURE AND PROPERTIES AND MODELS** | **(9)** |
| Degree distribution and Power loss – Clustering Co-efficients – Small World Phenomenon – Network Motifs and Patterns. Random Graphs – Scale Free Networks – Exponential Random Graphs – Preferential attachment Models | |
| **UNIT III – INFORMATION DIFFUSION AND COMMUNITY DETECTION** | **(9)** |
| Models of Information Diffusion – Influence Maximization – Contagion Models – Cascading behavior in networks – Community detection: Modularity and Community structure – Clustering algorithms : Louvain, Girvan-Newman – overlapping communities – Evaluation metrics for community detection | |
| **UNIT IV – ALGORITHMIC ASPECTS OF NETWORK ANALYSIS** | **(9)** |
| Network resilience and Robustness: Vulnerability of networks to nodes and edge removal – Resilience strategies – Robustness metrics – Cascading failures and network collapse. Algorithmic Aspects of Network Analysis: Centrality measures: Degree centrality and Betweenness centrality – Page Rank Algorithm – Network Embedding Techniques – Graph Neural Networks | |

| UNIT V – APPLICATIONS OF SOCIAL AND INFORMATION NETWORKS | (9) |
|---|---|
| Social media analysis – Recommender system – Epidemiology and disease spread modeling – Online advertising and viral marketing | |
| **TOTAL(L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World" by David Easley and Jon Kleinberg, first edition,2010
2. "Network Science" by Albert-Laszlo Barabasi,first edition, 2016
3. "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More" by Matthew A. Russell, Second edition, O'Reilly Media , 2019

**REFERENCES:**

1. "Social Network Analysis: Methods and Applications" by Stanley Wasserman and Katherine Faust:
2. "The Structure and Dynamics of Networks" by Mark Newman,This book covers the fundamental principles of network theory, including network structure, dynamics, and applications in various fields.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | | 3 |
| 2 | | 3 | | | | | | | | | | | 3 | |
| 3 | | | 3 | | | | | | | | | | 3 | |
| 4 | | | | 3 | | 3 | | | | | | | | 3 |
| 5 | | | | | | | | 3 | | 3 | | 3 | | 3 |
| **CO (W.A)** | **3** | **3** | **3** | **3** | | **3** | | **3** | | **3** | | **3** | **3** | **3** |

| 22ITX47-WEB MINING<br>*(Common to 22AIX47,22CSX47,22CCX44,22CIX57)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE :NIL** | | | | | |
| **Course Objective:** | To learn techniques for extracting knowledge from Web content as a basis for business decisions and applications. | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply key concepts of Web mining to discover useful information from the World-Wide Web and its usage patterns | Ap | 25% |
| CO2 | Analyse the data on web using crawlers and extract strutured data. | An | 25% |
| CO3 | Compare various methods of web data mining and its applications | Ap | 25% |
| CO4 | Demonstrate various pattern discovery and analysis techniques | An | 25% |
| CO5 | Ability to read and comprehend research articles related to the course. | An | Internal Assessment |

| **UNIT I- INTRODUCTION -WEBSEARCH** | **(9)** |
|---|---|
| Basic Concepts – Information Retrieval Models - Evaluation Measures – Text and Web Page Pre-processing – Inverted Index and its compression – Latent Sematic Indexing – Web Search – Meta-Searching and Combining Multiple Rankings–Web Spamming. | |
| **UNIT II - WEBCRAWLING** | **(9)** |
| BasicCrawlerAlgorithm–ImplementationIssues–UniversalCrawlers–FocusedCrawlers–TopicalCrawlers–Evaluation–CrawlerEthicsand Conflicts. | |
| **UNIT III - STRUCTURED DATA EXTRACTION** | **(9)** |
| Structured Data Extraction –Wrapper Induction-Instance-Based Wrapper Learning –Automatic Wrapper Generation: Problems –String Matching and Tree Matching – Multiple Alignment – Building DOM Trees – Extraction Based on a Single List Page –Introduction to Schema Matching–Pre-Processing for Schema Matching-Schema–Level Match– Domain and Instance-Level Matching | |
| **UNIT IV – WEB USAGE MINING** | **(9)** |
| WebUsageMining–ClickstreamAnalysis–LogFiles–DataCollectionandPre-Processing–DataModelingforWebUsageMining–TheBIRCHClusteringAlgorithm–AffinityAnalysisandtheAPrioriAlgorithm–DiscretizingtheNumericalVariable | |

| UNIT V – OPINION MINING | (9) |
|---|---|
| The Problem of Opinion Mining – Document Sentiment Classification – Sentence Subjectivity and Sentiment Classification –Opinion Lexicon Expansion – Aspect-Based Opinion Mining – Mining Comparative Opinions Search and Retrieval – Opinion Spam Detection. | |
| **TOTAL(L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. Bing Liu, " Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data Centric Systems and Applications)",Springer;2nd Edition2011forunitsI,II,III&V
2. DravkoMarkov,DanielT.Larose,"DataMiningtheWeb:UncoveringPatternsinWebContent,Structure,andUsage",JohnWiley& Sons, Inc.,2010for unit IV.

**REFERENCES:**

1. AnthonyScime,"WebMiningApplicationsandTechniques",IdeaGroupPub.,2005

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
| 2 | | 3 | | | | | | | | | | | 3 | |
| 3 | | | 3 | | | | | | | | | | | 3 |
| 4 | | | | 3 | 3 | | | | | | | | 3 | |
| 5 | | | | | | | | | | 3 | | 3 | | |
| **CO (W.A)** | **3** | **3** | **3** | **3** | **3** | | | | | **3** | | **3** | **3** | **3** |

| 22ITX48-MULTIMEDIA DATA COMPRESSION AND STORAGE<br>*(Common to 22AIX48,22CSX48,22CCX48,22CIX48)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PREREQUISITE :Nil**

| **Course Objective:** | • Apply data compression algorithms<br>• Explain Multimedia Information Sharing |
|---|---|

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply compression algorithms related to multimedia components such as text, speech, audio, image and video. | Ap | 20% |
| CO2 | Analyze the various image compression techniques and apply efficient technique for multimedia content | An | 20% |
| CO3 | Design a video using advanced video compression techniques and ensure efficient disk placement. | An | 40% |
| CO4 | Implement scheduling methods for request streams | An | 20% |
| CO5 | Submit a Multimedia presentation on assigned topics related to course | An | Internal Assessment |

| **UNIT I- BASICS OF DATA COMPRESSION** | **(9)** |
|---|---|
| **MULTIMEDIA:** Introduction-Uses of multimedia, Text, Images, Sound, Animation, Video—Lossless and Lossy Compression– Basics of Huffmann coding- Arithmetic coding- Dictionary techniques- Context based compression – Applications | |
| **UNIT II - IMAGE COMPRESSION** | **(9)** |
| Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications - Facsimile encoding | |
| **UNIT III - VIDEO COMPRESSION** | **(9)** |
| Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2- H.263. | |
| **UNIT IV - DATA PLACEMENT ON DISKS** | **(9)** |
| Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system. | |

| UNIT V – DISK SCHEDULING METHODS | (9) |
|---|---|
| Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods for request streams | |
| **TOTAL(L:45) = 45 PERIODS** | |

**TEXT BOOKS:**

1. 1.KhalidSayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.
2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008

**REFERENCES:**

1. David Salomon, A concise introduction to data compression, 2008.
2. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.
3. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis,2019
4. Irina Bocharova, Compression for Multimedia, Cambridge University Press; 1st edition, 2009

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | 3 | |
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| 3 | | | 3 | 3 | 3 | | | | | | | | | 3 |
| 4 | | | | 3 | | | | | | | | | 3 | |
| 5 | | | | | | | | | | 3 | | | | 3 |
| **CO (W.A)** | **3** | **3** | **3** | **3** | **3** | | | | | **3** | | | **3** | **3** |

| 22ITX51- OBJECT ORIENTED SOFTWARE ENGINEERING<br>*(Common to 22CSC16)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE :NIL**

| **Course Objective:** | Learn to apply object-oriented principles and software engineering methodologies to design and develop robust software solutions. |
|---|---|

| **Course Outcomes**<br>The student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply object oriented and software engineering process for a given problem | Ap | 20% |
| CO2 | Analyze the system requirements, various design and testing techniques for a given system | An | 30% |
| CO3 | Design object oriented model for different phases of software development to a given scenario | Ap | 30% |
| CO4 | Design object solutions with patterns and architectural layers | An | 20% |
| CO5 | Document and present project deliverables | Ap | Internal Assessment |

| **UNIT I – SOFTWARE PROCESS AND AGILE DEVELOPMENT** | **(9)** |
|---|---|
| Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Introduction to Agility-Agile process-Extreme programming-XP Process-Case Study. | |
| **UNIT II - REQUIREMENTS ANALYSIS AND SPECIFICATION** | **(9)** |
| Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram- CASE TOOLS. | |
| **UNIT III - SOFTWARE DESIGN** | **(9)** |
| Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered – Client Server – Tiered Pipe and filter- User interface design- Case Study. | |
| **UNIT IV - OBJECT DESIGN** | **(9)** |
| Preface to object orientation – Classes and Objects - Reusing pattern solutions –Overview of reuse concepts - Design patterns - Mapping models to code: Mapping concepts. | |

| UNIT V - SOFTWARE TESTING AND MAINTENANCE | (9) |
|---|---|
| Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging – Program analysis – Symbolic execution – Model Checking-Case Study. | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOK:**

1. Bernd Bruegge & Allen H. Dutoit, "Object-Oriented Software Engineering", 3rd edition, Pearson Education, 2014.

**REFERENCES:**

1. Roger S. Pressman, "Object-Oriented Software Engineering: An Agile Unified Methodology", First Edition, Mc Graw-Hill International Edition, 2014.
2. Timothy C. Lethbridge, Robert Laganiere, "Object Oriented Software Engineering", Tata McGraw-Hill, 6th ed., reprint, 2008.
3. Stephen Schach, "Object Oriented and Classical Software Engineering", 6th edition, McGraw-Hill, 2005.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | | | | | | | | | | | | | 3 |
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| 3 | | | 3 | | | | | | | | | | | 3 |
| 4 | | | 3 | | 2 | 2 | | | 2 | 3 | 2 | | | 3 |
| 5 | | | | | | | | | | | | | | 3 |
| **CO (W.A)** | **3** | **3** | **3** | | **2** | **2** | | | **2** | **3** | **2** | | | **3** |

## 22ITX52-SOFTWARE DEFINED NETWORKS

***(Common to 22AIX52,22CSX52,22CCX52)***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**PRE-REQUISITE :NIL**

**Course Objective:** Gain knowledge in networking fundamentals and conceptual understanding of Software Defined Networks (SDN)

| Course Outcomes<br>The students will be able to | | Cognitive Level | Weightage of COs in End Semester Examination |
|---|---|---|---|
| CO1 | Analyze the conventional network and SDN paradigm | An | 20% |
| CO2 | Analyze the flexibility and scalability of using SDN in terms of innovation and network management | An | 20% |
| CO3 | Apply troubleshooting on various components of SDN networks | Ap | 20% |
| CO4 | Analyze the security challenges in SDN paradigm | An | 20% |
| CO5 | Evaluate the emerging SDN applications | Ap | 20% |

| | |
|---|---|
| **UNIT I – INTRODUCING SOFTWARE DEFINED NETWORKS** | **(9)** |
| SDN Origins and Evolution – Introduction : SDN - Centralized and Distributed Control and Data Planes - The Genesis of SDN | |
| **UNIT II - SOFTWARE DEFINED NETWORKS ABSTRACTIONS** | **(9)** |
| How SDN Works - The Open flow Protocol - SDN Controllers: Introduction – General Concepts - VMware - Nicira - VMware/Nicira - Open Flow-Related - Mininet - NOX/POX- Trema - Ryu - Big Switch Networks/Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK | |
| **UNIT III - PROGRAMMING SOFTWARE DEFINED NETWORKS** | **(9)** |
| Network Programmability - Network Function Virtualization - NetApp Development, Network Slicing | |
| **UNIT IV - SOFTWARE DEFINED NETWORKS APPLICATIONS AND USE CASES** | **(9)** |
| SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System | |
| **UNIT V - SOFTWARE DEFINED NETWORKS FUTURE AND PERSPECTIVES** | **(9)** |
| SDN Open Source - SDN virtualization -SDN Futures - Final Thoughts and Conclusions | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOKS:**

1. S. Azodolmolky, "Software Defined Networking with Open Flow", 2nd Edition, Packt Pub Ltd, October 2017
2. E. Banks, "SDN Showdown: Examining the Differences between VMware's NSX and Cisco's ACI", Network World, January 6, 2014

**REFERENCES:**


1. Paul Goransson and Chuck Black ,"Software Defined Networks -A Comprehensive Approach ", Morgan Kaufmann Publications, 2014
2. Thomas D. Nadeau and Ken Gray ,"SDN- Software Defined Networks ", O'Reilly, 2013
3. Siamak Azodolmolky "Software Defined Networking with OpenFlow" By, Packt Publishing, 2013


**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
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| **CO (W.A)** | **3** | **3** | | | **3** | | | | | | | **2** | | **3** |

| 22ITX53-SOFTWARE PROJECT MANAGEMENT<br>*(Common to 22AIX53,22CSX53,22CCX53,22CIX54)* | | | | |
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| | **L** | **T** | **P** | **C** |
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**PRE-REQUISITE :NIL**

| | |
|---|---|
| **Course Objective:** | To provide an insight into detailed project management activities including project evaluation, planning, estimation, monitoring and control activities especially for software projects. |

| **Course Outcomes**<br>The students will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply different techniques in monitoring and control of the project | Ap | 30% |
| CO2 | Apply project estimation and evaluation techniques to real world problems | Ap | 20% |
| CO3 | Plan, schedule and sequence the activities using various techniques | An | 30% |
| CO4 | Identify project risk, monitor and track project deadlines | An | 20% |
| CO5 | Managing people and organizing teams while developing a software project | Ap | Internal Assessment |

| **UNIT I – SOFTWARE PROJECT MANAGEMENT** | **(9)** |
|---|---|
| Project Definition – Importance – Activities – Overview of the project Planning – Software project economics – objectives – Project Life Cycle. | |
| **UNIT II - PROJECT ESTIMATION AND EVALUATION** | **(9)** |
| An overview of project planning -project Evaluation –Selection Of Appropriate Project Objectives- Software Effort Estimation Techniques, Function Point Analysis-Object Point-COCOMO. | |
| **UNIT III - ACTIVITY PLANNING AND SCHEDULING** | **(9)** |
| Sequencing and scheduling activities – Objectives of planning – Forward pass and backward pass – Scheduling – PERT techniques – CRM. | |
| **UNIT IV - RISK MANAGEMENT AND MONITORING** | **(9)** |
| Creating Framework – Decision making – cost Monitoring – Types of Risk – Risk managing - Risk Planning and controlling. | |
| **UNIT V - MANAGING TEAM PROJECT** | **(9)** |
| Team structure – Project tracking - Managing the contract – change control – Team management – Communication – Software Configuration Management-Case Study: PMBOK , Agile Development | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOKS:**

1. Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management" , Sixth Edition, Tata McGraw Hill, New Delhi, 2017.
2. Pressman R S & Bruce R Maxhim, "Software Engineering - A Practitioner's Approach", 9th Edition, Tata McGraw Hill, 2023.

**REFERENCES:**

1. Robert K Wysocki "Effective Project Management, Traditional, Agile, Extreme, Hybrid", John Wiley & Sons Inc, 2019.
2. Hans-Bernd Kittlaus , Samuel A. Fricker, "Software Product Management: The ISPMA-Compliant Study Guide and Handbook",2018.
3. Gopalaswamy Ramesh, "Managing Global Software Projects: How to Lead Geographically Distributed Teams, Manage Processes and Use Quality Models", 2017.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
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| **CO (W.A)** | **3** | **3** | **3** | **3** | | | | | **3** | | **3** | | **3** | **3** |

| 22ITX54-SOFTWARE TESTING TOOLS AND TECHNIQUES<br>*(Common to 22AIX54,22CSX54,22CCX54,22CIX52)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE :NIL**

| | |
|---|---|
| **Course Objective:** | To equip students with the knowledge necessary to effectively utilize software testing tools and techniques in real-world software development environments. |

| **Course Outcomes**<br>The students will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply the knowledge of software testing fundamentals to a real-world problem | Ap | 30% |
| CO2 | Analyze various software testing levels | An | 20% |
| CO3 | Make use of structured and analytical testing approaches to ensure thorough testing | Ap | 30% |
| CO4 | Identify quality testing processes and tools in projects | An | 20% |
| CO5 | Use WinRunner tool to perform automated testing | Ap | Internal Assessment |

| **UNIT I – INTRODUCTION** | **(9)** |
|---|---|
| Introduction – The Testing process – Measurement of Testing - Basic Terminology Related to Software Testing - Testing Life Cycle – Principles of Testing – Limitations of Testing – Testing tools, techniques and metrics. | |
| **UNIT II - LEVELS OF TESTING** | **(9)** |
| Unit Testing – Integration Testing – System Testing – Acceptance Testing – Object Oriented Testing – Automated Testing. | |
| **UNIT III - STRUCTURED AND ANALYTICAL TESTING** | **(9)** |
| Structure-Based Testing: Introduction - Condition Coverage - Decision Condition Coverage - Modified Condition/Decision Coverage (MC/DC) - Multiple Condition Coverage - Path Testing - APT Testing; Analytical Techniques: Static Analysis - Dynamic Analysis. | |
| **UNIT IV - QUALITY TESTING AND TOOLS** | **(9)** |
| Quality Characteristics for technical testing: Security - Reliability - Efficiency – Maintainability - Portability - sample questionnaire; Test tools and Automation: Test automation project - Specific test tools: Fault Seeding and Fault Injection Tools – Performance Testing and Monitoring Tools – Tools for Web Testing. | |

| UNIT V - SOFTWARE TESTING TOOL | (9) |
|---|---|
| Need for Automated Testing Tool - Performance Testing Tools – WinRunner: Testing an application using WinRunner – Test Script Language (TSL) – GUI MAP File – Synchronization of Test Cases – Data-Driven Testing – Rapid Test Script Wizard – Mapping Custom Object to a Standard Classes – Checking GUI Objects. Silk Test: Architecture – Testing an Application Using Silk Test – The 4Test Scripting Language – Checkpoints – Data-Driven Test Cases. | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOKS:**

1. Rajiv Chopra, "Software Testing: A Self-Teaching Introduction", David Pallai- Mercury Learning and Information Publisher, 2018.
2. Jamie L Mitchell, Rex Black, "Advanced Software Testing: Guide to the ISTQB Advanced Certification as an Advanced Technical Test Analyst", 2nd Edition, Vol 3, 2015.

**REFERENCES:**

1. Dr.K.V.K.K Prasad, "Software Testing Tools", Dream tech 2012.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
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| CO (W.A) | 3 | 3 | | | 3 | | | | | | | | | 3 |

| 22ITX55-SOFTWARE QUALITY ASSURANCE<br>*(Common to 22AIX56,22CSX55,22CCX56,22CIX53)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE :NIL** | | | | | |
| **Course Objective:** | Acquire knowledge of software quality assurance principles, practices and standards | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Analyze the common challenges which affect software quality | An | 20% |
| CO2 | Apply the knowledge of SQA Components and Project Life Cycle | Ap | 20% |
| CO3 | Establish Software Quality Infrastructure through implementation of modern Engineering and IT tools | An | 20% |
| CO4 | Analyze the various metrics used in quality management | An | 20% |
| CO5 | Apply SQA Standards, Certifications and Assessments | Ap | 20% |

| **UNIT I – INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE** | **(9)** |
|---|---|
| Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall"s quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans. | |
| **UNIT II - SQA COMPONENTS AND PROJECT LIFE CYCLE_** | **(9)** |
| Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management. | |
| **UNIT III - SOFTWARE QUALITY INFRASTRUCTURE** | **(9)** |
| Procedures and work instructions - Templates - Checklists – 3S developmenting - Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval. | |
| **UNIT IV - SOFTWARE QUALITY MANAGEMENT & METRICS** | **(9)** |
| Project process control – Computerized tools - Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model. | |

| UNIT V - SQA STANDARDS, CERTIFICATIONS & ASSESSMENTS | (9) |
|---|---|
| Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – IEEE 1012 & 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems. | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOK:**

1. Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.

**REFERENCES:**

1. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 1997.
2. Mordechai Ben-Menachem, "Software Quality: Producing Practical Consistent Software", International Thomson Computer Press, 1997.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
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| **CO (W.A)** | | **3** | | **3** | **3** | **3** | **3** | **3** | **3** | | | | **3** | **3** |

| 22ITX56-SERVICE ORIENTED ARCHITECTURE<br>*(Common to 22AIX57,22CSX56,22CCX57)* | | | | |
|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE :NIL** | | | | |
| **Course Objective:** | To learn service-oriented analysis and design for developing SOA based application | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply XPath and XQuery to navigate and query XML documents efficiently | **Ap** | 30% |
| CO2 | Apply SOA principles and technologies to analyze real-world case studies across different industries. | **Ap** | 30% |
| CO3 | Analyze the impact of SOA on business process automation and agility | **An** | 20% |
| CO4 | Design service models and business process flows adhering to SOA principles and industry standards. | **Ap** | 20% |
| CO5 | Implement and demonstrate SOA-based applications using Microservices Architecture. | **An** | Internal Assessment |

| **UNIT I – XML** | **(9)** |
|---|---|
| XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath – XML Transformation and XSL – Xquery | |
| **UNIT II - EXPLORING SOA** | **(9)** |
| SOA Fundamentals: Evolution of SOA – SOA – Characteristics of SOA – Concept of a service in SOA – Basic SOA architecture -Web Services Introduction - Protocols: SOAP-REST – Web Security - Enterprise Software models - IBM on Demand operating environment. | |
| **UNIT III - SOA PRINCIPLES AND DESIGN** | **(9)** |
| Business centric SOA and its benefits – Principles of Service Orientation-SOA layers-SOA Patterns -Basic modeling building blocks –Service models for legacy application integration and enterprise integration – Enterprise solution assets (ESA). | |
| **UNIT IV - BUILDING SOA BASED APPLICATIONS** | **(9)** |
| Introduction to SAAS-Microservices Architecture-SOA Limitations - WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EE. | |

| UNIT V - SERVICE ORIENTED ANALYSIS AND DESIGN | (9) |
|---|---|
| SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines — Service design – Business process design – Case Study | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOKS:**

1. Thomas Erl,"Service Oriented Architecture Concepts Technology & Design", Pearson Education Limited, 2015.
2. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005.

**REFERENCES:**

1. Mark Endrei, Jenny Ang, Ali Arsanjani, Sook Chua, Philippe Comte, Pål Krogdahl, Min Luo, Tony Newling ,"Patterns: ServiceOriented Architecture and Web Services", 2004.
2. Mark D. Hansen "SOA Using Java™ Web Services", 2007.
3. Thomas Erl PHI "SOA Design Pattern", 2009.
4. Thomas Erl, Benjamin Carlyle, Cesare Pautasso, Raj Balasubramanian ,"SOA with REST: principles, patterns & constraints for building enterprise solutions with REST", 2013.

**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
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| 4 | 3 | | | | | | | | | | | | | 3 |
| 5 | 3 | | 3 | | | | | | | 3 | | | | 3 |
| **CO (W.A)** | **3** | **3** | **3** | | | | | | | **3** | | | | **3** |

| 22ITX57-IT OPERATIONS<br>*(Common to 22AIX55,22CSX57,22CCX55,22CIX55)* | | | | | |
|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |
| **PRE-REQUISITE :NIL** | | | | | |
| **Course Objective:** | To provide knowledge on IT Operation Management and Service Management. | | | | |

| **Course Outcomes**<br>The Student will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Analyze the fundamental components and processes involved in IT operations | **An** | 30% |
| CO2 | Analyze existing health and safety regulations applicable to IT operations environments | **An** | 30% |
| CO3 | Apply organizational theories to evaluate and improve the structure and efficiency of IT operations within an organization | **Ap** | 20% |
| CO4 | Analyze fundamental concepts and principles of information security in IT environments | **An** | 20% |
| CO5 | Develop strategies for leveraging Microsoft 365 to enhance productivity, collaboration, and efficiency within IT operations. | **Ap** | Internal Assessment |

| **UNIT I – IT OPERATIONS** | **(9)** |
|---|---|
| IT Operation Definition - Roles & Responsibilities of IT Operations - IT Monitoring - IT operations Management - Responsibilities of IT operations Management. IT Service Management: IT Service Management Best Practices - The Service Life Cycle( Service Strategy - Service Design - Service Transition - Service Operation - Continual Service Improvement) Functions of IT Service Management (Incident Management, Event Management, Request fulfillment, Problem Management, Change Management, Availability Management - The Service Desk) - Escalation & Governance Management. | |
| **UNIT II - HEALTHY SAFE AND SECURE WORKING ENVIRONMENT & ETIQUETTE** | **(9)** |
| Health and Safety Essentials - Control and Management Systems - Facilities Management and Ergonomics - Managing Equipment - Managing Material. Etiquette: Professionalism in Relationships - First Impressions - Conducting Yourself in a Working Environment - Make Your Work Place Healthy - Dinning Etiquette - Elevator Etiquette - Cafeteria Etiquette - Meeting Etiquette - Telephone Etiquette - Dealing with Difficult People and Conflicting Situations. | |
| **UNIT III - ITIL** | **(9)** |
| Introduction – Understanding ITIL Guiding Principles in an Organization–Optimize and Automate – Four Dimensions of Service Management – Key Activities of the Service Value Chain | |
| **UNIT IV - IT INFRASTRUCTURE & INFORMATION SECURITY** | **(9)** |
| Definition - Components of IT Infrastructure ( Hardware, Software, Network) - Types of IT infrastructure (Traditional, Cloud, Hyperconverged)- Risk, Response and Recovery: Risk Management and Information Security - The Risk Management Process - Business Continuity Management - Backing Up Data and | |

| |
|---|
| Applications - Incident Handling - Recovery From a Disaster. |
| **UNIT V - AMS & TOOLS** **(9)** |
| Introduction – Support Models – Activities Type – Audits – Microsoft 365 – Domain Management – Licensing – Managing Teams – Meeting Policies – Messaging Policies |
| **TOTAL (L:45) : 45 PERIODS** |

**REFERENCES:**


1. John Sansbury, Ernest Brewster, Aidan Lawes, Richard Griffiths, "IT Service Management :Support for your ITSM Foundation Exam",March 2016.
2. Elearn ,"Managing Health, Safety and Working Environment ",Revised Edition(Management Extra), 1st Edition, 2017 .
3. Vivek Bindra ,"Everything About Corporate Etiquette" , Bloomsbury India,2015.
4. AXELOS, "ITIL: Foundation ITIL 4 Edition", 2019
5. David Kim, Michael G. Solomon,"Fundamentals of Information Systems Security", Jones & Bartlett Learning, 3rd Edition.
6. https://docs.microsoft.com/en-us/learn/m365


**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
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| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
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| **CO (W.A)** | **3** | **3** | | | | **3** | **3** | **3** | | | **3** | | | **3** |

| 22ITX58-PRODUCT LIFE CYCLE MANAGEMENT<br>*(Common to 22AIX58,22CSX58,22CCX58,22CIX58)* | | | | |
|---|---|---|---|---|
| | **L** | **T** | **P** | **C** |
| | **3** | **0** | **0** | **3** |

**PRE-REQUISITE :NIL**

| **Course Objective:** | To comprehend the foundations, implementation, business benefits, integration with product management strategy, and application in service-related industries |
|---|---|

| **Course Outcomes**<br>The students will be able to | | **Cognitive Level** | **Weightage of COs in End Semester Examination** |
|---|---|---|---|
| CO1 | Apply Product Life Cycle Management **(**PLM) and integrate with lifecycle phases | Ap | 30% |
| CO2 | Analyze global impacts of PLM on product development | An | 20% |
| CO3 | Examine PLM deployment stages for decision-making | An | 30% |
| CO4 | Interpret and use PLM strategies for enhancing productization | An | 20% |
| CO5 | Develop a project using Scrum | Ap | Internal Assessment |

| **UNIT I – INTRODUCTION TO PRODUCT LIFECYCLE MANAGEMENT** | **(9)** |
|---|---|
| Introduction to PLM, Fundamentals of PLM- Objective of PLM - Activities of PLM - Joined-up and Holistic Approach - Generic Product Lifecycle Phases, PLM Grid, Components of PLM Grid, Why PLM, How PLM. | |
| **UNIT II - COMPLEX AND CHANGING ENVIRONMENT** | **(9)** |
| Changes and Interconnections, Macroeconomic and Geopolitical Changes, Environmental and Social Changes, Corporate Changes, Technological Changes, Product Changes, The Result and the Requirements. | |
| **UNIT III - PLM DEPLOYMENT AND BUSINESS BENEFITS** | **(9)** |
| Deployment Stages of PLM, PLM maturity model, Realization stage of the project, Accomplishing change, Business benefits of a PLM system - Factors leading to PLM, Benefits of the PLM system, Improving the productivity of labour, Costs of quality, PLM and data warehousing as a tool to support decision-making. | |
| **UNIT IV - SERVICE INDUSTRY AND PLM** | **(9)** |
| Introduction to service, Further productization, Making a service, PLM in service business - PLM challenges in service business, Services modularized, Making items out of product functions, IT specifically variable product. | |

| UNIT V - PRODUCT AND PRODUCT MANAGEMENT STRATEGY AS A PART OF BUSINESS STRATEGY | (9) |
|---|---|
| Product lifecycle management as a business strategy tool, From changes in the business environment to product strategy, Making a product strategy, Product management strategy, Time to market, Time to react, Time to volume, Time to service, Electronic business and PLM, Case Study: Scrum Framework | |
| **TOTAL (L:45) : 45 PERIODS** | |

**TEXT BOOKS:**


1. John Stark, "Product Lifecycle Management: 21st Century Paradigm for Product Realisation", 2nd Edition ,Springer Publisher, 2011.
2. Antti Saaksvuori and Anselmi Immonen, "Product Lifecycle Management", 3rd Edition,Springer Publisher, 2008


**REFERENCES:**


1. Uthayan Elagovan, "Product Lifecycle Management (PLM): A Digital Journey Using Industrial Internet of Things (IIoT)" , July 2020.
2. Ivica Crnkovic, Ulf Asklund and Annita Persson Dahlqvist, "Implementing and Integrating ProductData Management and Software Configuration Management", Art ech House Publishers, 2003


**Mapping of COs with POs / PSOs**

| COs | POs | | | | | | | | | | | | PSOs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
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| **CO (W.A)** | **3** | **3** | **3** | | **3** | | | | **2** | **3** | | | **3** | **3** |