# K.L.N. COLLEGE OF ENGINEERING

## Pottapalayam, Sivagangai District

**(An Autonomous Institution, Affiliated to Anna University, Chennai)**

Estd: 1994

## FINAL YEAR

## CURRICULUM AND SYLLABUS

### REGULATIONS 2020

### For under Graduate Program

# B.E. COMPUTER SCIENCE AND ENGINEERING

## CHOICE BASED CREDIT SYSTEM

**(For the students admitted in the academic year 2023-2024)**

**K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM**

**(An Autonomous Institution, Affiliated to Anna University, Chennai)**

## VISION OF THE INSTITUTION

To become a Premier Institute of National Repute by Providing Quality Education, Successful Graduation, Potential Employability and Advanced Research & Development through Academic Excellence.

## MISSION OF THE INSTITUTION

To Develop and Make Students Competent Professional in the Dynamic Environment in the field of Engineering, Technology and Management by emphasizing Research, Social Concern and Ethical Values through Quality Education System.

## VISION OF THE DEPARTMENT

To evolve in the field of Computer Science & Engineering through sustainable technical education with innovative research and to foster competent professionals to serve and lead the society

## MISSION OF THE DEPARTMENT

- Imparting demand based proficient education through quality teaching – learning process in tune with the interdisciplinary needs of global work environment.
- Inculcating the attitude of continuous learning through industry institution interaction, consultancy and research activities.
- Cultivating professionalism, ethics and integrity of character for positive contributions to society.

## Program Educational Objective (PEOs)

**PEO 1:** Contribute effectively to the society by applying principles of Computer Science and Engineering for analyzing the real world problems to produce optimal and sustainable technical solutions.

**PEO 2:** Sustain as good professionals by pursuing career / advanced studies and practice innovation in emerging technologies and current trends through lifelong learning.

**PEO 3:** Build professionalism, team work, effective communication, ethical values and leadership qualities**.**

## Program Specific Outcomes (PSOs)

**PSO 1:** Ability to apply good analytical, design and implementation skills to formulate and solve scientific and business applications pertaining to Algorithms, Computer Systems, Networks, Security, Data Analytics and Artificial Intelligence.

**PSO 2:** Ability to update knowledge continuously in various domains like Virtualization, Mobile Application Development, Data Visualization, Machine Learning and Technologies like Storage, Computing, Communication to meet the industry requirements.

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## PROGRAM OUTCOMES

**PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

**PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

**PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

**PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

**PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

**PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7)

**PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

**PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

**PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

**PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

**PO11: Life- Long Learning:**

Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

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## CATEGORY OF COURSES

i. **Humanities and Social Sciences (HS) Courses** include Technical English, Environmental Science and Engineering, Engineering Ethics and human values, Communication Skills and Management courses.

ii. **Basic Sciences (BS**) **Courses** include Mathematics, Physics, and Chemistry.

iii. **Engineering Sciences (ES) Courses** include Engineering practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Computer Engineering / Instrumentation etc.

iv. **Professional Core (PC) Courses** include the core courses relevant to the chosen programme of study.

v. **Professional Elective (PE) Courses** include the elective courses relevant to the chosen programme of study.

vi. **Open Elective (OE) Courses** include courses from other branches which a student can choose from the list specified in the curriculum of the students B.E. / B.Tech. Programmes.

vii. **Employability Enhancement Courses (EEC)** include Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.

viii. **Mandatory (MC) courses** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc

# K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM – 630 612

**(An Autonomous Institution, Affiliated to Anna University, Chennai)**

**B.E. COMPUTER SCIENCE AND ENGINEERING**

**REGULATIONS 2020**

**CHOICE BASED CREDIT SYSTEM**

## SEMESTER VII

| S. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | 20CS701 | Data Analytics | PC | 3 | 3 | 0 | 0 | 3 |
| 2 | 20CS702 | Artificial Intelligence | PC | 3 | 3 | 0 | 0 | 3 |
| 3 | | Professional Elective V | PE | 3 | 3 | 0 | 0 | 3 |
| 4 | | Professional Elective VI | PE | 3 | 3 | 0 | 0 | 3 |
| 5 | | Open Elective II | OE | 3 | 3 | 0 | 0 | 3 |
| 6 | | Management Elective | HS | 3 | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | |
| 7 | 20CS7L1 | Data Analytics Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8 | 20CS7L2 | Mini Project | EEC | 4 | 0 | 0 | 4 | 2 |
| **TOTAL** | | | | **26** | **18** | **0** | **8** | **22** |

## SEMESTER VIII

| S. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **PRACTICAL** | | | | | | | | |
| 1 | 20CS8L1 | Project Work | EEC | 20 | 0 | 0 | 20 | 10 |
| **TOTAL** | | | | **20** | **0** | **0** | **20** | **10** |

## PROFESSIONAL ELECTIVE (PE) : VERTICALS

| Vertical I | Vertical II | Vertical III | Vertical IV | Vertical V |
|---|---|---|---|---|
| **Cloud Computing and Data Center Technologies** | **Cyber Security and Data Privacy** | **Full Stack Development for IT** | **Innovative Computing Technologies** | **Artificial Intelligence and Machine Learning** |
| Cloud Computing Techniques | Social Network Analysis | Principles of Programming Languages | Data and Information Security | Business Intelligence System |
| Data Warehousing and Data Mining | Cyber Physical Systems | UI and UX Design | Quantum Computing | Data Communication and Computer Networks |
| Cloud Services Management | Digital and Mobile Forensics | Cloud Services Management | Neural Networks and Deep Learning | Neural Networks and Deep Learning |
| Software Defined Networks | Cryptocurrency and Blockchain Technologies | Software Testing and Automation | Cryptocurrency and Blockchain Technologies | Robotic Process Automation |
| Storage Technologies | Web Application Security | Web Application Security | Cyber Security | Text and Speech Analysis |
| Computer Vision | Engineering Secure Software Systems | Information Retrieval Techniques | 3D Printing and Design | Fuzzy Logic and Applications |
| Security and Privacy in Cloud | Security and Privacy in Cloud | DevOps | Agile Methodologies | Ethics and AI |
| Reinforcement Learning Techniques | Malware Analysis | Reinforcement Learning Techniques | Virtual Reality and Augmented Reality | Health Care Analytics |

## PROFESSIONAL ELECTIVES

### Vertical 1: Cloud Computing and Data Centre Technologies

| S. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 20CSV11 | Cloud Computing Techniques | PE | 4 | 2 | 0 | 2 | 3 |
| 2 | 20CSV21 | Data Warehousing and Data Mining | PE | 3 | 3 | 0 | 0 | 3 |
| 3 | 20CSV31 | Cloud Services Management | PE | 3 | 3 | 0 | 0 | 3 |
| 4 | 20CSV41 | Software Defined Networks | PE | 3 | 3 | 0 | 0 | 3 |
| 5 | 20ADV51 | Storage Technologies | PE | 3 | 3 | 0 | 0 | 3 |
| 6 | 20CSV61 | Computer Vision | PE | 3 | 3 | 0 | 0 | 3 |
| 7 | 20SCV71 | Security and Privacy in Cloud | PE | 3 | 3 | 0 | 0 | 3 |
| 8 | 20ITV81 | Reinforcement Learning Techniques | PE | 3 | 3 | 0 | 0 | 3 |

### Vertical 2: Cyber Security and Data Privacy

| S. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 20CSV12 | Social Network Analysis | PE | 3 | 3 | 0 | 0 | 3 |
| 2 | 20ITV22 | Cyber Physical Systems | PE | 3 | 3 | 0 | 0 | 3 |
| 3 | 20SCV32 | Digital and Mobile Forensics | PE | 4 | 2 | 0 | 2 | 3 |
| 4 | 20ITV42 | Cryptocurrency and Block chain Technologies | PE | 3 | 3 | 0 | 0 | 3 |
| 5 | 20SCV52 | Web Application Security | PE | 3 | 3 | 0 | 0 | 3 |
| 6 | 20CSV62 | Engineering Secure Software Systems | PE | 3 | 3 | 0 | 0 | 3 |
| 7 | 20SCV71 | Security and Privacy in Cloud | PE | 3 | 3 | 0 | 0 | 3 |
| 8 | 20SCV82 | Malware Analysis | PE | 4 | 2 | 0 | 2 | 3 |

### Vertical 3: Full Stack Development for IT

| S. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 20ITV13 | Principles of Programming Languages | PE | 3 | 3 | 0 | 0 | 3 |
| 2 | 20CSV23 | UI and UX Design | PE | 4 | 2 | 0 | 2 | 3 |
| 3 | 20CSV31 | Cloud Services Management | PE | 3 | 3 | 0 | 0 | 3 |
| 4 | 20ITV43 | Software Testing and Automation | PE | 3 | 3 | 0 | 0 | 3 |
| 5 | 20SCV52 | Web Application Security | PE | 3 | 3 | 0 | 0 | 3 |
| 6 | 20ITV63 | Information Retrieval Techniques | PE | 3 | 3 | 0 | 0 | 3 |
| 7 | 20ITV73 | DevOps | PE | 4 | 2 | 0 | 2 | 3 |
| 8 | 20ITV81 | Reinforcement Learning Techniques | PE | 3 | 3 | 0 | 0 | 3 |

## Vertical 4: Innovative Computing Technologies

| S. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 20ADV14 | Data and Information Security | PE | 3 | 3 | 0 | 0 | 3 |
| 2 | 20ITV24 | Quantum Computing | PE | 3 | 3 | 0 | 0 | 3 |
| 3 | 20ADV34 | Neural Networks and Deep Learning | PE | 4 | 2 | 0 | 2 | 3 |
| 4 | 20ITV42 | Cryptocurrency and Block chain Technologies | PE | 3 | 3 | 0 | 0 | 3 |
| 5 | 20SCV54 | Cyber Security | PE | 3 | 3 | 0 | 0 | 3 |
| 6 | 20ITV64 | 3D Printing and Design | PE | 3 | 3 | 0 | 0 | 3 |
| 7 | 20CSV74 | Agile Methodologies | PE | 3 | 3 | 0 | 0 | 3 |
| 8 | 20CSV84 | Virtual Reality and Augmented Reality | PE | 3 | 3 | 0 | 0 | 3 |

## Vertical 5: Artificial Intelligence and Machine Learning

| S. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 20ADV15 | Business Intelligence System | PE | 3 | 3 | 0 | 0 | 3 |
| 2 | 20ADV25 | Data Communication and Network | PE | 3 | 3 | 0 | 0 | 3 |
| 3 | 20ADV34 | Neural Network and Deep Learning | PE | 4 | 2 | 0 | 2 | 3 |
| 4 | 20ADV45 | Robotic Process Automation | PE | 3 | 3 | 0 | 0 | 3 |
| 5 | 20ADV55 | Text and Speech Analysis | PE | 3 | 3 | 0 | 0 | 3 |
| 6 | 20ITV65 | Fuzzy Logic and Applications | PE | 3 | 3 | 0 | 0 | 3 |
| 7 | 20ADV75 | Ethics and AI | PE | 3 | 3 | 0 | 0 | 3 |
| 8 | 20ADV85 | Health Care Analytics | PE | 3 | 3 | 0 | 0 | 3 |

## MANAGEMENT ELECTIVE

| S.No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 20HS5A1 | Management Concepts and Organizational Behaviour | HS | 3 | 3 | 0 | 0 | 3 |
| 2. | 20HS5A2 | Industrial Marketing | HS | 3 | 3 | 0 | 0 | 3 |
| 3. | 20HS6A1 | Intellectual Property Rights | HS | 3 | 3 | 0 | 0 | 3 |
| 4. | 20HS6B1 | Project Management and Entrepreneurship | HS | 3 | 3 | 0 | 0 | 3 |
| 5. | 20HS7A2 | Total Quality Management | HS | 3 | 3 | 0 | 0 | 3 |
| 6. | 20HS8A1 | Human Relations at Work | HS | 3 | 3 | 0 | 0 | 3 |
| 7. | 20HS8B2 | Economics for Engineers | HS | 3 | 3 | 0 | 0 | 3 |

## SEMESTER VII
## OPEN ELECTIVE II

| S. No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1 | 20OE106 | Fundamentals of Product Design | OE | 3 | 3 | 0 | 0 | 3 |
| 2. | 20OE108 | Industrial Safety Practices | OE | 3 | 3 | 0 | 0 | 3 |
| 3. | 20OE206 | Fundamentals of Fibre Optics and Lasers | OE | 3 | 3 | 0 | 0 | 3 |
| 4. | 20OE305 | Fundamentals of Image Processing | OE | 3 | 3 | 0 | 0 | 3 |
| 5. | 20OE306 | Consumer Electronics | OE | 3 | 3 | 0 | 0 | 3 |
| 6. | 20OE308 | Introduction to VLSI Technology | OE | 3 | 3 | 0 | 0 | 3 |
| 7. | 20OE507 | Concepts of Ethical Hacking | OE | 3 | 3 | 0 | 0 | 3 |
| 8. | 20OE605 | Lean Manufacturing Practices | OE | 3 | 3 | 0 | 0 | 3 |
| 9. | 20OE706 | Industrial computer Network | OE | 3 | 3 | 0 | 0 | 3 |
| 10. | 20OE708 | Instrumentation for Agro food industry | OE | 3 | 3 | 0 | 0 | 3 |

**OPEN ELECTIVE - II (VII SEMESTER) - offered to other Departments**

| S.No. | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 20OE405 | Machine Learning Techniques | OE | 3 | 3 | 0 | 0 | 3 |
| 2. | 20OE406 | Java Script Programming | OE | 3 | 3 | 0 | 0 | 3 |
| 3. | 20OE407 | Computer Graphics | OE | 3 | 3 | 0 | 0 | 3 |
| 4. | 20OE408 | Essentials of Data Analytics | OE | 3 | 3 | 0 | 0 | 3 |

| | | L | T | P | C |
|---|---|---|---|---|---|
| **20CS701** | **DATA ANALYTICS** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To understand the basic concepts of Data Analytics.
- To learn the data preprocessing techniques
- To Handle missing data in the real world data sets by choosing appropriate methods
- To apply the classification and clustering algorithms
- To apply the intelligent Data Analysis Techniques
- To gain knowledge on Hadoop related tools

**PRE-REQUISITE:**
Course Code: 20CS604
Course Name: Machine Learning

**UNIT - I INTRODUCTION 9**

Knowledge domains of Data Analysis, Understanding structured and unstructured data, data analytic tools, applications of data analytics, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization.

**UNIT - II DATA PREPROCESSING 9**

Data Preprocessing : Data Cleaning – Data Integration - Data Reduction – Data Transformation Handling Missing Data: Introduction to Missing data, Traditional methods for dealing with missing data, Maximum Likelihood Estimation – Basics, Missing data handling, improving the accuracy of analysis

**UNIT - III CLASSIFICATION AND CLUSTERING 9**

Statistical Methods: Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics.

**UNIT - IV INTELLIGENT DATA ANALYSIS 9**

Analysis of Time Series : Linear and Non Linear Systems Analysis, Neural Networks : Fundamentals – Back Propagation Neural Network – Fuzzy Logic : Basics of Fuzzy Sets and Fuzzy Logic - Genetic Algorithms.

**UNIT - V HADOOP FRAMEWORKS 9**

HADOOP – HDFS concepts, Algorithms using MapReduce, Introduction to NoSQL,Cassandra, Pig, Hive.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. John Wiley & Sons, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services (Editor),2015
2. Craig K. Enders, “Applied Missing Data Analysis”, The Guilford Press, 2010.
3. Michael Berthold, David J. Hand, —Intelligent Data Analysis, Springer, Second Edition, 2007.

**REFERENCES:**

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Wiley, 2012
2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : Data Analytics** | | | | | | | | | | | **Course Code : 20CS701** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | | | | | | | | | | **Unit** | **K-CO** | **POs** | **PSOs** |
| C401.1 | Explain the basic concepts of Data Analytics | | | | | | | | | | 1 | K2 | 1, 2, 8, 9 | 1 |
| C401.2 | Describe the Data Analysis preprocessing Techniques. | | | | | | | | | | 2 | K2 | 1, 2, 8,9, 10 | 1 |
| C401.3 | Explain about how missing data will be handled during preprocessing | | | | | | | | | | 2 | K2 | 1, 2, 8,9, 10 | 1 |
| C401.4 | Apply the Classification and Clustering algorithms for real time applications | | | | | | | | | | 3 | K3 | 1,2,3,8, 9,12 | 1 |
| C401.5 | Apply intelligent analytics techniques like neural networks, fuzzy and genetic algorithms for real time analytics applications | | | | | | | | | | 4 | K3 | 1, 2, 3,8,9 | 1 |
| C401.6 | Explain the Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics | | | | | | | | | | 5 | K2 | 1,2,5, 8,9, 12 | 1,2 |
| **CO-PO Mapping** | | | | | | | | | | | | | | |
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| C401.1 | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 1 | - |
| C401.2 | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | 1 | - |
| C401.3 | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | 1 | - |
| C401.4 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | - | 1 | 1 | - |
| C401.5 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | - | 1 | 1 | - |
| C401.6 | 2 | 1 | - | - | 1 | - | - | 1 | 1 | - | - | 1 | 1 | 2 |

| 20CS702 | ARTIFICIAL INTELLIGENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

**PRE-REQUISITE: NIL**

**UNIT - I INTRODUCTION** **9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

**UNIT - II PROBLEM SOLVING METHODS** **8**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games

**UNIT - III KNOWLEDGE REPRESENTATION** **9**

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

**UNIT - IV SOFTWARE AGENTS** **9**

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems

**UNIT - V APPLICATIONS** **9**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2011.
2. I. Bratko, Prolog: Programming forArtificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

**REFRENCES:**

1. M. TimJones, ArtificialIntelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J.Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish,Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.
4. Gerhard Weiss, Multi Agent Systems, Second Edition, MIT Press, 2013.
5. David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

**OUTCOMES:**
**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : ARTIFICIAL INTELLIGENCE** | | **Course Code : 20CS702** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| C402.1 | Explain the concept of intelligent agent and various problem solving approaches. | 1 | K2 | 1, 2, 8,9,10 | 1 |
| C402.2 | Determine the appropriate search algorithms for any AI problem | 2 | K2 | 1, 2, 8,9,10 | 1 |
| C402.3 | Discuss the suitable agent strategy to solve a given problem. | 2 | K2 | 1, 2, 8,9,10 | 1 |
| C402.4 | Illustrate first order and predicatelogic for a given problem | 3 | K3 | 1, 2, 3, 8,9,10 | 1 |
| C402.5 | Explain software agents components to solve a problem | 4 | K2 | 1, 2, 8,9,10 | 1 |
| C402.6 | Summarize the different applications that use Artificial Intelligence | 5 | K2 | 1, 2, 8,9,10 | 1 |

CO-PO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C402.1 | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |
| C402.2 | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |
| C402.3 | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |
| C402.4 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |
| C402.5 | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |
| C402.6 | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |

| 20CS7L1 | DATA ANALYTICS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

- To implement numerical and statistical analysis on various data sources
- To apply data pre-processing techniques
- To implement linear regression technique on numeric data for prediction
- To execute classification and clustering algorithms on different datasets
- To implement and evaluate the performance of KNN algorithm on different datasets

**PRE-REQUISITE: NIL**

1. Write a Program to perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) using in R.
2. Implement a program for statistical operations such as Mean, Median, Mode and Standard deviation.
3. Write a Program to Read and Write operations on different types of Files (csv, xls, txt etc).
4. Implement data pre-processing operations
    a. Handling Missing data
    b. Min-Max normalization
5. Write a Program to implement Principal Component Analysis for House dataset.
6. Implement simple linear regression program to predict the future values and analyze the goodness of fit.
7. Write a Program to implement Simple Naïve Bayes classification algorithm for predicting the weather forecast.
8. Write a Program to implement K-Means clustering operation and visualize for iris dataset.
9. Write a Program to diagnose any disease using KNN classification and plot the results.
10. Create the following visualization plots for the movie recommendations system
    a. Bar, Pie, Box and scatter plot.
    b. Find the outliers using plot.
11. Mini Project

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

Software Requirements: R / Python

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| Course Name : Data Analytics Laboratory | | Course Code : 20CS7L1 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Ex.No.** | **K-CO** | **POs** | **PSOs** |
| C406.1 | Build numerical and statistical analysis on various data sources | 1,2 | K3 | 1,2,3,8,9,10, 12 | 1,2 |
| C406.2 | Apply data preprocessing and dimensionality reduction methods on raw data | 3 | K3 | 1,2,3,8,9,10, 12 | 1,2 |
| C406.3 | Apply the different regression technique on given dataset | 4,5 | K3 | 1,2,3,8,9,10, 12 | 1,2 |
| C406.4 | Apply the classification and clustering algorithms on different datasets | 6,7,8 | K3 | 1,2,3,8,9,10, 12 | 1,2 |
| C406.5 | Apply appropriate visualization techniques for presenting the data | 9 | K3 | 1,2,3,8,9,10, 12 | 1,2 |
| C406.6 | Solve the real world data analysis problems. | 10 | K4 | 1,2,3,4,5,6,8, 9,10,11,12 | 1,2 |

**CO-PO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C406.1 | 3 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | - | 2 | 1 | 2 |
| C406.2 | 3 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | - | 2 | 1 | 2 |
| C406.3 | 3 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | - | 2 | 1 | 2 |
| C406.4 | 3 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | - | 2 | 1 | 2 |
| C406.5 | 3 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | - | 2 | 1 | 2 |
| C406.6 | 3 | 3 | 2 | 1 | 1 | 1 | - | 2 | 2 | 2 | 2 | 2 | 1 | 2 |

| 20CS7L2 | MINI PROJECT | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4, works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The first and second review will be evaluated by a thee member internal committee. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on third review's oral presentation and the submission of project report, before the internal examiners which was constituted by the Head of the Department.

**TOTAL:60 PERIODS**

**OUTCOMES:**
**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : Mini Project** | | **Course Code : 20CS7L2** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Experiments** | **K-CO** | **POs** | **PSOs** |
| C407.1 | Identify a problem and its applicability along with suitable domain. | - | K3 | 1,2,3,6,7,8,9, 10, 11,12 | 1,2 |
| C407.2 | Analyze and formulate project modules and identified constraints based on environmental and societal impact. | - | K4 | 1,2,3,4,5,6,7, 8,9,10,11,12 | 1,2 |
| C407.3 | Select efficient tools and methods for designing and implementing project modules. | - | K4 | 1,2,3,4,5,6,7, 8,9,10,11,12 | 1,2 |
| C407.4 | Propose an effective solution for the problem identified with the help of developed methodology and tools | - | K6 | 1,2,3,4,5,6,7, 8,9,10,11,12 | 1,2 |
| C407.5 | Summarize all the modules through effective integration and testing. | - | K5 | 1,2,3,4,5,6,7, 8,9,10,11,12 | 1,2 |
| C407.6 | Illustrate the completed task and compile the project report. | - | K4 | 1,2,3,4,5,6,7, 8,9,10,11,12 | 1,2 |

**CO-PO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C407.1 | 3 | 2 | 1 | - | - | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| C407.2 | 3 | 3 | 2 | 1 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| C407.3 | 3 | 3 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| C407.4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| C407.5 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| C407.6 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |

| PROJECT WORK | L | T | P | C |
|---|---|---|---|---|
| **20CS8L1** | **0** | **0** | **20** | **0** |

**OBJECTIVES:**

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 300 PERIODS**

**OUTCOMES:**
**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : Project Work** | | **Course Code : 20CS8L1** | | |
|---|---|---|---|---|
| **CO** | **Course Outcomes** | **K-CO** | **POs** | **PSOs** |
| C410.1 | Identify a domain and problem by applying required domain knowledge. | K3 | 1,2,3,6,7,8,9,10, 11,12 | 1,2 |
| C410.2 | Analyze and categorize executable project modules including real time project constraints based on environmental and societal impact. | K4 | 1,2,3,4,5,6,7,8, 9,10,11,12 | 1,2 |
| C410.3 | Examine efficient tools and methods for designing and implementing project modules. | K4 | 1,2,3,4,5,6,7,8, 9,10,11,12 | 1,2 |
| C410.4 | Develop effective solution for the problem identified with the help of proposed methodology and tools | K6 | 1,2,3,4,5,6,7,8, 9,10,11,12 | 1,2 |
| C410.5 | Assess all the modules through effective integration, optimization and testing. | K5 | 1,2,3,4,5,6,7,8, 9,10,11,12 | 1,2 |
| C410.6 | Elaborate the completed task and compile the project report. | K4 | 1,2,3,4,5,6,7,8, 9,10,11,12 | 1,2 |

**CO-PO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C410.1 | 3 | 2 | 1 | - | - | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| C410.2 | 3 | 3 | 2 | 1 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| C410.3 | 3 | 3 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| C410.4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| C410.5 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| C410.6 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |

| 20HS7A2 | TOTAL QUALITY MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand TQM Concepts and importance of customers.
- To know about TQM Principles, understand about employee involvement and supplier partnership.
- To understand six sigma, Traditional tools, New tools, Benchmarking and FMEA.
- To understand Control charts, Taguchi Quality Loss function, QFD, TPM and Performance measures.
- To understand the various elements of Quality Management System and Environment Management System.

**PREREQUISITE: NIL**

**UNIT - I INTRODUCTION** 9

Quality – Need, Evolution, Definitions, Dimensions of product and service quality. TQM - Basic concepts, Framework, Contributions of Deming, Juran and Crosby, Barriers. Quality statements, Customer satisfaction, Customer complaints, Customer retention, Costs of quality

**UNIT – II TQM PRINCIPLES** 9

Strategic quality planning, Quality Councils, Employee involvement, Motivation, Empowerment, Teamwork, Quality circles, Recognition and Reward, Performance appraisal, Continuous process improvement - PDCA cycle, 5S, Kaizen, Supplier partnership, Supplier selection, Supplier Rating.

**UNIT – III TQM TOOLS AND TECHNIQUES I** 9

Traditional tools of quality, New management tools. Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT, Bench marking, Reason to bench mark, Bench marking process, FMEA - Stages, Types.

**UNIT – IV TQM TOOLS AND TECHNIQUES** II 9

Control Charts, Process Capability, Quality Function Development (QFD), Taguchi quality loss function, TPM - Concepts, improvement needs, Performance measures.

**UNIT - V QUALITY SYSTEMS** 9

Need for ISO 9000, ISO 9001-2008 Quality System, Elements, Documentation, Quality Auditing, QS 9000 - ISO 14000, Concepts, Requirements and Benefits, TQM Implementation in manufacturing and service sectors.

**TOTAL : 45 PERIODS**

**TEXT BOOKS:**

1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, 5th Edition, 2018.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", Cengage Learning, 8th Edition, 2012.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2nd Edition, 2006.

**REFERENCES:**

1. Joel.E. Ross, “Total Quality Management – Text and Cases”, CRC Press, 5th Edition, 2017.
2. Kiran.D.R, “Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 1st Edition, 2016.
3. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2012.
4. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 1st Edition, 2006.
5. Brue G, "Six Sigma for Managers”, Tata-McGraw Hill, 2nd Edition, 2002.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name :** Total Quality Management | | **Course Code :** 20HS7A2 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| CO1 | Explain basic concepts, TQM framework, Barriers Benefits of TQM and importance of customers | 1 | K2 | 1,5,6,8 -12 | |
| CO2 | Explain the TQM Principles, understand the importance of employee involvement and supplier partnership | 2 | K2 | 1,5, 6,8 -12 | |
| CO3 | Explain the basics of Six Sigma, Traditional tools, New tools , | 3 | K2 | 1,5,6,8 -12 | |
| CO4 | Explain the process of Benchmarking and FMEA. | 3 | K2 | 1,5,6,8 -12 | |
| CO5 | Explain process capability, QFD, TPM, Taguchi quality loss function and performance measures | 4 | K2 | 1,5,6,8 -12 | |
| CO6 | Explain the Quality system ISO 9000, ISO 14000, Audit, Certification process and implementation of TQM in manufacturing and service sectors | 5 | K2 | 1,6,7,8-12 | |

**CO-PO Mapping**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | | 1 | 2 | | 2 | 2 | 2 | 2 | 1 | | | |
| CO2 | 1 | | | | 2 | 2 | | 2 | 2 | 2 | 2 | 1 | | | |
| CO3 | 1 | | | | 2 | 2 | | 2 | 2 | 2 | 2 | 1 | | | |
| CO4 | 1 | | | | 2 | 2 | | 2 | 2 | 2 | 2 | 1 | | | |
| CO5 | 1 | | | | 2 | 2 | | 2 | 2 | 2 | 2 | 1 | | | |
| CO6 | 1 | | | | - | 2 | 2 | 2 | 2 | 2 | 2 | 1 | | | |

| 20HS6A1 | INTELLECTUAL PROPERTY RIGHTS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To get an adequate knowledge on patent and copyright for their innovative research works.
- To use in their career, information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provide further way for developing their idea or innovations.
- To pave the way to catch up Intellectual Property (IP) as an career option.
    - R & D IP Counsel
    - Government Jobs – Patent Examiner
    - Private Jobs
    - Patent agent and Trademark agent
    - Entrepreneur

**PRE-REQUISITE: NIL**

**UNIT - I OVERVIEW OF INTELLECTUAL PROPERTY 9**

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design - Genetic Resources and Traditional Knowledge - Trade Secret - IPR in India: Genesis and development - IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention - 1883, the Berne Convention - 1886, the Universal Copyright Convention - 1952, the WIPO Convention - 1967, the Patent Co-operation Treaty - 1970, the TRIPS Agreement - 1994.

**UNIT - II PATENTS 9**

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non-Patentable Subject Matter - Registration Procedure - Rights and Duties of Patentee - Assignment and license - Restoration of lapsed Patents - Surrender and Revocation of Patents - Infringement - Remedies & Penalties - Patent office and Appellate Board.

**UNIT - III COPYRIGHTS 9**

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works - cinematograph films and sound recordings - Registration Procedure - Term of protection - Ownership of copyright - Assignment and license of copyright - Infringement - Remedies & Penalties - Related Rights - Distinction between related rights and copyrights.

**UNIT - IV TRADEMARKS 9**

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

**UNIT - V OTHER FORMS OF IP & REGISTRATION PROCESS 9**

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical Indication (GI): meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection. IPR registration process through government website-modalities and publications. Plant Variety Protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection. Layout Design Protection: meaning – Procedure for registration, effect of registration and term of protection.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. K.V.Nithyananda, “Intellectual Property Rights: Protection and Management”, Cengage Learning India Pvt. Ltd., 2019.
2. P.Neeraj and D.Khusdeep, “Intellectual Property Rights”, PHI Learning Pvt. Ltd., 2014.

**REFERENCES:**

1. V.K.Ahuja, “Law Relating to Intellectual Property Rights”, Lexis Nexis, Third Edition, 2017.
2. Journal of Intellectual Property Rights (JIPR): NISCAIR
3. Cell for IPR Promotion and Management (http://cipam.gov.in/)
4. World Intellectual Property Organization (https://www.wipo.int/about-ip/en/)
5. Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)

| **Course Name :** Intellectual Property Rights | | **Course Code :** 20HS6A1 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| CO1 | Explain the fundamental aspects of Intellectual property Rights which plays a major role in development and management of innovative projects in industries. | 1 | K2 | 6,7,8,10,11,12 | |
| CO2 | Describe the patents, patent regime in India and abroad and registration aspects. | 2 | K2 | 6,7,8,10,11,12 | |
| CO3 | Describe the copyrights and its related rights and registration aspects. | 3 | K2 | 6,7,8,10,11,12 | |
| CO4 | Explain the trademarks and registration aspects. | 4 | K2 | 6,7,8,10,11,12 | |
| CO5 | Explain the Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects. | 5 | K2 | 6,7,8,10,11,12 | |
| CO6 | Analyze the current trends in IPR and Government steps in fostering IPR. | 5 | K2 | 6,7,8,10,11,12 | |

**CO-PO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 1 | 1 | 1 | | 1 | 1 | 1 | | | |
| CO2 | | | | | | 1 | 1 | 1 | | 1 | 1 | 1 | | | |
| CO3 | | | | | | 1 | 1 | 1 | | 1 | 1 | 1 | | | |
| CO4 | | | | | | 1 | 1 | 1 | | 1 | 1 | 1 | | | |
| CO5 | | | | | | 1 | 1 | 1 | | 1 | 1 | 1 | | | |
| CO6 | | | | | | 1 | 1 | 1 | | 1 | 1 | 1 | | | |

| 20HS6B1 | PROJECT MANAGEMENT AND ENTREPRENEURSHIP | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To make them understand the concepts of project management for planning to execution of projects.
- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

**PRE-REQUISITE: NIL**

**UNIT - I PROJECT MANAGEMENT** **9**

Project management: meaning, scope & importance, role of project manager - Project life-cycle and Project appraisal - project feasibility report- Technical appraisal, Environmental appraisal, Market appraisal and Managerial appraisal.

**UNIT - II PROJECT FINANCING** **9**

Project cost estimation & working capital requirements - sources of funds - capital budgeting - Risk & uncertainty in project evaluation - preparation of projected financial statements viz. Projected balance sheet - projected income statement - projected funds & cash flow statements - Preparation of detailed project report - Project finance.

**UNIT - III ENTREPRENEURSHIP** **9**

Entrepreneurship need and scope - Entrepreneurial competencies and traits - Factors affecting entrepreneurial development - Entrepreneurial motivation (Mc Clellend's Achievement motivation theory) - conceptual model of entrepreneurship - entrepreneur vs. intrapreneur - Classification of entrepreneurs - Entrepreneurial Development Programmes.

**UNIT - IV ENTREPRENEURIAL IDEA AND INNOVATION** **9**

Introduction to Innovation - Entrepreneurial Idea Generation and Identifying Business Opportunities - Management skills for Entrepreneurs and managing for Value Creation - Creating and Sustaining Enterprising Model - Organizational Effectiveness.

**UNIT - V SOCIAL ENTREPRENEURSHIP** **9**

Social Sector Perspectives and Social Entrepreneurship - Social Entrepreneurship Opportunities and Successful Models - Social Innovations and Sustainability - Marketing Management for Social Ventures - Risk Management in Social Enterprises - Legal Framework for Social Ventures.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Robert D. Hisrich, Michael P. Peters and Dean A. Shepherd, "Entrepreneurship", McGraw Hill Education, Tenth Edition, 2018.
2. Peter F. Drucker, "Innovation and Entrepreneurship", Harper Business, 2006.

**REFERENCES:**


1. Anil K. Gupta, “Grassroots Innovation: Minds on the Margin Are Not Marginal Minds”, Random House, 2016.
2. V.S.P.Rao, “Business, Entrepreneurship and Management”, Vikas Publishing, 2014.
3. Rajeev Roy, “Entrepreneurship”, Oxford University Press, 2011.
4. Roman Pichler, “Agile Product Management with Scrum Creating Products That Customers Love”, Pearson India, 2013.
5. John M. Nicholas and Herman Steyn, “Project Management for Engineering, Business and Technology”, A Butterworth-Heinemann Title, Fourth Edition, 2011


**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name :** Project Management and Entrepreneurship | | | | | | | | | | | | | **Course Code :** 20HS6B1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | | | | | | | **Unit** | **K-CO** | **POs** | | | **PSOs** | |
| CO1 | Conclude the project characteristics and various stages of a project. | | | | | | | 1 | K6 | 8,9,10,11 | | | | |
| CO2 | Compile the conceptual clarity about project organization and feasibility. | | | | | | | 2 | K5 | 8,9,10,11 | | | | |
| CO3 | Apply the risk management plan and analyze the role of stakeholders. | | | | | | | 3 | K3 | 8,9,10,11 | | | | |
| CO4 | Analyze the social responsibility for an entrepreneurship. | | | | | | | 4 | K4 | 7,8,9,10,11 | | | | |
| CO5 | Interpret the gain knowledge to overcome the factors affecting small-scale business. | | | | | | | 4 | K3 | 8,9,10,11 | | | | |
| CO6 | Formulate a new small-scale business. | | | | | | | 5 | K6 | 7,8,9,10,11 | | | | |
| **CO-PO Mapping** | | | | | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO2** |
| CO1 | | | | | | | | 2 | 2 | 2 | 3 | | | |
| CO2 | | | | | | | | 2 | 2 | 2 | 3 | | | |
| CO3 | | | | | | | | 2 | 2 | 2 | 3 | | | |
| CO4 | | | | | | | 3 | 2 | 2 | 2 | 3 | | | |
| CO5 | | | | | | | | 2 | 2 | 2 | 3 | | | |
| CO6 | | | | | | | 3 | 2 | 2 | 2 | 3 | | | |

| 20HS8A1 | HUMAN RELATIONS AT WORK | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

• To create awareness of human relations at work its relationship with self.
• To create awareness about the processes involved in interaction with people at work.
• To understand the importance of psychological and physical health in maintaining human relations at work and progressing in career.

**PRE-REQUISITE : NIL**

**UNIT-I INTRODUCTION TO HUMAN RELATIONS 9**

Understanding and Managing Yourself – Human Relations and You – Self-Esteem and Self – Confidence – Self-Motivation and Goal Setting – Emotional Intelligence – Attitudes and Happiness – Values and Ethics – Problem Solving and Creativity.

**UNIT-II HUMAN RELATIONS AT WORK 9**

Dealing Effectively with People – Communication in the Workplace – Specialized Tactics for Getting Along with Others in the Workplace – Managing Conflict – Becoming an Effective Leader – Motivating Others and Developing Teamwork – Diversity and Cross-Cultural Competence.

**UNIT - III STAYING PHYSICALLY HEALTHY 9**

Yoga: Ashtanga, Yam and Niyam, Asan – Pranayam – Exercise: Aerobic and anaerobic.

**UNIT - IV STAYING PSYCHOLOGICALLY HEALTHY 9**

Managing Stress and Personal Problems – Meditation – Cognitive, behavioural and emotional well-being.

**UNIT - V DEVELOPING CAREER THRUST** 9

Getting Ahead in Your Career – Learning Strategies – Perception – Life Span Changes – Developing Good Work Habits.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Andrew DuBrin, “Human Relations for Career and Personal Success: Concepts, Applications, and Skills”, Pearson Education, Eleventh Edition, 2016.
2. Swami Vivekananda, “Raja-Yoga or Conquering the Internal Nature”, Vedanta Press, 1998.

**REFERENCES:**

1. Jerrold S. Greenberg, “Comprehensive Stress Management”, McGraw-Hill Humanities Social, Thirteenth Edition, 2012.
2. Y.Udai, “Yogasan aur pranayama”, N.S. Publications, New Delhi, 2015.
3. Janardan Swami Yogabhyasi Mandal, “Yogic Asanas for Group Training - Part-I”, Nagpur.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| Course Name : Human Relations at Work | | Course Code : 20HS8A1 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| CO1 | Implement the elements of Emotional Intelligence and create a plan for continual improvement. | 1 | K3 | 6,8,9,10 | |
| CO2 | Demonstrate the elements of teamwork such as team development stages, leadership skills, team dynamics, problems solving and decision making approaches, and team building. | 2 | K3 | 6,8,9,10 | |
| CO3 | Employ active listening skills including paraphrasing, questioning, empathetic listening, analytic listening, responding and communicating non-verbally while respecting individual differences. | 2 | K3 | 6,8,9,10 | |
| CO4 | Identify various Yoga Postures. | 3 | K3 | 6,8,9,10 | |
| CO5 | Develop an action plan to increase personal motivation in a personal and or workplace situation. | 4 | K3 | 6,8,9,10 | |
| CO6 | Identify different elements of organizational behavior and change including organizational climate, culture, power, ethics, and organizational development techniques to develop a change model for an aspect of their personal and or professional life. | 5 | K3 | 6,8,9,10 | |

**CO-PO Mapping**

| **COs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | | | | | | | | | | | |
| CO2 | 3 | 3 | 3 | 3 | | | | | | | | | | | |
| CO3 | 3 | 3 | 3 | 3 | | | | | | | | | | | |
| CO4 | 3 | 3 | 3 | 3 | | | | | | | | | | | |
| CO5 | 3 | 3 | 3 | 3 | | | | | | | | | | | |
| CO6 | 3 | 3 | 3 | 3 | | | | | | | | | | | |

| 20HS8B2 | ECONOMICS FOR ENGINEERS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the fundamental economic concepts
- To understand cost estimation concepts
- To understand value engineering
- To understand project appraisal and methods of analysis
- To understand the methods of depreciation

**PRE-REQUISITE: NIL**

**UNIT - I INTRODUCTION TO ECONOMICS 9**

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis - V ratio, Elementary economic Analysis – Material selection for product Design selection of a product, Process planning.

**UNIT - II COST ESTIMATION AND MACRO ECONOMICS 9**

Cost and revenue concepts- Determination of equilibrium price under perfect competition - Banking – Inflation - National Income

**UNIT - III VALUE ENGINEERING 9**

Make or buy decision, Value engineering – Function, aims, Value engineering procedure: Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

**UNIT - IV PROJECT APPRAISAL AND ANALYSIS 9**

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram),rate of return method, Examples in all the methods.

**UNIT - V DEPRECIATION 9**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions –procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi,2001.

**REFERENCES:**


1. ChanS.Park,“ContemporaryEngineeringEconomics”, PrenticeHallofIndia,2011.
2. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg.Press,Texas,2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, NewYork,2011.
4. ZahidAkhan:EngineeringEconomy,"EngineeringEconomy", DorlingKindersley,2012


**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : ECONOMICS FOR ENGINEERS** | | **Course Code : 20HS8B2** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| CO1 | Describe the concept of engineering economics | 1 | K2 | 6-10 | 1,2 |
| CO2 | Comprehend macroeconomic principles | 2 | K2 | 6-10 | 1,2 |
| CO3 | Decision making in diverse business set up | 3 | K2 | 6-10 | 1,2 |
| CO4 | Explain the Inflation & Price Change | 3 | K2 | 6-10 | 1,2 |
| CO5 | Explain Present Worth Analysis | 4 | K2 | 6-10 | 1,2 |
| CO6 | Apply the principles of economics through various case studies | 5 | K3 | 6-10,11 | 1,2 |

**CO-PO mapping**

| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 1 | 1 | 2 | 2 | 2 | | | 1 | 1 |
| CO2 | | | | | | 1 | 1 | 2 | 2 | 2 | | | 1 | 1 |
| CO3 | | | | | | 1 | 1 | 2 | 2 | 2 | | | 1 | 1 |
| CO4 | | | | | | 1 | 1 | 2 | 2 | 2 | | | 1 | 1 |
| CO5 | | | | | | 1 | 1 | 2 | 2 | 2 | | | 1 | 1 |
| CO6 | | | | | | 1 | 1 | 2 | 2 | 2 | 2 | | 1 | 1 |

| 20HS5A1 | MANAGEMENT CONCEPTS & ORGANIZATIONAL BEHAVIOR | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization with a perspective to diagnose and effectively handle human behavior**.**

**PRE-REQUISITE:NIL**

**UNIT-I INTRODUCTION TO MANAGEMENT 9**

Origin - Definition of management -Nature & Characteristics of management - Scope of management - Importance of Management - Difference between administration & management- Levels of management -Functions of Management - Principles of management - Management by objectives - Management by exception .

**UNIT-II PLANNINGAND ORGANIZING 9**

Definitions of planning -Nature of planning - Importance of planning - Limitations of planning - Process / steps of planning -Elements of planning - Decision making - Characteristics of decision making - Process / steps of decision making-Nature of Organisation-Principles of Organisation - Advantages of Organisation - Process / steps of Organisation - Formal & Informal Organisation - Organisational Structure (Types) - Organisation chart - delegation - Process / steps of delegation - Centralisation - De-Centralisation

**UNIT - III CO-ORDINATION AND CONTROLLING 9**

Definition of Co-ordination - characteristics of Co-ordination - Benefits of Co-ordination - Problems in Coordination -Techniques of Co-ordination - Defintion of controlling -characteristics of control function – Control process –Communication - Characteristics of Communication - Process of Communication - Formal &Informal Communication - Upward & Downward Communication - Sideward Communication – Written Communication -Barriers in Communication - Measures to overcome communication barriers

**UNIT - IV INDIVIDUAL BEHAVIOUR 9**

Meaning of Organizational behavior, contributing disciplines, importance of organizational behavior, Perception and Learning - Personality and Individual Differences - Motivation theories and Job Performance - Values, Attitudes and Beliefs - Communication Types-Process - Barriers - Making Communication Effective.

**UNIT - V GROUP BEHAVIOUR 9**

Groups and Teams: Definition, Difference between groups and teams, Stages of Group Development, Group Cohesiveness, Types of teams, Group Dynamics - Leadership - Styles - Approaches - Power and Politics .

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

On the successful completion of the course, student will be able to:

1. Explain Management principles into management practices and Managers manage business in global context with different strategies and to determine the effective ways of controlling, and decision making.
2. Understand and explain all the managerial functions.
3. Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization and management of individual behavior in the organization.
4. Analyze the complexities associated with management of the group behavior in the organization.
5. Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.
6. Managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management and the degree to which one can make an individual to think beyond self.

**REFERENCES:**

1. Stephen P. Robins, Organizational Behavior, Pearson Education, Edition 16, 2022.
2. Steven L. Mc Shane, Mary Ann Von Glinow, et al. Organizational Behavior, Edition 9, 2022
3. PC Tripathi, PN Reddy, AshishBajpai, Principles of Management, Tata McGraw Hill,

| 20HS5A2 | INDUSTRIAL MARKETING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To study the basics of Industrial Marketing.
- To know about the Management of Industrial Marketing
- To understand the methods of Strategic Planning and Implementation process.
- To learn the process of Logistics, Marketing Control and Channel Optimization
- To understand the techniques of Pricing and Sales Force Planning

**PRE-REQUISITE:NIL**

**UNIT-I Basics of Industrial Marketing 9**

Introduction to Industrial Marketing- Industrial versus Consumer Marketing- Economics of Industrial Demand Classification of Industrial Customers- Unique Characteristics of Organizational Procurement-Purchasing in Government Units

**UNIT-II Management of Industrial Marketing 9**

Industrial Buying Behaviour in Indian context- Conceptualization of Buying Behavior-Stages in Buying Uncertainty Management in Industrial Marketing- Purchasing Agents in Industrial Buying-Negotiation in Industrial Marketing

**UNIT - III Strategic Planning and Implementation 9**

Process of Strategic Planning-Macro and Micro Variables Used to Segment Industrial Marketing-Managing the Development of Strategic Planning- Understanding Strategy Formulation and Strategy Implementation Industrial Marketing Strategy Components - Industrial Marketing Research for New Product Development Industrial Marketing Strategy in India.

**UNIT - IV Logistics, Marketing Control and Channel Optimization 9**

Marketing Logistics- Physical Distribution and Customer Services- Marketing Control Channel Participants-Channel Functions and Dual Channels-Choosing the Right Distributor- Distribution and Manufacturers' Representatives

**UNIT - V Pricing and Sales Force Planning 9**

Price: A Crucial Element in Product Strategy- The nature of Derived Demand- Segregation of New Product Cost- Pricing in Industrial Marketing- Segregation of New Product Cost - Industrial Product Pricing in India Development of Industrial Sales Force-Motivation of Sales Force- Effective Use of Sales Compensation

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Compare industrial vs consumer marketing and the classifications of industrial customers.
- Develop Negotiation and buying techniques for industrial products .
- Formulate strategic plan and implementation methods.
- Develop techniques of Logistics, Marketing Control and Channel Optimization
- Identify Pricing tactics and Sales Force Planning techniques
- Manage the entire industrial marketing process.

**REFERENCES:**

1. Industrial Marketing: A Process of Creating and Maintaining Exchange by krishnamacharyulu Csg,Lalitha R, Publisher: Jaico Book House,
2. Industrial Marketing by Ghosh, Publisher: Oxford University Press,2019
3. Industrial Marketing 2e by K. K. Havaldar, Publisher: Tata McGraw-Hill Publishing Company limited,2016
4. Industrial Marketing Management by Govindarajan, Vikas Publishing House.2018
5. Industrial Marketing by Phadtare -M. T, Prentice Hall of India Private Limited ,2020

| 20CSV11 | CLOUD COMPUTING TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

**PRE-REQUISITE:** NIL

**UNIT - I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 6**

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.

**LAB COMPONENT: 6**

1. Install Virtualbox /VMware / Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.

**UNIT - II VIRTUALIZATION BASICS 6**

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.

**LAB COMPONENT: 6**

1. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs

**UNIT - III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 6**

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.

**LAB COMPONENT: 6**

1. Find a procedure to transfer the files from one virtual machine to another virtual machine.
2. Creating and Executing Your First Container Using Docker.

**UNIT - IV CLOUD DEPLOYMENT ENVIRONMENT 6**

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

**LAB COMPONENT: 6**

1. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
2. Use the GAE launcher to launch the web applications.

**UNIT - V CLOUD SECURITY 6**

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architectureand Practice.

**LAB COMPONENT: 6**

1. Install Hadoop single node cluster and run simple applications like word count.
2. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

**TOTAL: 60 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..

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| Course Name : Cloud Computing Techniques | | Course Code : 20CSV11 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Describe the cloud architecture, cloud deployment & service models and challenges of cloud design | 1 | K2 | 1,2,8,9 | 1,2 |
| **CO2** | Apply the concept of virtualization and its types | 2 | K3 | 1,2,8,9 | 1,2 |
| **CO3** | Experiment with virtualization of hardware resources | 3 | K2 | 1,2,8,9 | 1,2 |
| **CO4** | Use Docker in cloud environment | 3 | K3 | 1,2,8,9 | 1,2 |
| **CO5** | Develop and deploy services on the cloud and set up a cloud environment | 3 | K3 | 1,2,8,9 | 1,2 |
| **CO6** | Explain security challenges in the cloud environment | 4 | K2 | 1,2,8,9 | 1,2 |

**CO-PO Mapping**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 2 |
| **CO2** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | - | 2 | 2 |
| **CO3** | 2 | 1 | - | - | 1 | - | - | 1 | 1 | 1 | - | - | 2 | 2 |
| **CO4** | 3 | 2 | 1 | - | 1 | - | - | 1 | 1 | 1 | - | - | 2 | 2 |
| **CO5** | 3 | 2 | 1 | - | 1 | - | - | 1 | 1 | 1 | - | - | 2 | 2 |
| **CO6** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 2 |

| 20CSV21 | DATA WAREHOUSING AND DATA MINING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.

**PRE-REQUISITE:**

Course Code : 20CS402

Course Name : Database Management Systems

**UNIT - I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) 9**

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP

**UNIT - II DATA MINING - INTRODUCTION 9**

Introduction– Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns. Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

**UNIT - III FREQUENT PATTERN ANALYSIS 9**

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

**UNIT - IV CLASSIFICATION AND CLUSTERING 9**

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines —Clustering Techniques – Cluster Analysis- Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis

**UNIT - V DATA MINING TOOLS 9**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Data mining tools: WEKA, Hadoop, Spark, R tool – Learning algorithms, Clustering algorithms, Association–rule learners.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
2. Alex Berson and Stephen J.Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition, 5th Reprint 2016.

**REFERENCES:**

1. K.P. Soman, Shyam Diwakar and V. Ajay, Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
2. Ian H.Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.
3. Daniel T.Larose, “Data Mining Methods and Models”, Wiley-Interscience, 2006.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : DATA WAREHOUSING AND DATA MINING** | | **Course Code : 20CSV21** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Discuss data warehouse system and business analysis with OLAP tools | 1 | K2 | 1,2 | 1,2 |
| **CO2** | Describe various pre-processing and visualization techniques for data analysis | 2 | K2 | 1,2,8,9,10 | 1,2 |
| **CO3** | Apply frequent pattern and association rule mining techniques | 3 | K3 | 1,2,3,8,9,10 | 1,2 |
| **CO4** | Select and apply an appropriate classification algorithm for labelled data | 4 | K3 | 1,2,3,8,9,10, 12 | 1,2 |
| **CO5** | Apply various clustering techniques for unlabeled data | 4 | K3 | 1,2,3,8,9,10, 12 | 1,2 |
| **CO6** | Apply learning and clustering algorithms using data mining tools | 5 | K3 | 1,2,3,8,9,10, 12 | 1,2 |

**CO-PO Mapping**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 1 |
| **CO2** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 1 |
| **CO3** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | - | 2 | 1 |
| **CO4** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 1 | 2 | 1 |
| **CO5** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 1 | 2 | 1 |
| **CO6** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 1 | 2 | 1 |

| 20CSV31 | CLOUD SERVICE MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

**PRE-REQUISITE** : NIL

**UNIT - I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9**

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

**UNIT - II CLOUD SERVICES STRATEGY 9**

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.

**UNIT - III CLOUD SERVICE MANAGEMENT 9**

Cloud Service Reference Model, Cloud Service Life Cycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management.

**UNIT - IV CLOUD SERVICE ECONOMICS 9**

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

**UNIT - V CLOUD SERVICE GOVERNANCE & VALUE 9**

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

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

**REFERENCES:**

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

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : CLOUD SERVICE MANAGEMENT** | | **Course Code : 20CSV31** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Discuss the fundamentals of cloud service management | 1 | K2 | 1,2 | 2 |
| **CO2** | Describe the cloud service strategies like cloud policy, risk management and change management etc., | 2 | K2 | 1,2,8,9 | 2 |
| **CO3** | Explain the life cycle and benchmarks of cloud services | 3 | K2 | 1,2,8,9 | 2 |
| **CO4** | Illustrate deployment and migration of cloud services | 3 | K2 | 1,2,8,9 | 2 |
| **CO5** | Discuss the economic based cloud services | 4 | K2 | 1,2,8,9,10 | 2 |
| **CO6** | Explain the strong theoretical foundation leading to cloud service governance & measuring the value of cloud-based services | 5 | K2 | 1,2,8,9,10 | 2 |

| **CO-PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| **CO2** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | - | 2 |
| **CO3** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | - | 2 |
| **CO4** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | - | 2 |
| **CO5** | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | - | 2 |
| **CO6** | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | - | 2 |

| 20CSV41 | SOFTWARE DEFINED NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

1. To learn the fundamentals of software defined networks.
2. To understand the separation of the data plane and the control plane.
3. To study about the SDN Programming.
4. To study about the various applications of SDN

**PRE-REQUISITE: NIL**

**UNIT - I INTRODUCTION TO SOFTWARE DEFINED NETWORK 9**

SDN Origins and Evolution – Introduction – Why SDN? - Centralized and Distributed Control and Data Planes - The Genesis of SDN

**UNIT - II OPEN FLOW AND SDN CONTROLLERS 9**

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via HypervisorBased Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.

**UNIT - III DATA CENTERS 9**

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

**UNIT - IV SDN PROGRAMMING 9**

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

**UNIT - V SDN FRAMEWORK 9**

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehens Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, O'Reilly Media, 2013

**REFERENCES:**

1. SiamakAzodolmolky, Software Defined Networking with Open Flow, Packet Publishing, 2013.
2. Vivek Tiwari, SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| Course Name : Software Defined Networks | | Course Code : 20CSV41 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Explain the key benefits of SDN by separation of Data and Control Planes. | 1 | K2 | 1, 2, 8, 9 | 1 |
| **CO2** | Discuss the openflow specification and different controllers of SDN. | 2 | K2 | 1, 2, 8, 9 | 1 |
| **CO3** | Describe various Data centers and SDN solutions for the Data Center networks. | 3 | K2 | 1, 2,8, 9 | 1 |
| **CO4** | Develop various applications of SDN using current languages and tools. | 4 | K3 | 1, 2, 3, 8, 9 | 1 |
| **CO5** | Explain the various concepts of Network function virtualization in SDN programming. | 4 | K2 | 1, 2, 8, 9 | 1 |
| **CO6** | Explain different framework and controller used in SDN | 5 | K2 | 1, 2,8,9 | 1 |

CO-PO Mapping

| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |
| **CO2** | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |
| **CO3** | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |
| **CO4** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |
| **CO6** | 3 | 2 | - | - | - | - | - | 1 | 1 | 1 | - | - | 2 | - |

| 20ADV51 | STORAGE TECHNOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

**PRE-REQUISITE:** NIL

**UNIT - I STORAGE SYSTEMS 9**

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

**UNIT - II INTELLIGENT STORAGE SYSTEMS AND RAID 5**

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale out storage Architecture.

**UNIT- III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 13**

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol,connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

**UNI - IV BACKUP, ARCHIVE AND REPLICATION 12**

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).

**UNIT - V SECURING STORAGE INFRASTRUCTURE 6**

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

CO1: Demonstrate the fundamentals of information storage management and various models of

Cloud infrastructure services and deployment

CO2: Illustrate the usage of advanced intelligent storage systems and RAID

CO3: Identify various storage networking architectures - SAN

CO4: Apply storage subsystems and Virtualization

**TEXT BOOKS**

1. EMC Corporation, Information Storage and Management, Wiley, India

2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas,

**REFERENCES:**

1. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained, Second Edition, Wiley, 2009

| 20ITV63 | INFORMATION RETRIEVAL TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations
- To learn different techniques of recommender system

**PRE-REQUISITE:NIL**

**UNIT - I INTRODUCTION 9**

Information Retrieval – Early Developments – The IR Problem – The User s Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

**UNIT - II MODELING AND RETRIEVAL EVALUATION 9**

Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

**UNIT - III TEXT CLASSIFICATION AND CLUSTERING 9**

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

**UNIT - IV WEB RETRIEVAL AND WEB CRAWLING 9**

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

**UNIT - V RECOMMENDER SYSTEM 9**

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Ricardo BaezaYates and Berthier RibeiroNeto, Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, Recommender Systems Handbook, First Edition, 2011.

**REFERENCES:**

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : INFORMATION RETRIEVAL TECHNIQUES** | | | | | | | | | | | | | **Course Code : 20ITV63** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | | | | | | | | | | | | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Explain the IR components and Web Search Engine Framework | | | | | | | | | | | | 1 | K2 | 1, 2, 8, 9 | 1,2 |
| **CO2** | Discuss various information retrieval models | | | | | | | | | | | | 2 | K2 | 1, 2,8,9 | 1,2 |
| **CO3** | Apply appropriate method of classification or clustering | | | | | | | | | | | | 3 | K3 | 1, 2, 3, 8,9 | 1,2 |
| **CO4** | Explain the Web Search Engine architecture and ranking functions | | | | | | | | | | | | 4 | K2 | 1, 2,8,9 | 1,2 |
| **CO5** | Discuss Web Link Analysis algorithms and advanced search | | | | | | | | | | | | 4 | K2 | 1, 2,8,9 | 1,2 |
| **CO6** | Illustrate recommendation techniques and develop content-based Recommender Systems | | | | | | | | | | | | 5 | K3 | 1, 2, 3,5, 8,9 | 1,2 |
| **CO-PO Mapping** | | | | | | | | | | | | | | | | |
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | | |
| **CO1** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | 2 | 2 | 2 | | |
| **CO2** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | 2 | 2 | 2 | | |
| **CO3** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | - | - | 2 | 2 | 2 | | |
| **CO4** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | 2 | 2 | 2 | | |
| **CO5** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | 2 | 2 | 2 | | |
| **CO6** | 3 | 2 | 1 | - | 1 | - | - | 1 | 1 | - | - | 2 | 2 | 2 | | |

| 20SCV71 | SECURITY AND PRIVACY IN CLOUD | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

**PRE-REQUISITE:NIL**

**UNIT - I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9**

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

**UNIT - II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9**

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key.

**UNIT - III ACCESS CONTROL AND IDENTITY MANAGEMENT 9**

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention.

**UNIT - IV CLOUD SECURITY DESIGN PATTERNS 9**

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud.

**UNIT - V MONITORING, AUDITING AND MANAGEMENT 9**

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**


1. Raj Kumar Buyya , James Broberg, AndrzejGoscinski, “Cloud Computing": Wiley 2013
2. Dave shackleford, “Virtualization Security", SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, “Cloud Security and Privacy", OREILLY 2011


**REFERENCES:**


1. Mark C. Chu-Carroll “Code in the Cloud",CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi


**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : SECURITY AND PRIVACY IN CLOUD** | | | | | | | | | | | | | **Course Code : 20SCV71** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | | | | | | | | | | | | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Discuss the fundamental concepts of cloud security | | | | | | | | | | | | 1 | K2 | 1,2,8,9 | 1,2 |
| **CO2** | Illustrate the various cloud security design for cloud | | | | | | | | | | | | 2 | K2 | 1,2,8,9 | 1,2 |
| **CO3** | Apply data protection strategies for cloud | | | | | | | | | | | | 2 | K3 | 1,2,5,8,9,10 | 1,2 |
| **CO4** | Identify the cloud requirements, storage and network access control options | | | | | | | | | | | | 3 | K2 | 1,2,8,9 | 1,2 |
| **CO5** | Explain the different types of architectural and design considerations for security in the cloud. | | | | | | | | | | | | 4 | K2 | 1,2,8,9 | 1,2 |
| **CO6** | Explain the various risks, audit and monitoring mechanisms in the cloud. | | | | | | | | | | | | 5 | K2 | 1,2,8,9 | 1,2 |
| **CO-PO Mapping** | | | | | | | | | | | | | | | | |
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | | |
| **CO1** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 1 | 1 | | |
| **CO2** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 1 | 1 | | |
| **CO3** | 3 | 2 | 1 | - | 1 | - | - | 1 | 1 | - | - | - | 1 | 1 | | |
| **CO4** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 1 | 1 | | |
| **CO5** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 1 | 1 | | |
| **CO6** | 2 | 1 | 1 | - | - | - | - | 1 | 1 | - | - | - | 1 | 1 | | |

**20ITV81 REINFORCEMENT LEARNING TECHNIQUES**

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

**Objectives :**

- To introduce the fundamentals of Reinforcement Learning
- To illustrate model-based prediction and control using dynamic programming
- To illustrate model-free prediction and control
- To introduce planning and learning with tabular methods
- To explain approximation of a value function

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION** **9**

Introduction to Reinforcement learning, examples - Elements of reinforcement learning - Limitations and Scope- An extended example - multi-armed bandits - k-armed bandit problem - action-value methods - the 10-armed testbed - incremental implementation - tracking a nonstationary problem - optimistic initial values - upper-confidence-bound action selection - associative search

**UNIT II MARKOV DECISION PROCESS AND MODEL-BASED PREDICTION AND CONTROL** **9**

Finite Markov Decision Process - The Agent–Environment Interface - Goals and Rewards - Returns and Episodes - Unified Notation for Episodic and Continuing Tasks - Policies and Value Functions - Optimal Policies and Optimal Value Functions - Optimality and Approximation - Dynamic Programming - Policy Evaluation (Prediction) - Policy Improvement - Policy Iteration - Value Iteration - Generalized Policy Iteration - Efficiency of Dynamic Programming - Asynchronous Dynamic Programming

**UNIT III MODEL-FREE PREDICTION AND CONTROL** **9**

Model-free learning - Model-free prediction - Monte Carlo methods - Monte Carlo Prediction - Monte Carlo Estimation of Action Values - Temporal-Difference Learning - TD Prediction - Advantages of TD Prediction Methods - Optimality of TD(0) - n-step Bootstrapping - n-step TD Prediction - n-step Sarsa - Model-free control - Monte Carlo Control - Monte Carlo Control without Exploring Starts - Off policy learning - Importance sampling - Off-policy Monte Carlo Control - Sarsa: On-policy TD Control - Q-learning: Off-policy TD control

**UNIT IV PLANNING AND LEARNING WITH TABULAR METHODS** **9**

Models and planning - Dyna: Integrated Planning, Acting and Learning - When the model is wrong - Prioritized Sweeping - Real-time Dynamic Programming - Monte Carlo Tree Search

**UNIT V VALUE FUNCTION APPROXIMATION** **9**

On-policy Prediction with Approximation - Value Function Approximation - The Prediction Objective (VE) - Stochastic-gradient and Semi-gradient Methods - Linear Methods - Least-Squares TD.

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An introduction, 2nd edition, The MIT Press, 2015.
2. Martijn van Otterlo, Marco Wiering, Reinforcement Learning: State-of-the-Art, Springer Verlag Berlin Heidelberg, 2012.
3. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, 3rd edition, Pearson, 2015.

**REFERENCES:**

1. Good fellow, Y. Bengio, A. Courville, Deep Learning, MIT Press Ltd., 2016.
2. Reinforcement Learning with MATLAB, Math Works Inc., 2020.

**OUTCOMES:**
**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name: REINFORCEMENT LEARNING TECHNIQUES** | | | | | | | | | | **Course Code : 20ITV81** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | | | | | | | | | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Understand basic concepts of reinforcement learning | | | | | | | | | 1 | K2 | 1,2 | |
| **CO2** | Perform model-based prediction and control using dynamic programming | | | | | | | | | 2 | K2 | 1,2,3,8,10 | |
| **CO3** | Apply model-free prediction and control | | | | | | | | | 3 | K2 | 1,2,3 | 1,2 |
| **CO4** | Comprehend the use of tabular methods | | | | | | | | | 4 | K2 | 1,2,3,8,10 | 1,2 |
| **CO5** | Understand how a value function can be approximated | | | | | | | | | 5 | K2 | 1,2 | |
| **CO6** | Apply Stochastic-gradient and Semi-gradient Methods for value function approximation | | | | | | | | | 6 | K3 | 1,2,3,8,10 | 1,2 |
| **CO-PO Mapping** | | | | | | | | | | | | | |
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 2 | 1 | | | | | | | | | | | | |
| **CO2** | 3 | 2 | 1 | | | | | 2 | | 2 | | | | |
| **CO3** | 3 | 2 | 1 | | | | | | | | | | | |
| **CO4** | 3 | 2 | 1 | | | | | 2 | | 2 | | | 1 | 1 |
| **CO5** | 2 | 1 | | | | | | | | | | | | |
| **CO6** | 3 | 2 | 1 | | | | | 2 | | 2 | | | 1 | 1 |

| 20CSV12 | SOCIAL NETWORK ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behaviour in social web and related communities.
- To learn visualization of social networks.

.**PRE-REQUISITE:**

Course Code **:**20CS501

Course Name :Computer Networks

**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 communities 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: 45 PERIODS**

**TEXT BOOKS:**

1. Peter Mika, Social Networks and the Semantic Webll, First Edition, Springer 2007.
2. BorkoFurht, Handbook of Social Network Technologies and Applicationsll, 1st Edition, Springer, 2010.

**REFERENCES:**

1. GuandongXu ,Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web, Springer, 2009.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : SOCIAL NETWORK ANALYSIS** | | **Course Code : 20CSV12** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Explain the semantic web concepts and applications of social network analysis. | 1 | K2 | 1, 2, 8,9 | 2 |
| **CO2** | Discuss about modeling and knowledge representation using ontology of social network. | 2 | K2 | 1, 2, 8,9 | 2 |
| **CO3** | Illustrate the extraction and mining communities in web social networks. | 3 | K2 | 1, 2, 8,9 | 2 |
| **CO4** | Illustrate the various methods for predicting human behaviour in social communities. | 4 | K2 | 1, 2, 8,9 | 2 |
| **CO5** | Describe the privacy issues in trust network analysis. | 4 | K2 | 1, 2, 8,9 | 2 |
| **CO6** | Make use of visualization techniques for social network applications | 5 | K3 | 1, 2, 3, 8,9 | 2 |

| **CO-PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 2 |
| **CO2** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 2 |
| **CO3** | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | 2 | 2 |
| **CO4** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 2 |
| **CO5** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 2 |
| **CO6** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | - | 2 | 2 |

| 20ITV22 | CYBER PHYSICAL SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the nature of continuous and discrete systems
- To develop synchronous and asynchronous model of processes
- To specify both safety and liveness requirements in temporal logic
- To debug the correctness of the protocol using model checking
- To develop and analyze model of timed and hybrid systems
- To understand zero behaviors and its hybrid automata

**PRE-REQUISITE**: NIL

**UNIT I INTRODUCTION** 9

Introduction-key features of cyber physical systems- Continuous dynamics: Newtonian mechanics- actor models-properties of systems-feedback control-Discrete dynamics: Discrete systems- Finite state machines

**UNIT II SYNCHRONOUS AND ASYNCHRONOUS MODEL** 9

Synchronous model: Reactive components-properties of components-composing components- synchronous design, Asynchronous model- asynchronous processes-asynchronous design primitives- coordination protocols.

**UNIT III SAFETY AND LIVENESS REQUIREMENT** 9

Safety specifications- verifying invariants- Enumerative search- Temporal logic- Model checking- reachability analysis- proving liveness

**UNIT IV TIMED MODEL AND REAL-TIME SCHEDULING** 9

Timed processes- Timing based protocols: Timing-Based Distributed Coordination-Audio Control Protocol- Timed automata: Model of Timed Automata-Region Equivalence-Matrix-Based Representation for Symbolic Analysis, Real-time scheduling.

**UNIT V HYBRID SYSTEMS** 9

Classes of Hybrid Systems-Hybrid dynamic models: Hybrid Processes-Process Composition-Zeno Behaviors-Stability- designing hybrid systems- linear hybrid automata

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Rajeev Alur, Principles of cyber-physical systems, The MIT press, 2015
2. E. A. Lee and S. A. Seshia, Introduction to Embedded Systems - A Cyber-Physical Systems Approach, Lulu.com, Second Edition, 2015.

**REFERENCE:**

1.Sang C.Suh , U.JohnTanik and John N.Carbone , Applied Cyber-Physical systems, Springer,2014

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| Course Name : CYBER PHYSICAL SYSTEMS | | | | | | | | | | | Course Code :20IT7B1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | | | | | | | | | **Unit** | **K-CO** | **POs** | **PSOs** | |
| **CO1** | Ability to understand knowledge, opportunities, challenges and Logical Foundations of Cyber Physical Systems. | | | | | | | | | 1 | K2 | 1, 2, 8, 9 | 1,2 | |
| **CO2** | Ability to develop model for synchronous, asynchronous, continuous and discrete systems. | | | | | | | | | 2 | K2 | 1, 2, 8,9,10 | 1,2 | |
| **CO3** | Ability to identify safety specifications and critical properties of Cyber Physical Systems. | | | | | | | | | 3 | K2 | 1, 2, 5, 8, 9 | 1,2 | |
| **CO4** | Ability to design and analyze the stability of hybrid systems. | | | | | | | | | 4 | K2 | 1, 2, 5, 8, 9,10 | 1,2 | |
| **CO5** | Ability to apply automata for timed systems. | | | | | | | | | 5 | K2 | 1, 2, 5, 8, 9 | 1,2 | |
| **CO6** | Ability to understand Zeno Behaviors | | | | | | | | | 5 | K2 | 1, 2, 5, 8, 9 | 1,2 | |
| **CO-PO Mapping** | | | | | | | | | | | | | | |
| **CO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 2 | 1 | | | - | - | - | 1 | 1 | | - | - | 1 | 1 |
| **CO2** | 2 | 1 | | | - | - | - | 1 | 1 | 1 | - | - | 1 | 1 |
| **CO3** | 2 | 1 | | | 1 | - | - | 1 | 1 | - | - | 1 | 1 | 1 |
| **CO4** | 2 | 1 | | | 1 | - | - | 1 | 1 | 1 | - | 1 | 1 | 1 |
| **CO5** | 2 | 1 | | | 1 | - | - | 1 | 1 | - | - | 1 | 1 | 1 |
| **CO6** | 2 | 1 | | | 1 | | | 1 | 1 | | | | 1 | 1 |

| 20SCV32 | DIGITAL AND MOBILE FORENSICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

- To understand basic digital forensics and techniques.
- To understand digital crime and investigation.
- To understand how to be prepared for digital forensic readiness.
- To understand and use forensics tools for iOS devices.
- To understand and use forensics tools for Android devices.

**PRE-REQUISITE:** NIL

**UNIT - I INTRODUCTION TO DIGITAL FORENSICS** **6**

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase.

**Lab Component:** **6**

1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.

**UNIT - II DIGITAL CRIME AND INVESTIGATION** **6**

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.

**Lab Component:** **6**

1. Data extraction from call logs using Sleuth Kit.

**UNIT - III DIGITAL FORENSIC READINESS** **6**

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics.

**Lab Component:** **6**

1. Data extraction from SMS and contacts using Sleuth Kit.

**UNIT - IV iOS FORENSICS** **6**

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud.

**Lab Component:** **6**

1. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.
2. Process and parse records from the iOS system.

**UNIT-V ANDROID FORENSICS 6**

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling.

**Lab Component: 6**

1. Extract installed applications from Android devices.
2. Extract diagnostic information from Android devices through the adb protocol.
3. Generate a unified chronological timeline of extracted records.

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Andre Arnes, “Digital Forensics”, Wiley, 2018.
2. Chuck Easttom, “An In-depth Guide to Mobile Device Forensics”, First Edition, CRC Press, 2022.

**REFERENCE:**

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : DIGITAL AND MOBILE FORENSICS** | | **Course Code : 20SCV32** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Explain various digital forensics process | 1 | K2 | 1,2 | 1,2 |
| **CO2** | Discuss various digital crime and investigation methods. | 2 | K2 | 1,2,8,9 | 1,2 |
| **CO3** | Illustrate the digital forensic readiness and challenges in digital forensic | 3 | K2 | 1,2,8,9 | 1,2 |
| **CO4** | Identify and extract digital evidence from iOS devices. | 4 | K2 | 1,2,8,9 | 1,2 |
| **CO5** | Discuss the basics of Android forensics | 5 | K2 | 1,2,8,9 | 1,2 |
| **CO6** | Apply needed tools in Android devices | 5 | K3 | 1,2,3,5,8,9, 10 | 1,2 |

| **CO-PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | 2 |
| **CO2** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 1 | 2 |
| **CO3** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 1 | 2 |
| **CO4** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 1 | 2 |
| **CO5** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 1 | 2 |
| **CO6** | 3 | 2 | 1 | - | 1 | - | - | 1 | 1 | 1 | - | - | 1 | 2 |

**20ITV42 CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES**

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

**Objectives :**

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

**PRE-REQUISITE:** Nil

**UNIT I INTRODUCTION TO BLOCKCHAIN** **9**

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

**UNIT II BITCOIN AND CRYPTOCURRENCY** **9**

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

**UNIT III BITCOIN CONSENSUS** **9**

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases

**UNIT IV HYPERLEDGER FABRIC & ETHEREUM** **9**

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity

**UNIT V BLOCKCHAIN APPLICATIONS** **9**

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014.

**REFERENCES:**

1. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University
3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name: CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES** | | **Course Code : 20ITV42** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Understand emerging abstract models for Block chain Technology | 1 | K2 | 1,2 | |
| **CO2** | Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain. | 2 | K2 | 1,2, 8,10 | |
| **CO3** | Understand the function of Block chain as a method of securing distributed ledgers, how consensus on their contents is achieved | 3 | K2 | 1,2 | |
| **CO4** | Apply hyper ledger Fabric and Ethereum platform to implement the Block chain Application. | 4 | K2 | 1,2,3,8,10 | 1,2 |
| **CO5** | Understand emerging abstract models for Block chain Technology | 5 | K2 | 1,2 | |
| **CO6** | Apply block chain concepts in supply chain management | 6 | K3 | 1,2,3,8,10 | 1,2 |

**CO-PO Mapping**

| **CO** | **PO1** | **PO2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | | | | | | | | | | | | |
| CO2 | 2 | 1 | | | | | | 2 | | 2 | | | | |
| CO3 | 2 | 1 | | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | 2 | | 2 | | | 1 | 1 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | |
| CO6 | 2 | 1 | | | | | | 2 | | 2 | | | 1 | 1 |

| | | L | T | P | C |
|---|---|---|---|---|---|
| **20SCV52** | **WEB APPLICATION SECURITY** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applicatic
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

**PRE-REQUISITE:NIL**

**UNIT - I FUNDAMENTALS OF WEB APPLICATION SECURITY 9**

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, SessionManagement-Input Validation

**UNIT - II SECURE DEVELOPMENT AND DEPLOYMENT 9**

Web Applications Security - Security Testing, Security Incident Response Planning,The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

**UNIT - III SECURE API DEVELOPMENT 9**

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

**UNIT - IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 9**

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database- based vulnerability scanners, Types of Penetration Tests: External Testing, Web ApplicationTesting, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

**UNIT - V HACKING TECHNIQUES AND TOOLS 9**

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for ModernWeb Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, TheMcGraw-Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

**REFERENCES:**

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing,Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor &Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and TerronWilliams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : WEB APPLICATION SECURITY** | | **Course Code : 20SCV52** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Explain the fundamental concept of Web application security | 1 | K2 | 1,2,8,9 | 2 |
| **CO2** | Discuss Microsoft security development lifecycle, security process and software assurance maturity model | 2 | K2 | 1,2,8,9 | 2 |
| **CO3** | Illustrate API security using session cookies, token based authentication and encryption | 3 | K3 | 1,2,3,5,8,9 | 2 |
| **CO4** | Describe various vulnerability assessments tools in web application | 4 | K2 | 1,2,8,9 | 2 |
| **CO5** | Illustrate different type of penetration tests to identify security weaknesses in web application | 5 | K3 | 1,2,3,8,9 | 2 |
| **CO6** | Explain various hacking techniques and tools in web application | 5 | K2 | 1,2,5,8,9 | 2 |

| **CO-PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 2 | 1 | - | - | - | - | - | 2 | 2 | - | - | - | - | 2 |
| **CO2** | 2 | 1 | - | - | - | - | - | 2 | 2 | - | - | - | - | 2 |
| **CO3** | 3 | 2 | 1 | - | 1 | - | - | 2 | 2 | - | - | - | - | 2 |
| **CO4** | 2 | 1 | - | - | - | - | - | 2 | 2 | - | - | - | - | 2 |
| **CO5** | 3 | 2 | 1 | - | - | - | - | 2 | 2 | - | - | - | - | 2 |
| **CO6** | 2 | 1 | - | - | 1 | - | - | 2 | 2 | - | - | - | - | 2 |

| | | L | T | P | C |
|---|---|---|---|---|---|
| **20CSV62** | **ENGINEERING SECURE SOFTWARE SYSTEMS** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- Know the importance and need for software security.
- Know about various attacks.
- Learn about secure software design.
- Understand risk management in secure software development.
- Know the working of tools related to software security.

**PRE-REQUISITE:NIL**

**UNIT - I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS 9**

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks.

**UNIT - II SECURE SOFTWARE DESIGN 9**

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles.

**UNIT - III SECURITY RISK MANAGEMENT 9**

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management.

**UNIT - IV SECURITY TESTING 9**

Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing.

**UNIT - V SECURE PROJECT MANAGEMENT 9**

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2008
2. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, First edition, Syngress Publishing, 2011
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional, 2006.

**REFERENCES:**

1. Robert C. Seacord, “Secure Coding in C and C++ (SEI Series in Software Engineering)”, Addison-Wesley Professional, 2005.
2. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008.
3. Mike Shema, “Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, “Web Application Security, A Beginner's Guide”, Kindle Edition, McGraw Hill, 2012
5. Lee Allen, “Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)”, Kindle Edition, Packt Publishing,2012
6. Jason Grembi, “Developing Secure Software”

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name** : **ENGINEERING SECURE SOFTWARE SYSTEMS** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | **Course Code : 20CSV62** | | |
| **CO** | **Course Outcomes** | | | | | | | **Unit** | **K-CO** | **POs** | | | **PSOs** | |
| **CO1** | Identify various vulnerabilities related to memory attacks and low level attacks. | | | | | | | 1 | 2 | 1,2,8,9,10 | | | 1 | |
| **CO2** | Apply security principles in software development and secure design. | | | | | | | 2 | 3 | 1,2,3,8,9,10, 11 | | | 1 | |
| **CO3** | Discuss the risk factors in software systems and risk assessment techniques. | | | | | | | 3 | 2 | 1,2,8,9,10, 11 | | | 1 | |
| **CO4** | Apply various testing techniques related to software security in the testing phase of software development | | | | | | | 4 | 3 | 1,2,3,8,9,10, 11 | | | 1 | |
| **CO5** | Discuss the web application security , bypassing Firewalls and tools for penetration testing. | | | | | | | 4 | 2 | 1,2,8,9,10 | | | 1 | |
| **CO6** | Illustrate secure project management and its framework. | | | | | | | 5 | 3 | 1,2,3,8,9,10, 11 | | | 1 | |
| **CO-PO Mapping** | | | | | | | | | | | | | | |
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 2 | 1 | | - | - | - | - | 3 | 1 | 1 | - | - | 2 | - |
| **CO2** | 3 | 2 | 1 | - | - | - | - | 3 | 1 | 1 | 2 | - | 2 | - |
| **CO3** | 2 | 1 | | - | - | - | - | 3 | 1 | 1 | 2 | - | 2 | - |
| **CO4** | 3 | 2 | 1 | - | - | - | - | 3 | 1 | 1 | 2 | - | 2 | - |
| **CO5** | 2 | 1 | | - | - | - | - | 3 | 1 | 1 | - | - | 2 | - |
| **CO6** | 3 | 2 | 1 | - | - | - | - | 3 | 1 | 1 | 2 | - | 2 | - |

| | | L | T | P | C |
|---|---|---|---|---|---|
| **20SCV82** | **MALWARE ANALYSIS** | **2** | **0** | **2** | **3** |

**OBJECTIVES:**

- To introduce the fundamentals of malware, types and its effects
- To enable to identify and analyse various malware types by static analysis
- To enable to identify and analyse various malware types by dynamic analysis
- To deal with detection, analysis, understanding, controlling, and eradication of malware

**PRE-REQUISITE:NIL**

**UNIT - I INTRODUCTION AND BASIC ANALYSIS** **6**

Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, Static, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots.

**Lab Component:** **6**

1. Experimentation on Initial Infection Vectors and Malware Discovery
2. Implementation on Sandboxing Malware and Gathering Information From Runtime Analysis

**UNIT - II ADVANCED STATIC ANALYSIS** **6**

The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithmetic operations, Loops, Function Call Conventions, C Main Method and Offsets. Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing, The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism.

**Lab Component:** **6**

1. Implementation on Portable Executable (PE32) File Format
2. Implementation on Executable Metadata and Executable Packers

**UNIT - III ADVANCED DYNAMIC ANALYSIS** **6**

Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching

**Lab Component:** **6**

1. Experimentation on Malware Self - Defense, Compression, and Obfuscation Techniques
2. Experimentation on Malware behaviour analysis

**UNIT - IV MALWARE FUNCTIONALITY** **6**

Down loaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

**Lab Component:** **6**

1. Experimentation on analyzing Malicious Microsoft Office and Adobe PDF Documents
2. Experimentation on Mobile malware analysis
3. Experimentation on Packing and Unpacking of malware

**UNIT - V ANDROID MALWARE ANALYSIS** **6**

Android Malware Analysis: Android architecture, App development cycle, APKTool, APKInspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis, Case studies.

**Lab Component:** **6**

1. Experimentation on Rootkit AntiForensics and Covert Channels
2. Experimentation on Modern Rootkit Analysis
3. Experimentation on Malware traffic analysis

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Michael Sikorski and Andrew Honig, “Practical Malware Analysis” by No Starch Press, 2012,ISBN: 9781593272906
2. Bill Blunden, “The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System”, Second Edition,Jones & Bartlett Publishers, 2009.

**REFERENCES:**

1. Jamie Butler and Greg Hoglund, “Rootkits: Subverting the Windows Kernel” by 2005, Addison-Wesley Professional.
2. Bruce Dang, Alexandre Gazet, Elias Bachaalany, SébastienJosse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.
3. Victor Marak, "Windows Malware Analysis Essentials" Packt Publishing, O’Reilly, 2015.
4. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere, "Android Malware and Analysis",CRC Press, Taylor & Francis Group, 2015.
5. Windows Malware Analysis Essentials by Victor Marak, Packt Publishing, 2015.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| Course Name : MALWARE ANALYSIS | | Course Code : 20SCV82 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Discuss the various concepts of malware analysis and their technologies used. | 1 | K2 | 1,2,8,9 | 1,2 |
| **CO2** | Apply the skills necessary to carry out independent analysis of modern malware samples using static analysis techniques | 2 | K3 | 1,2,3,5,8,9 | 1,2 |
| **CO3** | Apply the knowledge to carry out malware analysis of using dynamic analysis techniques | 3 | K3 | 1,2,3,5,8,9 | 1,2 |
| **CO4** | Implement experimentation on Malware behaviour analysis | 3 | K3 | 1,2,3,5,8,9, 10 | 1,2 |
| **CO5** | Explain the methods and techniques used by professional malware analysts | 4 | K2 | 1,2,8,9 | 1,2 |
| **CO6** | Illustrate the concept of Android malware analysis their architecture, and App development | 5 | K3 | 1,2,3,5,8,9, 10 | 1,2 |

**CO-PO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 1 | 2 |
| **CO2** | 3 | 2 | 1 | - | 2 | - | - | 1 | 1 | - | - | - | 1 | 2 |
| **CO3** | 3 | 2 | 1 | - | 2 | - | - | 1 | 1 | - | - | - | 1 | 2 |
| **CO4** | 3 | 2 | 1 | - | 2 | - | - | 1 | 1 | 1 | - | - | 1 | 2 |
| **CO5** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 1 | 2 |
| **CO6** | 3 | 2 | 1 | - | 2 | - | - | 1 | 1 | 1 | - | - | 1 | 2 |

| 20ITV13 | PRINCIPLES OF PROGRAMMING LANGUAGES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives :**

- To understand and describe syntax and semantics of programming languages
- To understand data, data types, and basic statements
- To understand call-return architecture and ways of implementing them
- To understand object-orientation, concurrency, and event and ling in programming languages
- To develop programs in non-procedural programming paradigms.

**PRE-REQUISITE:** NIL

**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,DATATYPES, AND BASIC STATEMENTS** **9**

Names–variables–binding–type checking –scope–scope rules–life time 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

**UNIT III UB PROGRAMS AND IMPLEMENTATIONS** **9**

Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simplesubprograms–stackanddynamiclocalvariables–nestedsubprograms–blocks–dynamicscoping

**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 – threads – statement level concurrency–exception handling–event handling.

**UNIT V FUNCTIONALANDLOGICPROGRAMMINGLANGUAGES** **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: 45 PERIODS**

**TEXT BOOKS** :

1. Robert W. Sebesta, “Concepts of Programming Languages”, Twelfth Edition (Global Edition), Pearson, 2022.

2. Scott,“ProgrammingLanguagePragmatics”,FourthEdition,Elsevier,2018.

**REFERENCES:**


1. R.KentDybvig,“TheSchemeprogramminglanguage”,FourthEdition,PrenticeHall,2011.
2. Jeffrey D. Ullman,“ Elements of ML programming”, Second Edition, Pearson, 1997
3. W.F.Clocksin and C.S.Mellish, “Programming in Prolog: Using the ISO Standard” Fifth Edition, Springer,2003.


**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : PRINCIPLES OF PROGRAMMING LANGUAGES** | | **Course Code : 20ITV13** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Explain the syntax ,semantics and parsing of programming languages | 1 | K2 | 1,2,8,9 | 1,2 |
| **CO2** | Use data, data types, and basic statements of programming languages | 2 | K3 | 1,2,3,8,9, 10 | 1,2 |
| **CO3** | Identify the issues of subprograms and apply the relevant concepts to subprograms implementation | 3 | K3 | 1,2,3,8,9, 10 | 1,2 |
| **CO4** | Demonstrate the basic concepts of object-oriented programming and concurrency using semaphores monitors | 4 | K3 | 1,2,3,8,9, 10,12 | 1,2 |
| **CO5** | Illustrate the mechanism of threads and exception handling | 4 | K3 | 1,2,3,8,9, 10,12 | 1,2 |
| **CO6** | Compare features and applications of functional and logic programming language | 5 | K4 | 1,2,3,4,8,9, 10,12 | 1,2 |

**CO-PO Mapping**

| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 2 |
| **CO2** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | - | 2 | 2 |
| **CO3** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | - | 2 | 2 |
| **CO4** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 2 | 2 | 2 |
| **CO5** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 2 | 2 | 2 |
| **CO6** | 3 | 3 | 2 | 1 | - | - | - | 1 | 1 | 1 | - | 2 | 2 | 2 |

| 20CSV23 | UI AND UX DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX

**PRE-REQUISITE: NIL**

**UNIT – I FOUNDATIONS OF DESIGN 6**

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.

**Lab Component: 6**

1. Designing a Responsive layout for an societal application
2. Brainstorming feature for proposed product
3. Defining the Look and Feel of the new Project

**UNIT – II FOUNDATIONS OF UI DESIGN 6**

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides.

**Lab Component: 6**

1. Exploring various UI Interaction Patterns
2. Developing an interface with proper UI Style Guides

**UNIT – III FOUNDATIONS OF UX DESIGN 6**

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 Goal.

**LabComponent: 6**

1. Exploring various open source collaborative interface Platform
2. Hands on Design Thinking Process for a new product

**UNIT – IV WIREFRAMING, PROTOTYPING AND TESTING 6**

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.

**Lab Component:** **6**

1. Developing Wireflow diagram for application using open source software.
2. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)

**UNIT – V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 6**

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

**Lab Component:** **6**

1. Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping
2. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Joel Marsh, “UX for Beginners”, O’Reilly , 2022
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 rd Edition , O’Reilly 2020
2. Steve Schoger, Adam Wathan “Refactoring UI”, 2018
3. Steve Krug, “Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile”, Third Edition, 2015.
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| Course Name : UI AND UX DESIGN | | Course Code : 20CSV23 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Differentiate divergent and convergent thinking and explain brainstorming and game storming | 1 | K2 | 1,2 | 2 |
| **CO2** | Discuss the fundamental needs of UI design | 2 | K2 | 1,2,8,9 | 2 |
| **CO3** | Illustrate methods and tools to the process of UX design for research | 3 | K2 | 1,2,8,9 | 2 |
| **CO4** | Explain the sketching principles, responsive design and wire framing | 4 | K2 | 1,2,8,9 | 2 |
| **CO5** | Discuss the design of UI and UX prototyping and testing with suitable tools | 4 | K2 | 1,2,8,9 | 2 |
| **CO6** | Identifying and writing problem statements, appropriate research methods and creating scenarios | 5 | K2 | 1,2,8,9 | 2 |

**CO-PO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| **CO2** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | - | 1 |
| **CO3** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | - | 1 |
| **CO4** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | - | 1 |
| **CO5** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | - | 1 |
| **CO6** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | - | 1 |

| 20CSV31 | CLOUD SERVICE MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

**PRE-REQUISITE** : NIL

**UNIT - I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9**

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

**UNIT - II CLOUD SERVICES STRATEGY 9**

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.

**UNIT - III CLOUD SERVICE MANAGEMENT 9**

Cloud Service Reference Model, Cloud Service Life Cycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management.

**UNIT - IV CLOUD SERVICE ECONOMICS 9**

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

**UNIT - V CLOUD SERVICE GOVERNANCE & VALUE 9**

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

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

**REFERENCES:**

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

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : CLOUD SERVICE MANAGEMENT** | | **Course Code : 20CSV31** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Discuss the fundamentals of cloud service management | 1 | K2 | 1,2 | 2 |
| **CO2** | Describe the cloud service strategies like cloud policy, risk management and change management etc., | 2 | K2 | 1,2,8,9 | 2 |
| **CO3** | Explain the life cycle and benchmarks of cloud services | 3 | K2 | 1,2,8,9 | 2 |
| **CO4** | Illustrate deployment and migration of cloud services | 3 | K2 | 1,2,8,9 | 2 |
| **CO5** | Discuss the economic based cloud services | 4 | K2 | 1,2,8,9,10 | 2 |
| **CO6** | Explain the strong theoretical foundation leading to cloud service governance & measuring the value of cloud-based services | 5 | K2 | 1,2,8,9,10 | 2 |

**CO-PO Mapping**

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| **CO2** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | - | 2 |
| **CO3** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | - | 2 |
| **CO4** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | - | 2 |
| **CO5** | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | - | 2 |
| **CO6** | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | - | 2 |

| 20ITV43 | SOFTWARE TESTING AND AUTOMATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives :**

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

**PRE-REQUISITE:** NIL

**UNIT I FOUNDATIONS OF SOFTWARE TESTING 9**

Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

**UNIT II TEST PLANNING 9**

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

**UNIT III TEST DESIGN AND EXECUTION 9**

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

**UNIT IV ADVANCED TESTING CONCEPTS 9**

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile

**UNIT V TEST AUTOMATION AND TOOLS 9**

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018

**REFERENCES:**

**1.** Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
**2.** Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing
**3.** Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Fourth Edition, 2014, Taylor & Francis Group.
**4.** Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing
**5.** Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
**6.** Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.
**7.** Varun Menon, TestNg Beginner's Guide, 2013, Packt Publishing.

**OUTCOMES:**
**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : SOFTWARE TESTING AND AUTOMATION** | | | | | | | | | | | | | | **Course Code : 20ITV43** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | | | | | | | | | | | | | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Discuss the basic concepts of software testing and the need for software testing | | | | | | | | | | | | | 1 | K2 | 1,2,8,9 | 2 |
| **CO2** | Explain test planning and different activities involved in test planning | | | | | | | | | | | | | 2 | K2 | 1,2,8,9 | 2 |
| **CO3** | Identify the test objectives and apply different method of test strategies | | | | | | | | | | | | | 3 | K3 | 1,2,3,5,8,9, 10 | 2 |
| **CO4** | Apply advanced testing concepts like Fail-Over testing, usability testing, security testing etc. | | | | | | | | | | | | | 4 | K3 | 1,2,3,5,8,9, 10 | 2 |
| **CO5** | Describe the Testing methods for web and mobile applications | | | | | | | | | | | | | 4 | K2 | 1,2,8,9,10 | 2 |
| **CO6** | Use automatic software testing tools like Selenium web driver for automating web-based application testing | | | | | | | | | | | | | 5 | K3 | 1,2,3,5,8,9, 10 | 2 |
| **CO-PO Mapping** | | | | | | | | | | | | | | | | | |
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | | | |
| **CO1** | 2 | 1 | - | - | - | - | - | 2 | 2 | - | - | - | - | 2 | | | |
| **CO2** | 2 | 1 | - | - | - | - | - | 2 | 2 | - | - | - | - | 2 | | | |
| **CO3** | 3 | 2 | 1 | - | 2 | - | - | 2 | 2 | 1 | - | - | - | 2 | | | |
| **CO4** | 3 | 2 | 1 | - | 2 | - | - | 2 | 2 | 1 | - | - | - | 2 | | | |
| **CO5** | 2 | 1 | - | - | - | - | - | 2 | 2 | 1 | - | - | - | 2 | | | |
| **CO6** | 3 | 2 | 1 | - | 2 | - | - | 2 | 2 | 1 | - | - | - | 2 | | | |

| 20CSV61 | COMPUTER VISION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives :**

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 9**

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

**UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION 9**

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

**UNIT III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION 9**

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

**UNIT IV 3D RECONSTRUCTION 9**

Shape from X - Active rangefinding - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos

**UNIT V IMAGE-BASED RENDERING AND RECOGNITION 9**

View interpolation Layered depth images - Light fields and Lumi graphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

**REFERENCES:**

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006

**OUTCOMES:**
**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| Course Name: COMPUTER VISION | | Course Code : 20CSV61 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Understand basic knowledge, theories and methods in image processing and computer vision. | 1 | K2 | 1,2, 8,10 | |
| **CO2** | Implement basic and some advanced image processing techniques in Open CV. | 2 | K2 | 1,2,3, | |
| **CO3** | Apply 2D feature-based based image alignment, segmentation and motion estimations. | 3 | K2 | 1,2,3, 8,10 | 1,2 |
| **CO4** | Apply 3D image reconstruction techniques | 4 | K2 | 1,2,3 | 1,2 |
| **CO5** | Understand the innovative image processing concepts | 5 | K2 | 1,2, 8,10 | |
| **CO6** | Develop innovative image processing and computer vision applications. | 6 | K3 | 1,2,3 | 1,2 |

**CO-PO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | | | | | | 2 | | 2 | | | | |
| **CO2** | 3 | 2 | 1 | | | | | | | | | | | |
| **CO3** | 3 | 2 | 1 | | | | | 2 | | 2 | | | 1 | 1 |
| **CO4** | 3 | 2 | 1 | | | | | | | | | | 1 | 1 |
| **CO5** | 2 | 1 | | | | | | 2 | | 2 | | | | |
| **CO6** | 3 | 2 | 1 | | | | | | | | | | 1 | 1 |

| 20ITV73 | DEVOPS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 4 |

**Objectives :**

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ ContinuousDeployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve realworld problems

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO DEVOPS** **6**

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

**Lab Component:** **6**

**1.** Install Jenkins in Cloud
**2.** Install Ansible and configure ansible roles and to write playbook

**UNIT II COMPILE AND BUILD USING MAVEN & GRADLE** **6**

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

**Lab Component:** **6**

1. Build a simple application using Gradle

**UNIT III CONTINUOUS INTEGRATION USING JENKINS** **6**

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

**Lab Component:** **6**

1. Create CI pipeline using Jenkins
2. Create a CD pipeline in Jenkins and deploy in Cloud

**UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE** **6**

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible.

**Lab Component:** **6**

1. Create an Ansible playbook for a simple web application infrastructure

**UNIT V BUILDING DEVOPS PIPELINES USING AZURE** **6**

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

**Lab Component:** **6**

1.Create Maven Build pipeline in Azure
2.Run regression tests using Maven Build pipeline in Azure

**TOTAL: 60 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
2. Jeff Geerling, “Ansible for DevOps: Server and configuration management for
3. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
4. 4. Mariot Tsitoara, “Ansible Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : DEVOPS** | | **Course Code : 20ITV73** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Understand different actions performed through Version control tools like Git. | 1 | K2 | 1,2,8,10 | |
| **CO2** | Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle | 2 | K2 | 1,2 | |
| **CO3** | Perform Automated Continuous Deployment | 3 | K2 | 1,2,8,10 | |
| **CO4** | Do configuration management using Ansible | 4 | K2 | 1,2 | |
| **CO5** | Understand to leverage Cloud-based DevOps tools using Azure DevOps | 5 | K2 | 1,2,5,8,10 | 1,2 |
| **CO6** | Implement the Devop pipeline using Azure | 6 | K3 | 1,2,3,5 | 1,2 |

**CO-PO Mapping**

| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | | | | | | 2 | | 2 | | | | |
| **CO2** | 2 | 1 | | | | | | | | | | | | |
| **CO3** | 2 | 1 | | | | | | 2 | | 2 | | | | |
| **CO4** | 2 | 1 | | | | | | | | | | | | |
| **CO5** | 2 | 1 | | | 2 | | | 2 | | 2 | | | 1 | 1 |
| **CO6** | 3 | 2 | 1 | | 2 | | | | | | | | 1 | 1 |

**20ITV81 REINFORCEMENT LEARNING TECHNIQUES**

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

**Objectives :**

- To introduce the fundamentals of Reinforcement Learning
- To illustrate model-based prediction and control using dynamic programming
- To illustrate model-free prediction and control
- To introduce planning and learning with tabular methods
- To explain approximation of a value function

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION** **9**

Introduction to Reinforcement learning, examples - Elements of reinforcement learning - Limitations and Scope- An extended example - multi-armed bandits - k-armed bandit problem - action-value methods - the 10-armed testbed - incremental implementation - tracking a nonstationary problem - optimistic initial values - upper-confidence-bound action selection - associative search

**UNIT II MARKOV DECISION PROCESS AND MODEL-BASED PREDICTION AND CONTROL** **9**

Finite Markov Decision Process - The Agent–Environment Interface - Goals and Rewards - Returns and Episodes - Unified Notation for Episodic and Continuing Tasks - Policies and Value Functions - Optimal Policies and Optimal Value Functions - Optimality and Approximation - Dynamic Programming - Policy Evaluation (Prediction) - Policy Improvement - Policy Iteration - Value Iteration - Generalized Policy Iteration - Efficiency of Dynamic Programming - Asynchronous Dynamic Programming

**UNIT III MODEL-FREE PREDICTION AND CONTROL** **9**

Model-free learning - Model-free prediction - Monte Carlo methods - Monte Carlo Prediction - Monte Carlo Estimation of Action Values - Temporal-Difference Learning - TD Prediction - Advantages of TD Prediction Methods - Optimality of TD(0) - n-step Bootstrapping - n-step TD Prediction - n-step Sarsa - Model-free control - Monte Carlo Control - Monte Carlo Control without Exploring Starts - Off policy learning - Importance sampling - Off-policy Monte Carlo Control - Sarsa: On-policy TD Control - Q-learning: Off-policy TD control

**UNIT IV PLANNING AND LEARNING WITH TABULAR METHODS** **9**

Models and planning - Dyna: Integrated Planning, Acting and Learning - When the model is wrong - Prioritized Sweeping - Real-time Dynamic Programming - Monte Carlo Tree Search

**UNIT V VALUE FUNCTION APPROXIMATION** **9**

On-policy Prediction with Approximation - Value Function Approximation - The Prediction Objective (VE) - Stochastic-gradient and Semi-gradient Methods - Linear Methods - Least-Squares TD.

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An introduction, 2nd edition, The MIT Press, 2015.
2. Martijn van Otterlo, Marco Wiering, Reinforcement Learning: State-of-the-Art, Springer Verlag Berlin Heidelberg, 2012.
3. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, 3rd edition, Pearson, 2015.

**REFERENCES:**

1. Good fellow, Y. Bengio, A. Courville, Deep Learning, MIT Press Ltd., 2016.
2. Reinforcement Learning with MATLAB, Math Works Inc., 2020.

**OUTCOMES:**
**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name: REINFORCEMENT LEARNING TECHNIQUES** | | | | | | | | | | **Course Code : 20ITV81** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | | | | | | | | | **Unit** | **K-CO** | **POs** | | **PSOs** |
| **CO1** | Understand basic concepts of reinforcement learning | | | | | | | | | 1 | K2 | 1,2 | | |
| **CO2** | Perform model-based prediction and control using dynamic programming | | | | | | | | | 2 | K2 | 1,2,3,8,10 | | |
| **CO3** | Apply model-free prediction and control | | | | | | | | | 3 | K2 | 1,2,3 | | 1,2 |
| **CO4** | Comprehend the use of tabular methods | | | | | | | | | 4 | K2 | 1,2,3,8,10 | | 1,2 |
| **CO5** | Understand how a value function can be approximated | | | | | | | | | 5 | K2 | 1,2 | | |
| **CO6** | Apply Stochastic-gradient and Semi-gradient Methods for value function approximation | | | | | | | | | 6 | K3 | 1,2,3,8,10 | | 1,2 |
| **CO-PO Mapping** | | | | | | | | | | | | | | |
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 2 | 1 | | | | | | | | | | | | |
| **CO2** | 3 | 2 | 1 | | | | | 2 | | 2 | | | | |
| **CO3** | 3 | 2 | 1 | | | | | | | | | | | |
| **CO4** | 3 | 2 | 1 | | | | | 2 | | 2 | | | 1 | 1 |
| **CO5** | 2 | 1 | | | | | | | | | | | | |
| **CO6** | 3 | 2 | 1 | | | | | 2 | | 2 | | | 1 | 1 |

| | | L | T | P | C |
|---|---|---|---|---|---|
| **20CSV74** | **AGILE METHODOLOGIES** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To Provide iterative, incremental development process leads to faster delivery of more
  useful software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques and Analyze the essence of agile development methods.
- To understand the benefits and pitfalls of working in an Agile team and Develop prototyping in the software process..
- To understand Agile development and testing.

**PRE REQUISITE:** NIL

**UNIT - I FUNDAMENTALS OF AGILE 9**

The Genesis of Agile – Introduction and background – Agile Manifesto and Principles – Overview of Scrum – Extreme Programming – Feature Driven development – Lean Software Development – Agile project management – Design and development practices in Agile projects - Continuous Integration – Refactoring - Pair Programming - Simple Design - AgileTools.

**UNIT - II AGILE SCRUM FRAMEWORK 9**

Introduction to Scrum – Project phases – Agile Estimation – Planning game –Product backlog – Sprint backlog - Iteration planning – User story definition –Characteristics and content of user stories – Acceptance tests and Verifying stories – Project velocity – Burndown chart – Sprint planning and retrospective – Daily scrum – Scrum roles — Product Owner - Scrum Master - Scrum Team - Scrum case study - Tools for Agile project management.

**UNIT - III AGILE REQUIREMENTS ENGINEERING ANDTESTING 9**

Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment – Concurrency in Agile Requirements Generation – The Agile lifecycle and its impact on testing –Test Driven Development (TDD) – acceptance tests and scenarios – Planning and managing testing cycle – Exploratory testing - Risk based testing - Regression tests - Test Automation – Tools to support the Agile tester.

**UNIT - IV AGILE SOFTWARE DESIGN AND DEVELOPMENT 9**

Agile design practices- Role of design Principles including Single Responsibility Principle- Open Closed Principle- Liskov Substitution Principle – Interface Segregation Principles- Dependency Inversion Principle in Agile Design - Need and significance of Refactoring- Refactoring Techniques- Continuous Integration - Automated build tools - Version control.

**UNIT - V QUALITY ASSURANCE AND INDUSTRYTRENDS 9**

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance – Agile Approach in Global Software Development. Agile applicability-Agile in Distributed teams – Business benefits –Challenges in Agile – Risks and Mitigation.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Hazza and Dubinsky, Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009
2. Ken Schawber, Mike Beedle, Agile Software Development with Scrum, Pearson, 2008.
3. Robert C.Martin, Agile Software Development, Principles, Patterns and Practices, Prentice Hall, 2002.

**REFERENCES:**

1. Lisa Crispin, Janet Gregory, "AgileTesting: A Practical Guide for Testers and AgileTeams", Addison Wesley, 2008
2. Kevin C. Desouza, Agile Information Systems: Conceptualization, Construction, and Management, Butterworth Heinemann, 2007
3. Alistair Cockburn, Agile Software Development: The Cooperative Game", Addison Wesley, 2006.
4. Mike Cohn Publisher, "User Stories Applied: For Agile Software", Addison Wesley, 2004
5. Craig Larman, Agile and Iterative Development: A Manager’s Guide, Addison Wesley, 2004.

| 20CSV84 | VIRTUAL REALITY AND AUGMENTED REALITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To learn rapidly evolving and commercially viable field of computer science.
- To become familiar with geometric modeling and computer graphics.
- To learn various types of Hardware and Software in virtual Reality systems

**PRE-REQUISITE:NIL**

**UNIT - I INTRODUCTION TO VIRTUAL REALITY 9**

Virtual Reality and Virtual Environment: Introduction-Computer graphics-Real time computer graphics-Flight Simulation-Virtual environment requirement-benefits of virtual reality-Historical development of VR-Scientific Landmark.

**UNIT - II AUGMENTED REALITY 9**

Taxonomy-technology and features of augmented reality-difference between AR and VR-Challenges with AR-AR systems and functionality-Augmented reality method-visualization techniques for augmented reality-enhancing interactivity in AR environments-evaluating AR systems.

**UNIT - III COMPUTER GRAPHICS AND GEOMETRIC MODELING 9**

Introduction-The Virtual world space-positioning the virtual observer-The perspective projection-Human vision-Stereo perspective projection- Colour theory-Geometrical Transformations-Introduction-frames of reference-Modeling transformations-scaling the VE-Collision detection.

**UNIT - IV DEVELOPMENT TOOLS AND FRAMEWORK 9**

Human factors-Hardware-Software-The somatic senses-Sensor hardware-Head coupled displays-Acoustic hardware-Integrated VR systems-Modeling virtual world-Physical simulation.

**UNIT - V AUGMENTED AND VIRTUAL REALITY APPLICATION 9**

Virtual Reality Applications: Introduction – Engineering – Entertainment-Education- The Future: Introduction – Virtual environments – modes of interaction. Case study on Oculus Rift - Head mounted display.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Jernej Barbic-Mirabelle D'Cruz Marc Erich Latoschik, Melslater Patrick Bourdot Edition 2017.
2. Timothy Jung M.claudia tom Diek Philip A.Rauschnabel 2019

**REFERENCES:**


1. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016
2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan A. Kaufmann, 2013
3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications,
4. Foundations of Effective Design, Morgan Kaufmann, 2009.
5. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007


**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : VIRTUAL REALITY AND AUGMENTED REALITY** | | | | | | | | | | | | **Course Code : 20CSV84** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | | | | | | | | | | | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Explain the Virtual Reality and Environment, Virtual Reality Requirements and benefits | | | | | | | | | | | 1 | K2 | 1,2,8,9 | 1,2 |
| **CO2** | Illustrate the visualization techniques for augmented reality | | | | | | | | | | | 2 | K2 | 1,2,8,9, 10 | 1,2 |
| **CO3** | Discuss the concept of Computer Graphics And Geometric Modeling | | | | | | | | | | | 3 | K2 | 1,2,8,9 | 1,2 |
| **CO4** | Use various types of Hardware and software in virtual Reality systems | | | | | | | | | | | 4 | K3 | 1,2,3,8,9, 12 | 1,2 |
| **CO5** | Apply Development Tools And Framework for Virtual Reality | | | | | | | | | | | 4 | K3 | 1,2,3, 5,6,8,9, 12 | 1,2 |
| **CO6** | Analyze and Design a system or process to meet given specifications with Realistic Engineering Constraints | | | | | | | | | | | 5 | K4 | 1,2,3,4, 5,6,8,9, 10, 12 | 1,2 |
| **CO-PO Mapping** | | | | | | | | | | | | | | | |
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | |
| **CO1** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 3 | |
| **CO2** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 3 | |
| **CO3** | 2 | 1 | - | - | - | - | - | 1 | 1 | - | - | - | 2 | 3 | |
| **CO4** | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 1 | 2 | 3 | |
| **CO5** | 3 | 2 | 1 | - | 2 | 1 | - | 2 | 2 | 1 | - | 1 | 2 | 3 | |
| **CO6** | 3 | 3 | 2 | 1 | 1 | 1 | - | 2 | 2 | 2 | - | 1 | 2 | 3 | |

| | | L | T | P | C |
|---|---|---|---|---|---|
| 20ADV14 | DATA AND INFORMATION SECURITY | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To equip the students' knowledge on digital signature, email security and web security

**UNIT-I INTRODUCTION** **9**

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

**UNIT- II SECURITY INVESTIGATION** **9**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

**UNIT- III DIGITAL SIGNATURE AND AUTHENTICATION** **9**

Digital Signature and Authentication Schemes: Digital Signature-Digital Signature Schemes and their Variants- Digital Signature Standards-Authentication: Overview- Requirements Protocols - Applications - Kerberos -X.509 Directory Services

**UNI-IV E-MAIL AND IP SECURITY** **9**

E-mail and IP Security: Electronic mail security: Email Architecture -PGP – Operational Descriptions- Key management- Trust Model- S/MIME.IP Security: Overview- Architecture - ESP, AH Protocols IPSec Modes – Security association - Key management.

**UNIT-V WEB SECURITY** **9**

Web Security: Requirements- Secure Sockets Layer- Objectives-Layers -SSL secure Communication- Protocols - Transport Level Security. Secure Electronic Transaction- Entities DS Verification-SET processing.

**TOTAL:45 PERIODS**

**TEXTBOOKS**

1. Fundamentals and Applications of Renewable Energy | Indian Edition, by Mehmet Kanoglu, Yunus A. Cengel, John M. Cimbala, cGraw Hill; First edition (10 December 2020), ISBN- 10 : 9390385636
2. Renewable Energy Sources and Emerging Technologies, by Kothari, Prentice Hall India Learning Private Limited; 2nd edition (1 January 2011), ISBN-10 : 8120344707

**REFERENCES:**

1. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 2012.
2. Rai.G.D., “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2014.
3. Sukhatme.S.P., “Solar Energy: Principles of Thermal Collection and Storage”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.
4. Tiwari G.N., “Solar Energy – Fundamentals Design, Modelling and applications”, Alpha Science Intl Ltd, 2015.
5. Twidell, J.W. & Weir A., “Renewable Energy Resources”, EFNSpon Ltd., UK, 2015

| 20ITV24 | QUANTUM COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives :**

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

**PRE-REQUISITE:** NIL

**UNIT I QUANTUM COMPUTING BASIC CONCEPTS 9**

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits - Superpositions

**UNIT II QUANTUM GATES AND CIRCUITS 9**

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction

**UNIT III QUANTUM ALGORITHMS 9**

Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm

**UNIT IV QUANTUM INFORMATION THEORY 9**

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels

**UNIT V QUANTUM CRYPTOGRAPHY 9**

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computing for Everyone".

**REFERENCES:**

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.

**20ITV42 CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES**

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

**Objectives :**

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION TO BLOCKCHAIN 9**

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

**UNIT II BITCOIN AND CRYPTOCURRENCY 9**

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

**UNIT III BITCOIN CONSENSUS 9**

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases

**UNIT IV HYPERLEDGER FABRIC & ETHEREUM 9**

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity

**UNIT V BLOCKCHAIN APPLICATIONS 9**

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014.

**REFERENCES:**

1. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

| 20ITV64 | 3D PRINTING AND DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Objectives :**

- To discuss on basics of 3D printing
- To explain the principles of 3D printing technique
- To explain and illustrate inkjet technology
- To explain and illustrate laser technology
- To discuss the applications of 3D printing

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION** **9**

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats

**UNIT II PRINCIPLE** **9**

Processes – Extrusion, Wire, Granular, Lamination, Photopolymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations;

**UNIT III INKJET TECHNOLOGY** **9**

Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continous jet, Mulitjet; Powder based

**UNIT IV LASER TECHNOLOGY** **9**

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow–Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures;

**UNIT V INDUSTRIAL APPLICATIONS** **9**

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends;

TOTAL: 45 PERIODS

**TEXT BOOKS :**

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.

**REFERENCES:**

1. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007
3. Joan Horvath, Mastering 3D Printing, APress, 2014

| 20SCV54 | CYBER SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand various types of cyber-attacks and cyber-crimes
- To learn threats and risks within context of the cyber security
- To have an overview of the cyber laws & concepts of cyber forensics
- To study the defensive techniques against these attacks

**PRE-REQUISITE: NIL**

**UNIT - I INTRODUCTION 9**

Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats - Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc.

**UNIT - II CYBER FORENSICS 9**

Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

**UNIT -III CYBER CRIME: MOBILE AND WIRELESS DEVICES 9**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones

**UNIT -IV PRIVACY ISSUES 9**

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains - medical, financial, etc

**UNIT - V CYBERCRIME 9**

Cybercrime: Examples and Mini-Cases Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, 2013
2. B.B.Gupta, D.P.Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, 2018.

**REFERENCES:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press, 2016
2. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber security, CRC Press T&F Group, 2013.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : CYBER SECURITY** | | | | | **Course Code : 20SCV54** |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Identify the fundamental concepts of cyber security and the layers of cyber security based on real time scenarios | 1 | K3 | 1,2,3,6,8,9,12 | 1 |
| **CO2** | Illustrate the process of digital forensics, analysis and challenges in computer forensics | 2 | K4 | 1,2,3,4,6,8,9,12 | 1 |
| **CO3** | Analyze the security challenges and prevention measures for the security attacks on mobile and wireless devices | 3 | K4 | 1,2,3,4,6,8,9,12 | 1 |
| **CO4** | Discuss the concepts of privacy Attacks, Data linking and profiling | 4 | K2 | 1,2,6,8,9,10,12 | 1 |
| **CO5** | Explain the privacy policies and their specifications in various domains | 4 | K2 | 1,2,6,8,9,10,12 | 1 |
| **CO6** | Infer the category of the cyber security attacks and analyze its security measures | 5 | K4 | 1,2,3,4,6,8,9,12 | 1 |

CO-PO Mapping

| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | - | 3 | - | 2 | 2 | 2 | - | 2 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 1 | - | 3 | - | 2 | 2 | 2 | - | 2 | 1 | 1 |
| **CO3** | 3 | 3 | 2 | 1 | - | 3 | - | 2 | 2 | 2 | - | 2 | 1 | 1 |
| **CO4** | 2 | 1 | - | - | - | 3 | - | 2 | 2 | 2 | - | 2 | 1 | 1 |
| **CO5** | 2 | 1 | - | - | - | 3 | - | 2 | 2 | 2 | - | 2 | 1 | 1 |
| **CO6** | 3 | 3 | 2 | 1 | - | 3 | - | 2 | 2 | 2 | - | 2 | 1 | 1 |

| 20ADV15 | BUSINESS INTELLIGENCE SYSTEM | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for analytics.
- To apply analytics for different functions of a business

**PRE-REQUISITE**: NIL

**UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9**

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation –Deployment and Iteration

**UNIT II BUSINESS INTELLIGENCE 9**

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions – Decision Making Process- Decision Support Systems –Business Intelligence –OLAP–, Analytic functions

**UNIT III BUSINESS FORECASTING 9**

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling–Machine Learning for Predictive analytics.

**UNIT IV HR & SUPPLY CHAIN ANALYTICS 9**

HumanResources–PlanningandRecruitment–TrainingandDevelopment-Supplychainnetwork - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR &Supply Chain

**UNIT V MARKETING& SALES ANALYTICS 9**

Marketing Strategy, Marketing Mix, Customer Behavior– selling Process – Sales Planning – Analytics applications in Marketing and Sales

**TOTAL:45 PERIODS**

**REFERENCES:**

1. R. EvansJames, Business Analytics, 2017
2. RNPrasad, Seema Acharya, Fundamentals of Business Analytics, 2016
3. PhilipKotler and KevinKeller, Marketing Management, 15thedition,PHI,2016
4. VSPRAO, Human Resource Management, 3rdEdition, ExcelBooks,2010.
5. MahadevanB,“OperationsManagement-TheoryandPractice”,3rdEdition,PearsonEducation, 2018.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name :** Business Intelligence System | | **Course Code :** 20ADV15 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Describe the fundamental concepts of analytics life cycle modeling and evaluation | 1 | K2 | 1, 2, 6, 8, 9, 10, 12 | 1,2 |
| **CO2** | Apply business analytics and business intelligence tools as a business process to support evidence-based decision-making. | 2 | K3 | 1, 2, 3, 6, 8, 9, 10, 12 | 1,2 |
| **CO3** | Illustrate business analytics using data mining techniques to meet the needs of a business forecasting. | 3 | K3 | 1, 2, 3 6, 8, 9, 10, 12 | 1,2 |
| **CO4** | Discuss the concepts of human resources and Supply chain network | 4 | K2 | 1, 2, 6, 8, 9, 10, 12 | 1,2 |
| **CO5** | Summarize the process involved in Marketing and Sales. | 5 | K2 | 1, 2, 6, 8, 9, 10, 12 | 1,2 |
| **CO6** | Analyze, Investigate and evaluate key concepts of Business Intelligence and Analytics techniques that assess complex datasets in field of HR, Supply chain, Marketing and Sales | 4,5 | K4 | 1, 2, 3,4, 6, 8, 9, 10, 12 | 1,2 |

| CO-PO Mapping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 2 | 1 | - | - | - | 3 | 2 | 2 | 2 | 2 | - | 2 | 1 | 1 |
| **CO2** | 3 | 2 | 1 | - | - | 3 | 2 | 2 | 2 | 2 | - | 2 | 1 | 1 |
| **CO3** | 3 | 2 | 1 | - | - | 3 | 2 | 2 | 2 | 2 | - | 2 | 1 | 1 |
| **CO4** | 2 | 1 | - | - | - | 3 | 2 | 2 | 2 | 2 | - | 2 | 1 | 1 |
| **CO5** | 2 | 1 | - | - | - | 3 | 2 | 2 | 2 | 2 | - | 2 | 1 | 1 |
| **CO6** | 3 | 3 | 2 | 1 | - | 3 | 2 | 2 | 2 | 2 | - | 2 | 1 | 1 |

| 20ADV25 | DATA COMMUNICATION AND COMPUTER NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the fundamental various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI Model
- To introduce UDP and TCP Models.

**UNIT-I DATA COMMUNICATIONS 9**

Components–Direction of Dataflow– Networks– Components and Categories–Types of Connections – Topologies –Protocols and Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay, ISDN Physical layer: Transmission modes, Multiplexing,Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks.

**UNIT- II DATA LINK LAYER 9**

Introduction, Framing, and Error– Detection and Correction– Parity– LRC – CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols. 111Medium Access sub layer: ALOHA, CSMA/CD, LAN –Ethernet IEEE802.3, IEEE802.5–IEEE802.11,Randomaccess,Controlledaccess,Channelization

**UNIT- III NETWORK LAYER 9**

Logical Addressing, Inter networking,Tunneling, Address mapping, ICMP,IGMP,Forwarding,Uni-Cast Routing Protocols, Multi cast Routing Protocols.

**UNI-IV TRANSPORT LAYER 9**

Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS,
Integrated Services, Differentiated Services, QoS in Switched Networks.

**UNIT-V APPLICATION LAYER 9**

Domain namespace, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.

**TOTAL:45PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

1. Familiarize the basic layers and its functions in computer networks
2. Evaluate the performance of a network
3. Concepts of the basics of how data flows from one node to another
4. Analyze and design routing algorithms
5. Design protocols for various functions in the network
6. Know about the working of various application layer protocols

**TEXTBOOKS**

1. Data Communications and Networking, BehrouzA. Forouzan, Fourth EditionTMH,2006.
2. ComputerNetworks,AndrewSTanenbaum,4th Edition.Pearson Education, PHI

**REFERENCES**

1. Data communications and Computer Networks, P.C .Gupta, PHI.
2. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, PearsonEducation.

3. Understanding communications and Networks, 3rd Edition, W.A. Shay, Cengage Learning.
4. Computer Networking: A Top-Down Approach Featuring the Internet. James F.Kurose & Keith W. Ross, 3 rd Edition, Pearson Education.
5. Data and Computer Communication, William Stallings, Sixth Edition, Pearson Education, 2000.

| 20ADV34 | NEURAL NETWORKS AND DEEP LEARNING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES*:***

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- To apply generative models for suitable applications.

**UNIT-I INTRODUCTION** **6**

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction-Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network

**Lab Component:** **6**

1. Implement simple vector addition in TensorFlow.
2. Implement a regression model in Keras.

**UNIT -II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS** **6**

Training Algorithms for Pattern Association-Auto associative Memory Network-Hetero associative Memory Network-Bidirectional Associative Memory (BAM)-Iterative Auto associative Memory Networks-Fixed Weight Competitive Nets(MAXNET, Hamming Network)-Kohonen Self-Organizing Feature Maps.

**Lab Component:** **6**

1. Implement a perceptron in TensorFlow/Keras Environment.
2. Implement a Feed-Forward Network in TensorFlow/Keras.

**UNIT -III THIRD-GENERATION NEURAL NETWORKS** **6**

Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Efficient Convolution Algorithms

**Lab Component:** **6**

**1.** Implement an Image Classifier using CNN in TensorFlow/Keras

**UNIT -IV DEEP FEED FORWARD NETWORKS** **6**

A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout.

**Lab Component:** **6**

**1.** Implement character and Digit Recognition using ANN

**UNIT V RECURRENT NEURAL NETWORKS** **6**

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing.

**Lab Component:** **6**

1. Perform Sentiment Analysis using RNN
2. Recommendation system from sales data using Deep Learning

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Ian Good fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.
2. Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications, 2021.

**REFERENCES:**

1. Introduction to Neural Networks Using Matlab 6.0 - S. N. Sivanandam, S. N Deepa Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow”, Oreilly, 2018.
2. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media, 2017.
3. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017.S Rajasekaran, G A Vijayalakshmi Pai, “Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications”, PHI Learning, 2017.
7. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
8. James A Freeman, David M S Kapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003

**OUTCOMES:**
**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| Course Name : NEURAL NETWORKS AND DEEP LEARNING | | Course Code : 20ADV34 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Describe the scope of the neural network and explain the basic models of Artificial Neural Network | I | K2 | 1,2 | 1,2 |
| **CO2** | Illustrate the different types of associative memory networks | II | K2 | 1,2,8,9,10 | 1,2 |
| **CO3** | Apply conventional neural network model and its algorithms | III | K3 | 1,2,3,8,9,10 | 1,2 |
| **CO4** | Use deep learning components to build and train deep neural networks for various tasks | IV | K3 | 1,2,3,8,9,10 | 1,2 |
| **CO5** | Apply Recurrent Neural Network and its variants for text analysis | V | K3 | 1,2,3,8,9,10 | 1,2 |
| **CO6** | Utilize the applications of neural networks and deep learning for image compression and Natural Language Processing | V | K3 | 1,2,3,5,8,9,10 | 1,2 |

**CO-PO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | 2 | 1 |
| **CO2** | 2 | 1 | - | - | - | - | - | 2 | 2 | 2 | - | - | 2 | 1 |
| **CO3** | 3 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | - | - | 2 | 1 |
| **CO4** | 3 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | - | - | 2 | 1 |
| **CO5** | 3 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | - | - | 2 | 1 |
| **CO6** | 3 | 2 | 1 | - | 2 | - | - | 2 | 2 | 2 | - | - | 2 | 1 |

| 20ADV45 | ROBOTIC PROCESS AUTOMATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

**PRE-REQUISITE:** NIL

**UNIT - I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9**

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA fromAutomation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms.Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, WorkflowFiles

**UNIT - II AUTOMATION PROCESS ACTIVITIES 9**

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flowfor Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboardmanagement, File operations Controls: Finding the control, waiting for a control, Act on a control,UiExplorer, Handling Events

**UNIT- III APP INTEGRATION, RECORDING AND SCRAPING 9**

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse andkeyboard actions to perform operation, Scraping data from website and writing to CSV.Process Mining

**UNI - IV EXCEPTION HANDLING AND CODE MANAGEMENT 9**

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crashdumps, Error reporting. Code management and maintenance: Project organization, Nestingworkflows, Reusability, Templates, Commenting techniques, State Machine.

**UNIT - V DEPLOYMENT AND MAINTENANCE 9**

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploybots, License management, Publishing and managing updates. RPA Vendors -Open Source RPA, Future of RPA

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

CO1: Understand the robotic process automation and its applications
CO2: Illustrate control flows and work flows for the target process
CO3: Demonstrate recording, web scraping and process mining by automation
CO4:Determineexception handling in automation processes
CO5:Understand Code management and maintenance in automation
CO6: Understand the Orchestrator for controlling of automated bots.

**TEXT BOOKS**

1. Learning Robotic Process Automation: Create Software robots and automate business

processes with the leading RPA tool - UiPath by Alok Mani Tripathi, PacktPublishing, 2018.

2. Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing

RPA Systems”, Apress publications, 2020.

**REFERENCES:**

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston(Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018

2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots,Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018

3. A Gerardus Blokdyk, “Robotic Process Automation Rpa A Complete Guide “, 2020

| 20ADV55 | TEXT AND SPEECH ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

**UNIT-I NATURAL LANGUAGE BASICS 9**

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop- words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

**UNIT- II TEXT CLASSIFICATION 9**

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of 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

**UNI-IV TEXT-TO-SPEECH SYNTHESIS 9**

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems

**UNIT-V AUTOMATIC SPEECH RECOGNITION 9**

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

1. Explain existing and emerging deep learning architectures for text and speech processing
2. Apply deep learning techniques for NLP tasks,
3. Understand the language modeling and machine translation
4. Explain coreference and coherence for text processing
5. Build question-answering systems, chatbots and dialogue systems
6. Apply deep learning models for building speech recognition and text-to-speech systems

**TEXTBOOKS**

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. DipanjanSarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress,2018.
2. TanveerSiddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3. LawrenceRabiner, 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.

| | | L | T | P | C |
|---|---|---|---|---|---|
| 20ITV65 | FUZZY LOGIC AND APPLICATIONS | 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To impact knowledge on fuzzy logic principles
- To understand models of ANN
- To explain the concepts of fuzzy sets are introduced and their role in applications of semantic interpreters, control systems and reasoning system
- To use the fuzzy logic and neural network for application related to design and manufacture.

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION TO FUZZY LOGIC PRINCIPLES 9**

Basic concepts of fuzzy set theory – operations of fuzzy sets – properties of fuzzy sets – Crisp relations – Fuzzy relational equations – operations on fuzzy relations – fuzzy systems – propositional logic – Inference – Predicate Logic – Inference in predicate logic – fuzzy logic principles – fuzzy quantifiers – fuzzy inference – fuzzy rule based systems – fuzzification and defuzzification – types.

**UNIT II ADVANCED FUZZY LOGIC APPLICATIONS 9**

Fuzzy logic controllers – principles – review of control systems theory – various industrial applications of FLC adaptive fuzzy systems – fuzzy decision making – Multi objective decision making – fuzzy classification – means clustering – fuzzy pattern recognition – image processing applications – systactic recognition – fuzzy optimization

**UNIT III INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 9**

Fundamentals of neural networks – model of an artificial neuron – neural network architectures – Learning methods – Taxonomy of Neural network architectures – Standard back propagation algorithms – selection of various parameters – variations Applications of back propagation algorithms.

**UNIT IV OTHER ANN ARCHITECTURES 9**

Associative memory – exponential BAM – Associative memory for real coded pattern pairs – Applications adaptive reasonance theory – introduction – ART 1 – ART2 –Applications – neural networks based on competition – kohenen self organizing maps –learning vector quantization – counter propagation networks – industrial applications.

**UNIT V RECENT ADVANCES 9**

Fundamentals of genetic algorithms – genetic modeling – hybrid systems – integration of fuzzy logic, neural networks and genetic algorithms – non-traditional optimization techniques like ant colony optimization – Particle swarm optimization and artificial immune systems – applications in design and manufacturing.

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1.S.Rajasekaran.G.A.Vijayalakshmi Pai “Neural Networks, fuzzy logic and genetic algorithms”, prentice hall of India private limited, 2003

2. Timothy J.Ross, “Fuzzy logic with engineering applications”, McGraw Hill, 1995

3. Zurada J.M. “Introduction to artificial neural systems”, Jaico publishing house, 1994

**REFERENCES:**

1. Klir.G, Yuan B.B. “Fuzzy sets and fuzzy logic prentice Hall of India private limited, 1997.

2. Laurance Fausett, “Fundamentals of neural networks”, Prentice hall, 1992

3. Gen, M. and R. Cheng “Genetic algorithm and engineering design”, john wiley 1997

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name: FUZZY LOGIC AND APPLICATIONS** | | **Course Code : 20ITV65** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| **CO1** | Understand basic knowledge of the fuzzy sets, operations and their properties. | 1 | K2 | 1,2 | |
| **CO2** | Understand the fundamental concepts of Fuzzy functions and Fuzzy logic | 2 | K2 | 1,2,8,10 | |
| **CO3** | Apply the concepts of Fuzzy sets in image processing, pattern reorganization and decision making | 2 | K2 | 1,2,3 | 1,2 |
| **CO4** | Understand the fundamental of neural network and architecture | 3 | K2 | 1,2,8,10 | |
| **CO5** | Understand the advanced neural network and architecture | 4 | K2 | 1,2 | |
| **CO6** | Apply non-traditional optimization techniques in design and manufacturing applications. | 5 | K3 | 1,2,3,8,10 | 1,2 |

**CO-PO Mapping**

| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | | | | | | | | | | | | |
| **CO2** | 2 | 1 | | | | | | 2 | | 2 | | | | |
| **CO3** | 3 | 2 | 1 | | | | | | | | | | | 1 |
| **CO4** | 2 | 1 | | | | | | 2 | | 2 | | | 1 | |
| **CO5** | 2 | 1 | | | | | | | | | | | | |
| **CO6** | 3 | 2 | 1 | | | | | 2 | | 2 | | | 1 | 1 |

| 20ADV75 | ETHICS AND AI | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- Study the morality and ethics in AI
- Learn about the Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- Study about AI and Ethics- challenges and opportunities

**UNIT-I INTRODUCTION** **9**

DefinitionofmoralityandethicsinAI-Impactonsociety-Impactonhumanpsychology-Impactonthelegalsystem-Impactontheenvironmentand the planet-Impact on trust

**UNIT- II ETHICAL INITIATIVES IN AI** **9**

International ethical initiatives-Ethical harms and concerns-Case study: health care robots, Autonomous Vehicles, Warfare and weaponization

**UNIT- III AI STANDARDS AND REGULATION** **9**

ModelProcessforAddressingEthicalConcernsDuringSystemDesign-TransparencyofAutonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - OntologicalStandardforEthicallyDrivenRoboticsandAutomationSystems

**UNI-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.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

1. Learn about morality and ethics in AI
2. Acquire the knowledge of real time application ethics, issues and its challenges.
3. Understand the ethical harms and ethical initiatives in AI
4. Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems
5. Understand the concepts of Roboethics and Morality with professional responsibilities.
6. Learn about the societal issues in AI with National and International Strategies on AI

**TEXTBOOKS**

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

| 20ADV85 | HEALTH CARE ANALYTICS | L | T | P | C |
|---|---|---|---|---|---|

**3 0 0 3**

**OBJECTIVES:**

- Understand the health data formats, health care policy and standards
- Learn the significance and need of data analysis and data visualization
- Understand the health data management frameworks
- Learn the use of machine learning and deep learning algorithms in healthcare
- Apply healthcare analytics for critical care applications

**UNIT-I INTRODUCTIONINTRODUCTION 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 , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , 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

**UNI-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:45 PERIODS**

**TEXT BOOKS:**

1. ChandanK.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, ChintanBhatl, “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.

**OUTCOMES:**

On Completion of the course, the students should be able to:

| Course Name: HEALTH CARE ANALYTICS | | Course Code:20ADV85 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| CO1 | Explain the machine learning and deep learning algorithms for health data analysis | 1 | K2 | 1,2,9,12 | 1 |
| CO2 | Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications | 2 | K3 | 1,2,3,5,12 | 1 |
| CO3 | Discuss the data management techniques for healthcare data | 3 | K2 | 1,2,9,12 | 1 |
| CO4 | Apply health data analytics for real time applications | 4 | K3 | 1,2,9,12 | 1 |
| CO5 | Understand emergency care system using health data analysis | 4 | K2 | 1,2,9,12 | 1 |
| CO6 | Apply health care analytics in Healthcare and Emerging Technologies | 5 | K3 | 1,2,3,9,12 | 1 |

CO-PO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | - | - | - | - | 2 | | - | 2 | 2 | 1 |
| CO2 | 3 | 2 | 1 | - | 2 | - | - | - | | | - | 2 | 1 | 3 |
| CO3 | 2 | 1 | - | - | - | - | - | - | 2 | | - | 2 | - | 3 |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | 2 | | - | 2 | - | 3 |
| CO5 | 2 | 1 | - | - | - | - | - | - | 2 | | - | 2 | 3 | - |
| CO6 | 3 | 2 | 1 | - | 2 | - | - | - | 2 | | - | 2 | 3 | - |

**20OE405 MACHINE LEARNING TECHNIQUES L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To provide a broad survey of different machine learning approaches and techniques
- To understand the principles and concepts of machine learning
- To understand neural networks concepts
- To learn regression and reinforcement learning
- To develop programming skills that helps to build real world applications based on machine learning

**PRE-REQUISITE: NIL**

**UNIT - I INTRODUCTION 9**

Introduction: Machine learning: What and why? - Types of Machine Learning - Supervised Learning -Unsupervised Learning - The Curse of dimensionality - Over and under fitting - Model selection - Error analysis and validation - Parametric vs. non-parametric models.

**UNIT - II CLASSIFICATION 9**

Types of Machine Learning - Supervised Learning - Classification models - Naïve Bayes Classifier – Decision trees - Support Vector Machines - KNN model - Dimensionality reduction - PCA.

**UNIT - III CLUSTERING 9**

Clustering approaches - Mean Shift clustering - Clustering data points and features - Bi-clustering - Multi-view clustering - K-Means clustering - K-medians clustering - Expectation Maximization (EM).

**UNIT - IV REGRESSION 9**

Linear models for regression - Ridge Regression - Bayesian linear regression - Logistic models for regression - Bayesian logistic Regression- Reinforcement Learning.

**UNIT - V ARTIFICIAL NEURAL NETWORKS 9**

Neural networks - Biological motivation for Neural Network - Neural network Representation - Perceptron – Feed forward networks - Multilayer Networks and Back Propagation Algorithms - Hidden layer representation – Application of neural network.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
2. Ethem Alpaydin, “Introduction to Machine Learning”, Second Edition, Prentice Hall of India, 2010.

**REFERENCES**

1. Laurene Fausett, “Fundamentals of Neural Networks, Architectures, Algorithms and Applications”, Pearson Education, 2008.
2. Tom Mitchell, “Machine Learning”, McGraw-Hill, 1997.
3. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| Course Name : MACHINE LEARNING TECHNIQUES | | Course Code : 20OE405 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| CO1 | Discuss the principles and concepts of machine learning and different approaches and techniques | 1 | K2 | 1, 2, 8, 9 | |
| CO2 | Illustrate different classification techniques for various data sets | 2 | K3 | 1,2,3,8,9, 12 | |
| CO3 | Utlize clustering approaches for implementing unsupervised learnin on data sets | 3 | K3 | 1,2,3,8,9, 12 | |
| CO4 | Make use of regression models based on supervised learning for data prediction | 4 | K3 | 1,2,3,8,9, 12 | |
| CO5 | Build an appropriate neural network for learning features in a given data set | 5 | K3 | 1,2,3,5,6,8,9, 12 | |
| CO6 | Apply neural network for solving real world machine learning problems | 5 | K3 | 1,2,3,5,6,8,9, 12 | |

**CO-PO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | - | - | - | 1 | **1** | **1** | - | - | | |
| CO2 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 1 | | |
| CO3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 1 | | |
| CO4 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 1 | | |
| CO5 | 3 | 2 | 1 | - | 1 | 1 | - | 1 | 1 | 1 | - | 1 | | |
| CO6 | 3 | 2 | 1 | - | 1 | 1 | - | 1 | 1 | 1 | 2 | 1 | | |

| 20OE406 | JAVA SCRIPT PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand Definition, Evolution and Nature of JavaScript
- To understand the basics of Script Writing
- To Learn Java Script Names, Objects, and Methods
- To Create Dynamic Web Pages
- To understand the method of Adding Interactivity to a Web Page.

**PRE-REQUISITE: NIL**

**UNIT - I JAVA SCRIPT BASICS 9**

JAVA Script Basics: An introduction to JavaScript– Advantages & Limitations of Java Script. Syntax, Variables, Variable Naming Rules and JavaScript Data Types, Expressions and Operators, Flow Control

**UNIT - II OBJECTS AND ARRAYS 9**

Creating objects, Object Attributes, Serializing Object, Object Methods Represent Multiple values in Java Script, JavaScript DOM, Arrays: Creating Arrays, Array elements, Multi dimensional Arrays, Array Methods , Functions and Methods.

**UNIT - III ADDING INTERACTIVITY TO A WEB PAGE 9**

Controlling Script Flow, Storing Tasks within Functions, Using Conditional Statements for Decision Making, if Statements, if-else Conditional Statements, Using the Date Object, for Conditional Statements, while Conditional Statements, break and continue Statements, with Statements, Creating Functions in JavaScript, Declaring a Function, Designing a Simple Function.

**UNIT - IV CLIENT SIDE JAVASCRIPT 9**

Embedding Java Script in HTML, Execution of JS Program, Dialog boxes, Error Handling & Exceptions. Event Handling: Types of Events, Event Handlers, Document load Events, Mouse Events, Keyboard Events, Drag and Drop Events, Text Events.

**UNIT - V JAVA SCRIPT VALIDATION 9**

Working with Forms: Accessing the form element, The form object, Accessibility, Validation, Using form-based navigation, Form widgets in libraries and HTML5. Errors and Exceptions, Form Validation, Validation-Built-in objects-Event Handling, DHTML with JavaScript

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. David Flanagan JavaScript: The Definitive Guide, 6th Edition,O'Relly, 2011
2. David Sawyer McFarland JavaScript & jQuery: The Missing Manual 3rd Edition, 2014

**REFERENCES:**

1. Marijn Haverbeke Eloquent JavaScript 3rd Edition, No Starch Press, 2018
2. Michael Moncur Teach yourself Java Script in 24 Hours SAMS Publication 2007

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : JAVA SCRIPTING** | | | | **Course Code : 20OE406** | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| CO1 | Summarize various java script components like data types, expressions, operators etc. | 1 | K2 | 1, 2, 8, 9 | |
| CO2 | Discuss the various JavaScript elements, methods, properties, functions and objects | 2 | K2 | 1, 2, 8, 9 | |
| CO3 | Apply appropriate user experience and interactive design concepts to custom websites | 3 | K3 | 1, 2, 3,8, 9,12 | |
| CO4 | Apply the event handling methods in client side scripting | 4 | K3 | 1, 2, 3,8, 9,12 | |
| CO5 | Develop interactive web pages using HTML5 and media tags. | 5 | K3 | 1, 2, 3, 5,8,9,12 | |
| CO6 | Demonstrate HTML5 integration with JavaScript scripting skills in a variety of student designed projects | 5 | K3 | 1,2,3,5,8,9, 10,11,12 | |

**CO-PO Mapping**

| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | - | - | - | 1 | **1** | **1** | - | - | | |
| CO2 | 2 | 1 | - | - | - | - | - | 1 | 1 | 1 | - | - | | |
| CO3 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 1 | | |
| CO4 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 1 | | |
| CO5 | 3 | 2 | 1 | - | 1 | - | - | 1 | 1 | 1 | - | 1 | | |
| CO6 | 3 | 2 | 1 | - | 1 | - | - | 1 | 1 | 2 | 2 | 1 | | |

| 20OE407 | COMPUTER GRAPHICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To Gain knowledge about graphics hardware devices and software used.
- To Understand the two dimensional graphics and their transformations.
- To Understand the three dimensional graphics and their transformations.
- Appreciate illumination and color models.
- Be familiar with understand animation techniques.

**PRE-REQUISITE: NIL**

**UNIT - I INTRODUCTION 9**

Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms.

**UNIT - II TWO DIMENSIONAL GRAPHICS 9**

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

**UNIT - III THREE DIMENSIONAL GRAPHICS 10**

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces - B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping.

**UNIT - IV ILLUMINATION AND COLOUR MODELS 8**

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection.

**UNIT - V ANIMATIONS & REALISM 9**

Animation Graphics: Design of Animation sequences – animation function – raster animation –key frame systems – motion specification –morphing – tweening. Computer Graphics Realism: Tiling the plane – Recursively defined curves – Koch curves – C

curves – Dragons – space filling curves – fractals – Grammar based models – fractals – turtle graphics – ray tracing.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**


1. John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, StevenK. Feiner and Kurt Akeley, Computer Graphics: Principles and Practice", 3rd Edition, Addison-Wesley Professional, 2013.
2. Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007


**REFERENCES:**


1. Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL",4th Edition, Pearson Education, 2010.
2. Jeffrey McConnell, "Computer Graphics: Theory into Practice", Jones and Bartlett Publishers, 2006.
3. Hill F S Jr., "Computer Graphics", Maxwell Macmillan", 1990.
4. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.


**OUTCOMES:**
**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| **Course Name : COMPUTER GRAPHICS** | | **Course Code : 20OE407** | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| CO1 | Explain the hardware devices and software used in graphics systems. | 1 | K2 | 1, 2, 8,9 | |
| CO2 | Apply two dimensional graphics and transformation | 2 | K3 | 1, 2, 3, 8,9 | |
| CO3 | Apply three dimensional graphics and transformation | 3 | K3 | 1, 2, 3, 8,9 | |
| CO4 | Demonstrate the clipping techniques to graphics. | 2,3 | K3 | 1, 2, 3,8,9 | |
| CO5 | Discuss about basic illumination and colour models. | 4 | K2 | 1, 2, 8,9 | |
| CO6 | Explain the animation sequences and various methods in graphics realism | 5 | K2 | 1, 2, 8,9 | |

| **CO-PO Mapping** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | | |
| CO1 | 2 | 1 | | | | | | 1 | **1** | **1** | | | | |
| CO2 | 3 | 2 | 1 | | | | | 1 | 1 | 1 | | | | |
| CO3 | 3 | 2 | 1 | | | | | 1 | 1 | 1 | | | | |
| CO4 | 3 | 2 | 1 | | | | | 1 | 1 | 1 | | | | |
| CO5 | 2 | 1 | | | | | | 1 | 1 | 1 | | | | |
| CO6 | 2 | 1 | | | | | | 1 | 1 | 1 | | | | |

| 20OE408 | ESSENTIALS OF DATA ANALYTICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the basic concepts of Data Analytic.
- To Handle missing data in the real world data sets by choosing appropriate methods
- To Learn data analysis methods
- To learn stream computing
- To Understand and apply Data Analysis Techniques
- To gain knowledge on Hadoop related tools

**PRE-REQUISITE: NIL**

**UNIT - I INTRODUCTION 9**

Knowledge domains of Data Analysis, Understanding structured and unstructured data, data analytic tools, applications of data analytics.

**UNIT – II DATA PREPROCESSING 9**

Data Preprocessing : Data Cleaning –Data Integration - Data Reduction – Data Transformation – Handling Missing Data

**UNIT – III CLASSIFICATION AND CLUSTERING 9**

Mining Various Kinds of Association Rules – Correlation Analysis, Classification: SVM & Kernel Methods Cluster Analysis, Types of Data in Cluster Analysis, K means, Partitioning Methods, Hierarchical Methods, Density Based Methods, Clustering High Dimensional Data - Predictive Analytics.

**UNIT - IV MINING DATA STREAMS 9**

Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams - Real Time Analytics Platform (RTAP) Applications. Case Study: Stock Market Predictions

**UNIT - V DATA ANALYTICS USING R**

Introduction to R Programming: data types in R - built-in functions - Data Manipulation: Data Cleaning, functions used in Data Inspection - Data Visualization: graphical functions, various graphs like tableplot, histogram, Boxplot

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. John Wiley & Sons-Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services (Editor), 2015
2. Craig K. Enders, “Applied Missing Data Analysis”, The Guilford Press, 2010.
3. Kun Ren, Learning R programming, Packt publishing, 2016

**REFERENCES:**

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, Second Edition, 2007.
2. Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis, ,O‘Reilly Media, 2013.
4. Jiawei Han, Micheline Kamber and Jian Pei - Data Mining: Concepts and Techniques”, Third Edition, ISBN 0123814790,

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

| Course Name : ESSENTIALS OF DATA ANALYTICS | | Course Code : 20OE408 | | | |
|---|---|---|---|---|---|
| **CO** | **Course Outcomes** | **Unit** | **K-CO** | **POs** | **PSOs** |
| CO1 | Explain the basic concepts of Data Analytic. | 1 | K2 | 1, 2,8,9 | |
| CO2 | Describe the Data Analysis preprocessing Techniques. | 2 | K2 | 1, 2, 8,9 | |
| CO3 | Explain about how missing data will be handled during preprocessing. | 2 | K2 | 1, 2, 8,9 | |
| CO4 | Apply the Classification and Clustering algorithm for a given data set. | 3 | K3 | 1, 2,3,8,9 | |
| CO5 | Apply the different mining techniques for real time analytics applications. | 4 | K3 | 1, 2, 3,8,9 | |
| CO6 | Explain the Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics | 5 | K2 | 1, 2,5,8,9 | |

**CO-PO Mapping**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | | | | | | 1 | **1** | | | | | |
| CO2 | 2 | 1 | | | | | | 1 | **1** | | | | | |
| CO3 | 2 | 1 | | | | | | 1 | **1** | | | | | |
| CO4 | 3 | 2 | 1 | | | | | 1 | **1** | | | | | |
| CO5 | 3 | 2 | 1 | | | | | 1 | **1** | | | | | |
| CO6 | 2 | 1 | | | 2 | | | 1 | **1** | | | | | |