# CURRICULUM AND SYLLABI

## Choice Based Credit System

## Regulations 2024

# M.Tech – Information Technology

### Department Vision

To attain global recognition in Information Technology education and training and to meet the growing needs of the industry and society.

### Department Mission

Imparting quality education for the challenging needs of the IT industry with ethics and to reach the unreached through technological development. * Promote new uses of Information Technology within the institution through the support for exploratory and innovative applications

# DEPARTMENT OF INFORMATION TECHNOLOGY

# TABLE OF CONTENT

## PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To enable graduates to excel professionally by adapting to the dynamic needs of the industry, academia and research in the field of Information Technology.
2. To enable graduates to practice and promote information technologies for societal needs.
3. To enable graduates to contribute to advancement of information technology by means of research and lifelong learning.

## PROGRAM OUTCOMES (POs)

**Engineering Graduates will be able to:**

a. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

f. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

g. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in

diverse teams, and in multidisciplinary settings.

**j. Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. To analyze, design and develop applications relevant to the industrial needs.

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

3. To develop programs related to IT services based on open source technologies.

**MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME     OUTCOMES**

A broad relation between the programme objective and the outcomes is given in the table

| PROGRAMME EDUCATIONAL OBJECTIVES(PEO) | PROGRAMME OUTCOMES (PO) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | a | b | c | D | e | f | g | h | i | j |
| PEO 1 | M | H | M | H | | | | L | L | M |
| PEO 2 | H | | | | H | | M | | L | L |
| PEO 3 | | H | | M | M | M | M | H | M | |

Contribution L: Low / Reasonable  M: Medium / Significant   H:High / Strong

# FRANCIS XAVIER ENGINEERING COLEGE

## M.TECH INFORMATION TECHNOLOGY

### REGULATION 2024

### CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

## SUMMARY OF CREDIT DISTRIBUTION

| S.No | Category | Credits Per Semester | | | | Total Credits |
|------|----------|------|------|------|------|---------------|
| | | **I** | **II** | **III** | **IV** | |
| **1** | **FC** | 4 | | | | **4** |
| **2** | **PC** | 20 | 14 | | | **34** |
| **3** | **PE** | | 6 | 9 | | **15** |
| **4** | **EEC** | | 1 | 6 | 12 | **19** |
| **Total** | | **24** | **21** | **15** | **12** | **72** |

**Total No. of Credits: 72**

FC      -    Foundation Course

PC      -    Professional Core

PE      -    Professional Elective

EEC    -    Employability Enhancement Course

# FRANCIS XAVIER ENGINEERING COLLEGE

## M. TECH – INFORMATION TECHNOLOGY
### REGULATION 2024
### CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION
### I – IV SEMESTER CURRICULUM AND SYLLABI

## SEMESTER I

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|------|-------------|-------------|----------|-----------------|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 24MA1254 | Statistical Estimation and Random Variables | FC | 4 | 3 | 1 | 0 | 4 |
| 2 | 24IF1601 | Advanced Data Structures and Algorithm Design Techniques | PC | 3 | 3 | 1 | 0 | 4 |
| 3 | 24IF1602 | Multicore Architecture | PC | 3 | 3 | 0 | 0 | 3 |
| 4 | 24IF1603 | Modern Operating System | PC | 3 | 3 | 0 | 0 | 3 |
| 5 | 24IF1604 | Advanced Network Security Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 6 | 24IF1605 | Software Testing and Project Management | PC | 3 | 3 | 0 | 0 | 3 |
| **Practical Courses** | | | | | | | | |
| 1 | 24IF1611 | Advanced Data Structures Laboratory using Java | PC | 4 | 0 | 0 | 4 | 2 |
| 2 | 24IF1612 | Advanced Operating System Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| **Total** | | | | 27 | 18 | 2 | 8 | 24 |

# SEMESTER II

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|------|-------------|-------------|----------|-----------------|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | 24IF2601 | Machine Learning Techniques | PC | 3 | 3 | 0 | 0 | 3 |
| 2 | 24IF2602 | Research Methodologies | PC | 3 | 3 | 0 | 0 | 3 |
| 3 | 24IF2603 | Database Technologies | PC | 3 | 3 | 0 | 0 | 3 |
| 4 | 24IF2604 | Digital Image Processing and Pattern Recognition | PC | 3 | 3 | 0 | 0 | 3 |
| 5 | | Professional Elective - I | PE | 3 | 3 | 0 | 0 | 3 |
| 6 | | Professional Elective - II | PE | 3 | 3 | 0 | 0 | 3 |
| **Practical Courses** | | | | | | | | |
| 1 | 24IF2611 | Database Technologies Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 2 | 24IF2612 | Technical Paper Writing and Seminar | EEC | 2 | 0 | 0 | 2 | 1 |
| **Total** | | | | **24** | **18** | **0** | **6** | **21** |

## SEMESTER III

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|------|-------------|-------------|----------|-----------------|---|---|---|---|
| **Theory Courses** | | | | | | | | |
| 1 | | Professional Elective – III | PE | 3 | 3 | 0 | 0 | 3 |
| 2 | | Professional Elective – IV | PE | 3 | 3 | 0 | 0 | 3 |
| 3 | | Professional Elective - V | PE | 3 | 3 | 0 | 0 | 3 |
| **Practical Courses** | | | | | | | | |
| 1 | 24IF3611 | Innovative Project Phase - I | EEC | 12 | 0 | 0 | 12 | 6 |
| | | **Total** | | **21** | **9** | **0** | **12** | **15** |

## SEMESTER IV

| S.No | Course Code | Course Name | Category | Contact Periods | L | T | P | C |
|------|-------------|-------------|----------|-----------------|---|---|---|---|
| **Practical Courses** | | | | | | | | |
| 1 | 24IF4611 | Innovative Project Phase - II | EEC | 24 | 0 | 0 | 24 | 12 |
| | | **Total** | | 24 | 0 | 0 | 24 | 12 |

| S.No | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| | | **PROFESSIONAL ELECTIVES** | | | | |
| | | **PROFESSIONAL ELECTIVE I** | | | | |
| 1 | 24IF2701 | Statistical Method for Machine Learning | 3 | 0 | 0 | 3 |
| 2 | 24IF2702 | Cloud Computing Technologies | 3 | 0 | 0 | 3 |
| 3 | 24IF2703 | Software Defined Networks | 3 | 0 | 0 | 3 |
| 4 | 24IF2704 | Soft Computing and Fuzzy Logic | 3 | 0 | 0 | 3 |
| | | **PROFESSIONAL ELECTIVE II** | | | | |
| 1 | 24IF2705 | Data Visualization and Interpretation | 3 | 0 | 0 | 3 |
| 2 | 24IF2706 | Big Data Acquisition | 3 | 0 | 0 | 3 |
| 3 | 24IF2707 | Augmented Reality and Virtual Reality | 3 | 0 | 0 | 3 |
| 4 | 24IF2708 | Genetic Algorithms | 3 | 0 | 0 | 3 |
| | | **PROFESSIONAL ELECTIVE III** | | | | |
| 1 | 24IF3701 | Artificial Neural Networks | 3 | 0 | 0 | 3 |
| 2 | 24IF3702 | Big Data Mining and Analytics | 3 | 0 | 0 | 3 |
| 3 | 24IF3703 | Network and Digital Forensics | 3 | 0 | 0 | 3 |
| 4 | 24IF3701 | Artificial Neural Networks | 3 | 0 | 0 | 3 |
| | | **PROFESSIONAL ELECTIVE IV** | | | | |
| 1 | 24IF3704 | Deep Learning Techniques | 3 | 0 | 0 | 3 |
| 2 | 24IF3705 | Social Network Analysis for Big Data | 3 | 0 | 0 | 3 |
| 3 | 24IF3706 | Block Chain Technology | 3 | 0 | 0 | 3 |
| 4 | 24IF3704 | Deep Learning Techniques | 3 | 0 | 0 | 3 |
| | | **PROFESSIONAL ELECTIVE V** | | | | |
| 1 | 24IF3707 | Natural Language Processing | 3 | 0 | 0 | 3 |
| 2 | 24IF3708 | Big Data Security | 3 | 0 | 0 | 3 |
| 3 | 24IF3709 | Quantum Computing | 3 | 0 | 0 | 3 |

| 4 | 24IF3710 | Multi Objective Optimization | 3 | 0 | 0 | 3 |

# FRANCIS XAVIER ENGINEERING COLLEGE

## DEPARTMENT OF INFORMATION TECHNOLOGY

## PG - REGULATION 2024

### STREAM / DOMAIN WISE PROFESSIONAL ELECTIVE COURSES

| Professional Elective | SEM | Data Science | Big Data Analytics | Advanced Computing | AI and ML |
|---|---|---|---|---|---|
| PE I | II | Statistical Method for Machine Learning | Cloud Computing Technologies | Software Defined Networks | Soft Computing and Fuzzy Logic |
| PE II | II | Data Visualization and Interpretation | Big Data Acquisition | Augmented Reality and Virtual Reality | Genetic Algorithms |
| PE III | III | Artificial Neural Networks | Big Data Mining and Analytics | Network and Digital Forensics | Artificial Neural Networks |
| PE IV | III | Deep Learning Techniques | Social Network Analysis for Big Data | Block Chain Technology | Deep Learning Techniques |
| PE V | III | Natural Language Processing | Big Data Security | Quantum Computing | MultiObjective Optimization |

| 24MA1254 | STATISTICAL ESTIMATION AND RANDOM VARIABLES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**Preamble**

An engineering PG student needs to have some basic mathematical tools and techniques to apply in diverse applications in Engineering. This emphasizes the development of rigorous logical thinking and analytical skills of the student and appraises him the complete procedure for solving different kinds of problems that occur in engineering. Based on this, the course aims at giving adequate exposure in probability and estimation theory.

**Prerequisites for the course**

The students should have the ability to use the appropriate and relevant, fundamental and applied mathematical and statistical knowledge.

**Objectives**

- To introduce the basic concepts of random variables.
- To introduce the basic concepts of two dimensional random variables.
- To have knowledge in principles of estimation theory.
- To acquire the knowledge of testing hypotheses for small and large samples this plays an important role in real life problems.
- To introduce the basic concepts of multivariate analysis

| UNIT I | PROBABILITY AND RANDOM VARIABLES | 9+3 |
|---|---|---|

Probability – Axioms of probability – Conditional probability – Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Uniform, and Normal distributions – Function of a random variable.

| UNIT II | TWO DIMENSIONAL RANDOM VARIABLES | 9+3 |
|---|---|---|

Joint distributions two random variables – Marginal distributions and Conditional distributions – Covariance – Correlation coefficients for two dimensional random variables forstatistical data.

| UNIT III | ESTIMATION THEORY | 9+3 |
|---|---|---|

Unbiased estimators – Method of moments – Maximum likelihood estimation - Curve fitting by principle of least squares – Regression lines for two dimensional random variables for statistical data.

| UNIT IV | TESTING OF HYPOTHESIS | 9+3 |
|---|---|---|

Sampling distributions and Standard Error - Small samples and large samples - Test of hypothesis - Type I, Type II Errors - Large sample tests for mean –Small sample tests for mean – t and f test - Chi-Square distribution -Test of independence of attributes.

| UNIT V | MULTIVARIATE ANALYSIS | 9+3 |
|---|---|---|

Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components - Population principal components –Principal components from standardized variables.

| | Total Periods | 45+15 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test | Formative Assessment Test | End Semester Exams |
|---|---|---|
| (30 Marks) | (10 Marks) | (60 Marks) |

| 1. Descriptive Questions | 1. Assignment 2. Online quizzes | 1. Descriptive Questions |
|---|---|---|

**Outcomes**

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

| 1 | Apply the fundamental knowledge of moments and distributions (Apply) |
|---|---|
| 2 | Apply the basic concept of two dimensional random variable in engineering application. (Apply) |
| 3 | Apply Consistency and efficiency of estimator  (Apply) |
| 4 | Testing of hypothesis for large samples and small samples in real life problems(Analyze) |
| 5 | Apply the  Multivariate statistical analysis. (Apply) |

**Reference Books**

1. Devore, J. L., ―Probability and Statistics for Engineering and the Sciences‖, 8th Edition, Cengage learning, 2014

2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers ", Pearson Education, Asia, 8th Edition, 2015.

**Web Resources**

1.  Probability and random variables - https://youtu.be/COI0BUmNHT8
2. Two dimensional random variables – https://youtu.be/_WM8vzYSQhs
3. Estimation theory - https://youtu.be/SeT3TbMXQ8A
4. Testing of hypothesis - https://youtu.be/IEP3swFeauE
5. Multivariate analysis - https://youtu.be/n9qpktdFfLU

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | 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 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 1 | | | | | | | | 3 | | | | |
| 2 | 3 | 1 | | | | | | | | 2 | | | | |
| 3 | 1 | 1 | | | | | | | | 2 | | | | |
| 4 | 3 | 1 | | | | | | | | 2 | | | | |
| 5 | 3 | 1 | | | | | | | | 3 | | | | |

| 24IF1601 | ADVANCED DATA STRUCTURES AND ALGORITHM DESIGN TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**Preamble**

Building upon the fundamental principles learned in introductory courses, this course aims to deepen students' understanding of complex data structures and sophisticated algorithmic strategies, equipping them with the skills necessary to tackle challenging computational problems.

**Prerequisites for the course**

NIL

**Objectives**

1. To extend the students' knowledge of algorithms and data structures.
2. To enhance their expertise in algorithmic analysis and algorithm design techniques.
3. To understand various types of search and heap structures.
4. To study various types of geometric, randomized and approximation algorithms.
5. To extrapolate from them in order to apply those algorithms and techniques to solve problems.

| UNIT I | INTRODUCTION | 12 |
|---|---|---|

Importance and need of good data structures and algorithms - Dictionaries: Definition, Dictionary, Abstract Data Type – Properties of Big-oh Notation –Conditional Asymptotic Notation – Algorithm Analysis – Amortized Analysis – Recurrence Equations - collision Resolution techniques in hashing

| UNIT II | DIGITAL SEARCH STRUCTURES | 12 |
|---|---|---|

Binary Search Trees – AVL Trees – Red-Black trees – Multi-way Search Trees –B-Trees – Splay Trees – Tries

| UNIT III | GRAPH AND HEAP STRUCTURES | 12 |
|---|---|---|

Single-Source Shortest Paths: The Bellman-Ford algorithm–All- Pairs Shortest Paths: Shortest Paths and Matrix Multiplication–The Floyd-Warshall Algorithm; HEAP: Min/Max heaps – Deaps – Leftist Heaps – Skew Heaps – Lazy Binomial Heaps

| UNIT IV | GEOMETRIC ALGORITHMS | 12 |
|---|---|---|

Segment Trees – 1-Dimensional Range Searching – k-d Trees – Line Segment Intersection – Computing the Overlay of Two Subdivisions – Voronoi Diagram

| UNIT V | APPROXIMATION ALGORITHMS | 12 |
|---|---|---|

Approximation Algorithms: Introduction to NP-Completeness/NP-Hard  - Vertex Cover & Euclidean Travelling Salesperson Problem – Randomized Algorithms: Closest Pair Problem & Minimum Spanning Trees – Online Algorithm: Euclidean Spanning Tree

| | Total Periods | 60 |
|---|---|---|

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING | 1. TUTORIAL PROBLEMS<br>2. ASSIGNMENT<br>3. QUIZZES | 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING |

**Outcomes**

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

CO1 – Design data structures and algorithms to solve computing problems

CO2 – Design algorithms using graph structure and various string-matching algorithms to solve real-life problems

CO3 – Apply suitable design strategy for problem solving

CO4 – Comprehend and select algorithm design approaches in a problem specific manner.

CO5 – Understand the necessary mathematical abstraction to solve problems.

**Text Book:**

1.   Maxwell Rivers "Data Structures and Algorithms in Java : A comprehensive Guide , 2023

**Reference Books**

1. Narasimha karumanchi, "Data Structures and algorithms made easy", Fifth Edition, Career Monk publications, 2021.

2.   Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C",Second Edition, University Press,2008

3.   Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, "Computational Geometry Algorithms and Applications", Third Edition, Springer, 2008.

4.   ThomasH.Cormen,CharlesE.Leiserson,RonaldL.Rivest,CliffordStein,"Introductionto Algorithms",ThirdEdition,Prentice-Hall,2011.

**Web Resources**
1.       https://nptel.ac.in/courses/106/102/106102064/
2.       https://nptel.ac.in/courses/106/103/106103069/
3.       https://nptel.ac.in/courses/106/106/106106131/
4.       https://nptel.ac.in/courses/106/105/106105157/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | | 3 | | | 3 | | | | | | | 3 | |
| 2 | | 3 | | | 3 | | | | 3 | | | | 3 | |
| 3 | | | 3 | | | 3 | 3 | | | | | | 3 | |
| 4 | | | | 3 | | | 3 | | | 3 | | | 3 | |
| 5 | | | 3 | | | 3 | | | 3 | | | | 3 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | | | | | |
| UNDERSTAND | 40 | 40 | 10 | 10 | 40 |
| APPLY | 60 | 60 | 15 | 15 | 60 |
| ANALYZE | | | | | |
| EVALUATE | | | | | |
| CREATE | | | | | |

| 24IF1602 | MULTICORE ARCHITECTURE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

This course provides a comprehensive exploration of parallel programming, a critical area in modern computing essential for leveraging the capabilities of multi-core and distributed systems. As we transition from single-core to multi-core architectures, understanding the principles and practices of parallel programming becomes paramount for optimizing performance and scalability of software applications.

**Prerequisites for the course**

NIL

**Objectives**

1. To understand the need for multi-core processors, and their architecture.
2. To understand the challenges in parallel and multithreaded programming.
3. To learn about the various parallel programming paradigms
4. To implement and optimize MPI programs.
5. To develop multicore programs and design parallel solutions.

| UNIT I | MULTI-CORE PROCESSORS | 9 |
|---|---|---|

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.

| UNIT II | PARALLEL PROGRAM CHALLENGES | 9 |
|---|---|---|

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

| UNIT III | SHARED MEMORY PROGRAMMING WITH OPENMP | 9 |
|---|---|---|

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.

| UNIT IV | DISTRIBUTED MEMORY PROGRAMMING WITH MPI | 9 |
|---|---|---|

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

| UNIT V | PARALLEL PROGRAM DEVELOPMENT | 9 |
|---|---|---|

Case studies – n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|

| 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING | 1. ASSIGNMENT<br>2. QUIZZES | 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING |
|---|---|---|

**Outcomes**

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

CO1 – Describe multicore architectures and identify their characteristics and challenges

CO2 – Identify the issues in programming Parallel Processors.

CO3 – Write programs using OpenMP and MPI

CO4 – Design parallel programming solutions to common problems

CO5 – Compare and contrast programming for serial processors and programming for parallel processors.

**Text Books**

1. Peter S. Pacheco, "An Introduction to Parallel Programming, Morgan-Kauffman/Elsevier, 2021.

**Reference Books**

1. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011
2. Michael J Quinn, "Parallel programming in C with MPI and OpenMP, Tata McGraw Hill,2003.
3. Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015
4. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015

**Web Resources**

https://onlinecourses.nptel.ac.in/noc23_cs113/preview

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | | 3 | | | | | | | | | 3 | |
| 2 | | 3 | 3 | 3 | | | | | | | | | 3 | |
| 3 | 3 | 3 | 3 | | | | | | | | | 3 | | |
| 4 | 1 | 2 | 3 | 3 | 3 | | | | | | | | | |
| 5 | 2 | 1 | 2 | 2 | 3 | 1 | | | | | | 1 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 20 | 5 | 5 | 20 |
| UNDERSTAND | 50 | 50 | 10 | 10 | 50 |
| APPLY | 30 | 30 | 10 | 10 | 30 |
| ANALYZE | | | | | |
| EVALUATE | | | | | |
| CREATE | | | | | |

| 24IF1603 | MODERN OPERATING SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

The students should have the basic knowledge on Operating Systems

**Prerequisites for the course**

**NIL**

**Objectives**

1. Be able to understand the modern operating systems.

2. Learn how the processes are implemented in operating system.

3. Understand the implementation of the distributed operating systems.

4. To study database operating system and concurrency control algorithms.

5. Understand how program execution happens in mobile operating system.

| UNIT I | PROCESS SYNCHRONIZATION | 9 |
|---|---|---|

Multiprocessor Operating Systems: System Architectures – Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation – memory management.

| UNIT II | DISTRIBUTED OPERATING SYSTEMS | 9 |
|---|---|---|

Distributed Operating Systems: System Architectures – Design issues – Communication models –Clock synchronization – mutual exclusion – election algorithms – Distributed Deadlock detection

| UNIT III | DISTRIBUTED SCHEDULING | 9 |
|---|---|---|

Distributed scheduling – Distributed shared memory – Distributed File system – Multimedia file systems - File placement – Catching

| UNIT IV | DATABASE OPERATING SYSTEM | 9 |
|---|---|---|

Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives – Concurrency control algorithms.

| UNIT V | MOBILE OPERATING SYSTEMS | 9 |
|---|---|---|

Mobile Operating Systems: ARM and Intel architectures – Power Management – Mobile OS Architectures – Underlying OS – Kernel structure and native level programming – Runtime issues - Approaches to power management

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS 2. MCQ | MCQ,SEMINAR, ASSIGNMENT | 1. DESCRIPTIVE QUESTIONS 2. MCQ |

**Outcomes**

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

CO1 To study the characteristics of OS for Multiprocessor and Multicomputer.

CO2 To learn the issues related to designing OS.

CO3 To identify the functionality of distributed Operating Systems.

CO4 To explain the concepts of distributed scheduling.

CO5 To analyze the issues related to database Operating System

**Reference Books**

1.A S Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2002

2.Source Wikipedia, Mobile Operating Systems, General Books LLC, 2010

3.M Singhal and NG Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw

HillI nc, 2001.

### CO Vs PO Mapping and CO Vs PSO Mapping

| CO | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2 | | | | | 1 | | | | | | 1 | | |
| **2** | | 2 | 1 | 2 | | | | | | | | | | |
| **3** | 1 | 2 | | 3 | | 1 | | | | | | 2 | | |
| **4** | 1 | | 3 | | 2 | 1 | | | | | | 2 | | |
| **5** | | 2 | 3 | 2 | | 2 | | | | | | | | |
| **6** | | | 2 | 1 | 3 | | 1 | | | | | | | 2 |

### BLOOMS LEVEL ASSESSMENT PATTERN

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| **REMEMBER** | | | | | |
| **UNDERSTAND** | 40 | 40 | 10 | 10 | 40 |
| **APPLY** | 60 | 60 | 15 | 15 | 60 |
| **ANALYZE** | | | | | |
| **EVALUATE** | | | | | |

| 24IF1604 | ADVANCED NETWORK SECURITY SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Prerequisites for the course**

The students should have the fundamental knowledge on Computer Networks.

**Objectives**

1. To learn security mechanisms and techniques to provide security services.
2. To be exposed to symmetric & asymmetric key algorithms and key management aspects.
3. To learn the algorithms using encryption and authentication.
4. To learn about the Network Security Applications.
5. To explore the security at system level

| UNIT I | SYMMETRIC & ASYMMETRIC KEY ALGORITHMS | 9 |
|---|---|---|

Substitutional Ciphers, Transposition Ciphers, Data Encryption Standard (DES) – Triple DES, Block Cipher modes of operation - AES Cipher.

| UNIT II | PUBLIC KEY CRYPTOGRAPHY | 9 |
|---|---|---|

Introduction to number Theory: Modular Arithmetic - Euclid's Algorithm - Fermat's and Eular's Theorems - The Chinese Remainder Theorem and Discrete Logarithms. Public Key Cryptography and RSA – Key Management – Kerberos – Needham Schroeder Protocol.

| UNIT III | AUTHENTICATION | 9 |
|---|---|---|

Hash Algorithms: MD5 Message Digest Algorithm – Secure Hash Algorithm – RIPEMD-160 – HMAC. Digital Signatures – Digital Signature Standard – User Authentication Protocols.

| UNIT IV | TRUSTED IDENTITY | 9 |
|---|---|---|

Entity Authentication: Password System- Fixed and One time Passwords (S/Key) RFC 2289 – Callback Systems, Zero Knowledge, Challenge and Response Systems – RADIUS –– ITU-T X.509.

| UNIT V | SYSTEM LEVEL SECURITY | 9 |
|---|---|---|

Intrusion detection – password management – Viruses and related Threats – Virus Counter Measures - Firewall Design Principles – Trusted Systems - Firewall - Concepts, Architecture, Packet Filtering, Proxy Services and Bastion Hosts

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30Marks) | Formative Assessment Test (10Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| • Descriptive Questions <br> • MCQ | • MCQ <br> • SEMINAR <br> • ASSIGNMENT | • Descriptive Questions <br> • MCQ |

**Outcomes**

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

CO1 Apply the mathematical foundations in security principles.

CO2 Identify the features of encryption and decryption.

CO3 Apply various Encryption, Authentication and Digital Signature Algorithms.

CO4 Deal with different general purpose and application specific Security Protocols and
          Techniques.

CO5 Understand the Network Security Applications at system level.

**Reference Books**

1. William Stallings, "Cryptography and Network Security – Principles and Practices", 5th Edition, Pearson Education, 2015.

2. Behrouz A. For uzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", $2^{nd}$ Edition, Tata Mc Graw - Hill, 2016.

3. Bruice Schneier, "Applied Cryptography: Protocols, Algorithms and Source Code in C", $2^{nd}$ Edition, Wiley India (P) Ltd., 2008.

4. Charles P. P fleeger and Shari Lawrence P fleeger, "Security in Computing", $4^{th}$ edition, Pearson Education, 2011.

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

| 24IF1605 | SOFTWARE TESTING AND PROJECT MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

It is a part of project management in which software projects are planned, implemented, monitored, and controlled. This article focuses on discussing Software Project Management

**Prerequisites for the course**

NIL

**Objectives**

1. To understand the need of software engineering
2. To understand various Lifecycle models
3. To understand requirement analysis and specifications
4. To understand Design Concepts
5. To know Software Project Management

| UNIT I | REQUIREMENTS ANALYSIS AND DESIGN | 9 |
|---|---|---|

Requirement Analysis – Analysis process, Requirements specification, desirable characteristics of an SRS, structure of an SRS document, Data Flow Diagrams - Role of Software Architecture and Architecture Views - Planning for a Software Project Software Design - Software design concepts - Function Oriented Design and its Complexity Metrics - Object Oriented Design and its Complexity Metrics - Detailed Design.

| UNIT II | SOFTWARE TESTING | 9 |
|---|---|---|

Overview of testing- Need for software testing – Testing principles – STLC models Testing in STLC models: Unit Testing, Integration Testing, System Testing, Acceptance Testing. Testing of software attributes: Smoke test, functional testing, usability testing, security, compliance testing.

| UNIT III | SOFTWARE IMPLEMENTATION AND TESTING | 9 |
|---|---|---|

Software Coding - Programming principles and coding guidelines - method of incrementally developing code - managing the evolving code Testing - Unit testing and Code Inspection - Testing concepts and testing process - Design of Test case and Test plan - Black-box testing - White box testing

| UNIT IV | SOFTWARE PROJECT MANAGEMENT | 9 |
|---|---|---|

Software Project Management Framework - methods to estimate project time and cost, Resource Management, Identification, Analysis, mitigation, and monitoring of Project Risks - Ensuring Project quality and quality management, Configuration Management, change management, CMMI, different levels and need of accreditation

| UNIT V | SPM TOOLS | 9 |
|---|---|---|

Software project management using Primavera & Redmine and case study on SPM tools like

| | Selenium, Test-sigma, Lambda Test, Apache J-Meter, Test Complete. | | |
|---|---|---|---|

| | **Total Periods** | **45** |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING | 1. TUTORIAL PROBLEMS<br>2. ASSIGNMENT<br>3. QUIZZES | 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING |

**Outcomes**

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

CO1 – Apply project management concepts and techniques to an IT project.

CO2 – Identify issues that could lead to IT project success or failure.

CO3 – Explain project management in terms of the software development process.

CO4 – Describe the responsibilities of IT project managers.

CO5 – Apply project management concepts through working in a group as team leader

**Text Books**

1. Software Engineering, A Precise Approach: Pankaj Jalote, Wiley India-2010
2. Software Project Management : Saikat Dutt /S. Chandramouli, Pearson-Second Edition-2015

**Reference Books**

1. Software Engineering : Ian Sommerville, Pearson,Nineth Edition-2011
2. Software Engineering a practitioners approach – Roger S Pressman,Seventh Edition, 2009
3. Project Management Absolute Beginner's Guide : Greg Horine , Pearson, Second Edition, 2017

**Web Resources**

https://onlinecourses.nptel.ac.in/noc22_cs61/preview

## CO Vs PO Mapping and CO Vs PSO Mapping

| CO | 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 |
|----|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| 1 | 3 | 3 | | | | | | | | | | | 2 | 1 |
| 2 | 3 | 3 | 2 | 2 | 2 | | | | | | | | | |
| 3 | 2 | 3 | | 2 | 2 | | | | | 3 | | | | |
| 4 | | 3 | 3 | 2 | 2 | | | | 2 | | | | | |
| 5 | 3 | 3 | 3 | 3 | | | | | | | | | | |

## BLOOMS LEVEL ASSESSMENT PATTERN

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|-----------------|-------|-------|-------|-------|--------------|
| REMEMBER | | | | | |
| UNDERSTAND | 30 | 5 | 5 | 30 | 30 |
| APPLY | 40 | 10 | 10 | 40 | 40 |
| ANALYZE | 30 | 10 | 10 | 30 | 30 |
| EVALUATE | | | | | |
| CREATE | | | | | |

| 24IF1611 | ADVANCED DATA STRUCTURES LABORATORY USING JAVA | L | T | P | C |
|----------|------------------------------------------------|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Pre requisites for the course**

The students should have the basic knowledge on Data structures.

**Objectives**

- •To learn the implementation of sorting and searching.
- •To acquire the knowledge of using advanced tree structures.
- •To analyze the usage of heap structures.
- •To understand the usage of graph structures and spanning trees.

• To comprehend the usage of segment trees

| S.NO | LIST OF EXPERIMENTS | CO |
|------|---------------------|-----|
| 1 | Implementation of Merge Sort and Quick Sort-Analysis | **CO1** |
| 2 | Implementation of a Binary Search Tree | **CO1** |
| 3 | Red-Black Tree Implementation | **CO1** |
| 4 | Heap Implementation | **CO2** |
| 5 | Leftist Heaps | **CO2** |
| 6 | Graph Traversals | **CO3** |
| 7 | Spanning Tree Implementation | **CO3** |
| 8 | Shortest Path Algorithms (Dijkstra's algorithm, Bellmann Ford Algorithm) | **CO3** |
| 9 | n-Queen's problem using Back Tracking, Segment Trees | **CO4** |
| 10 | Line segment intersection | **CO4, CO5** |

**Total Periods: 60**

**Suggestive Assessment Methods**

| Lab Components Assessments(50Marks) | End Semester Exams(50Marks) |
|---|---|
| • Experiments<br>• Viva | • Experiments<br>• Viva |

**Outcomes:**

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

CO1 – Design and implement basic and advanced data structures extensively.

CO2 – Develop and design programs for sorting and searching.

CO3 – Design algorithms using graph structures

CO4 – Design and develop efficient algorithms with minimum complexity using design techniques

CO5 – Be able to design and analyze the time and space efficiency of the data structure

**Laboratory Requirements**

Standalone desktop with java development kit Compiler

**Text Book**

1.Maxwell Rivers "Data Structures and Algorithms in Java : A comprehensive Guide , 2023

**Reference Books**

1. Anany Levitin "Introduction to the Design and Analysis of Algorithms" Pearson Education, 2015

2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C",Second Edition, University Press,2008

3. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, "Computational Geometry Algorithms and Applications", Third Edition, Springer, 2008.

**Web Resources**

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://nptel.ac.in/courses/106/103/106103069/
3. https://nptel.ac.in/courses/106/106/106106131/
4. https://nptel.ac.in/courses/106/105/106105157/

### CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|
| 1 | 3 | 3 | 3 | | | | | | | | | | 3 | |
| 2 | | 1 | | 3 | | 2 | | | | | 3 | | 3 | |
| 3 | 3 | | | 3 | | 3 | | | | | | | 3 | |
| 4 | | 2 | 3 | | | | | | 2 | | 2 | | 3 | |
| 5 | | 3 | | 3 | | 3 | | | | | | | 3 | |

| 24IF1612 | **ADVANCED OPERATING SYSTEMS LABORATORY** | **L** | **T** | **P** | **C** |
|----------|---------------------------------------------|-------|-------|-------|-------|
| | | **0** | **0** | **4** | **2** |

**Preamble:**

Operating systems are the fundamental part of every computing device to run any type of software. The Operating System Laboratory, OS Lab is a course that will teach students about principles of operating systems using a constructivist approach and problem-oriented learning.

**Prerequisites for the course**

| | 21CS1501- C Programming |
|---|---|

**Objectives**

1. Implement practical experience with designing and implementing concepts of operating systems
2. To implement various CPU Scheduling Algorithms
3. To implement Process Creation and Inter Process Communication.
4. To implement Deadlock Avoidance and Deadlock Detection Algorithms
5. To implement Page Replacement Algorithms
6. To implement File Organization and File Allocation Strategies

| S.NO | LIST OF EXPERIMENTS | CO |
|---|---|---|
| 1 | Simulate the following CPU scheduling algorithms:<br>a) FCFS<br>b)SJF<br>c)Round Robin<br>d)Priority | CO1 |
| 2 | Simulate the file allocation strategies:<br>a) Sequential b) Indexed c) Linked | CO1 |
| 3 | Simulate MVT and MFT | CO1 |
| 4 | Simulate all File Organization techniques<br>a)Single level directory<br>b)Two level<br>c)Hierarchical<br>d)DAG | CO2 |
| 5 | Simulate Bankers Algorithm for Deadlock Avoidance | CO2 |
| 6 | Simulate Bankers algorithm for Deadlock Prevention | CO3 |
| 7 | Simulate all page replacement Algorithms a)FIFO b) LRU c) LFU | CO4 |
| 8 | Simulate Paging Technique of memory management. | CO3 |
| 9 | Write a C program to stimulate the following contiguous memory allocation techniques a) Worst-fit b) Best fit c) First fit | CO3 |
| 10 | Write a C program to stimulate the disk scheduling algorithms. a) FCFS b) SCAN c) C-SCAN | CO3 |

| 11 | Write a C program to simulate optimal page replacement algorithms | **CO4** |
|---|---|---|
| 12 | Write a C program to simulate the concept of Dining-Philosophers problem | **CO5** |

| **Suggestive Assessment Methods** | |
|---|---|
| **Lab Components Assessments (50 Marks)** | **End Semester Exams (50 Marks)** |
| **50** | **50** |

**Outcomes**

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

**CO1**     Understand and implement basic services and functionalities of the operating system using system calls and able to Understand the benefits of thread over process and implement synchronized programs using multithreading concepts.

**CO2**     Use modern operating system calls and synchronization libraries in software/ hardware interfaces.

**CO3**     Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priori

**CO4**     implement memory management schemes and page replacement schemes

**CO5**     Simulate file allocation and organization techniques

**Laboratory Requirements**

- C compiler
- 30 PC System with windows

**Reference Books**

1. Gary Nutt, ―Operating Systems, Third Edition, Pearson Education, 2004.
2. Harvey M. Deitel, ―Operating Systems, Third Edition, Pearson Education, 2004.

## Web Resources

1. www.systutorials.com ,www.javatpoint.com/os-tutorial
2. www.tutorialspoint.com

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

| 24IF2601 | MACHINE LEARNING TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

This course introduces you to the fundamental concepts and practical applications of machine learning, covering a range of algorithms including supervised, unsupervised, and reinforcement learning. You will gain hands-on experience in implementing models using popular tools and learn how to evaluate their performance. Emphasis will also be placed on understanding the ethical considerations of machine learning. By the end of the course, you'll be well-equipped to apply machine learning techniques to real-world problems and innovate in various fields.

**Prerequisites for the course**

probability and statistics

python

**Objectives**

Understand the Fundamentals: Gain a solid understanding of the core concepts, terminology, and methodologies used in machine learning.

Explore Various Algorithms: Study a range of machine learning algorithms, including supervised learning, unsupervised learning, and reinforcement learning.

Hands-on Experience: Implement machine learning models using popular programming languages and tools. Practical assignments and projects will help solidify your understanding.

Critical Evaluation: Learn to evaluate the performance of machine learning models using appropriate metrics and techniques.

Ethical Considerations: Understand the ethical implications and responsibilities associated with the deployment of machine learning models.

| UNIT I | INTRODUCTION TO MACHINE LEARNING | 9 |
|---|---|---|

Machine Learning–Types of Machine Learning : Supervised Learning, Unsupervised Learning – Machine Learning process- Testing machine learning algorithms - Parametric Vs non-parametric models - Mathematical Basics for Machine Learning : Probability and Statistics for Machine Learning – Probability Distributions – Decision Theory – Information theory – Bias Variance tradeoff.

| UNIT II | SUPERVISED LEARNING METHODS | 9 |
|---|---|---|

Regression: Introduction - Linear Regression - Least Squares - Under fitting and Overfitting - CrossValidation - Lasso Regression - Logistic Regression; Classification: Linear and Non-linear models - - Support Vector Machines - Kernel Methods; K-Nearest Neighbours; Learning with Trees: constructing Decision Tree using ID3 - Classification and regression trees (CART); Decision by Committee : Ensemble Methods -- Bagging -- Boosting -- Random Forest; Evaluation of Classification Algorithms.

| UNIT III | UNSUPERVISED AND REINFORCEMENT LEARNING | 9 |
|---|---|---|

Clustering- K-means – Mixtures of Gaussians – Vector Quantization – The Self Organizing Feature Map- Dimensionality Reduction, Linear Discriminant Analysis, Principal Components Analysis, Independent Components Analysis - Reinforcement Learning : Q learning, Deterministic and Nondeterministic Rewards and Actions Temporal Difference Learning - Markov Decision Process.

| UNIT IV | PROBABILISTIC GRAPHICAL MODELS AND EVOLUTIONARY LEARNING | 9 |
|---|---|---|

Graphical Models – Undirected Graphical Models : Markov Random Fields – Directed Graphical Models : Bayesian Networks – Conditional Independence properties – Markov Random Fields, Hidden Markov Models – Conditional Random Fields(CRFs) - Evolutionary Learning : The Genetic Algorithm , Generating offspring - Map Colouring, Punctuated Equilibrium - Knapsack problem - Limitations of the GA.

| UNIT V | NEURAL NETWORK AND DEEP LEARNING | 9 |
|---|---|---|

Neural Networks: The Brain and the Neuron - Perceptron learning algorithm; Multi-Layer Perceptron: Back propagation algorithm - Multi-layer perceptron in Practice, Deep Learning: Introduction - Convolution Neural Networks - Recurrent Neural Networks – Stochastic Neurons : the Boltzmann Machine – Deep Belief Networks.

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS 2. PROBLEM SOLVING | 1. TUTORIAL PROBLEMS 2. ASSIGNMENT 3. QUIZZES | 1. DESCRIPTIVE QUESTIONS 2. PROBLEM SOLVING |

**Outcomes**

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

CO1:Explain the basic concepts of machine learning

CO2:Analyse linear and non-linear techniques for classification problems

CO3:Apply unsupervised and reinforcement algorithms, probabilistic and evolutionary approaches for the given problems

CO4: Analyse importance of neural networks in machine learning and deep learning.

CO5: Identify applications suitable for different types of Machine Learning and to Implement appropriate learning algorithms for an application and to analyse the results.

**Text Books**

1. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Chapman and Hall, CRC

Press, Second Edition, 2014.

2. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.

3. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.

**Reference Books**

1. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.

2. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

**Web Resources**

1. https://www.kaggle.com/
2. https://www.coursera.org/
3. https://towardsdatascience.com/?gi=8222889875ba

### CO Vs PO Mapping and CO Vs PSO Mapping

| CO | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 1 | 2 | 1 | | | | | | | | | 2 | |
| **2** | 3 | 3 | 2 | | | | | | | | | | 1 | |
| **3** | 3 | 3 | | | | | | | | | | | 3 | |
| **4** | 3 | 1 | 2 | 1 | 1 | | | | | | | | 1 | |
| **5** | 2 | 3 | 3 | | | | | | | | | | 1 | |

### BLOOMS LEVEL ASSESSMENT PATTERN

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| **REMEMBER** | 10 | 10 | | | 10 |
| **UNDERSTAND** | 10 | 10 | | | 10 |
| **APPLY** | 60 | 60 | | | 60 |
| **ANALYZE** | 20 | 20 | | | 20 |
| **EVALUATE** | | | | | |
| **CREATE** | | | | | |

| 24IF2602 | RESEARCH METHODOLOGIES | L | T | P | C |
|----------|------------------------|---|---|---|---|
|          |                        | 3 | 0 | 0 | 3 |

**Preamble**

The Objective of this course is to understand and analyze research methodology and IPR protection.

**Prerequisites for the course**

**NIL**

**Objectives**

1. To Understand the basic concepts of Research Methodologies,

2. To Analyse the data collected using various measurements.

3. To Analyse the various research problems.

4. To Apply the hypothesis to collect data from samples.

5. To Apply the research methodologies to real world problems.

| UNIT I | INTRODUCTION TO RESEARCH METHODOLOGIES | 9 |
|--------|----------------------------------------|---|

Concept and Meaning of Research – Motivation – research types – research approaches – research significance – importance of knowing how research is done – research process and its criteria - Defining the research problem – Selecting the problem – necessity of defining the problem – Techniques involved in defining the problem

| UNIT II | DATA COLLECTION AND ANALYSIS | 9 |
|---------|------------------------------|---|

Statistical Tools – Scales of measurements – Measures of Central tendency – Measures of dispersion – Probability – Scatter diagram – Coefficient – Correlation – Regression – Non Parametric tests – Chi-square Test – t Test – analysis of Variance – one way analysis.

| UNIT III | RESEARCH DESIGN | 9 |
|----------|-----------------|---|

Meaning and need for research design – Features of a Good design – Major Concepts - types of Good design - Various stages of sampling design and its characteristics - Research Design – Types of research – Methods of Research – Research Problems.

| UNIT IV | DATA FORMULATION METHODS | 9 |
|---------|--------------------------|---|

Data Collection – Collection of data through various methods – selecting an appropriate method for the research problem – Processing and analysis of Data - formulation of hypotheses – Testing of hypotheses -Sampling methods – Sampling techniques

| UNIT V | APPLICATION FOR RESEARCH | 9 |
|--------|--------------------------|---|

Role of Computer in Research- The Configuration and Computer Technology- The Computer System- The Binary Number System- Computer Application- Interpretation and report writing.

| | **Total Periods** | **45** |
|---|---|---|

| Outcomes |
| --- |
| **Upon completion of the course, the students will be able to:** |
| CO1 – Understand research problem formulation |
| CO2 – Analyze research related information |
| CO3 – Understand the research ethics. |
| CO4 – Analyse the Data related to Research Methodologies |
| CO5 – Understand the importance of Report writing |

**Text Books**

1.Research Methodology, methods and Techniques, Ed. 2, C.R. Kothari, Wishwa Prakasan, New Delhi.

2.Scientific Social Surveys and Research, Pauline V. Young

3.Applied Statistics for Library Science Research, vol. 2, R.L. Sehgal, Ess Ess Publications, New Delhi.

4.Quantitative Methods for Library and Information Science. I.K.RavichandRao, wiley eastern Ltd.

**Reference Books**

1.   Statistical Techniques for Librarians, R.L. Sehgal, Ess Ess Publications, New Delhi.

### CO Vs PO Mapping and CO Vs PSO Mapping

| CO | 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 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | 3 | 1 | 2 | 1 | | | | | | | | | 2 | |
| **2** | 3 | 3 | 1 | | | | | | | | | | 2 | |
| **3** | 3 | 3 | 1 | | | | | | | | | | 2 | |
| **4** | 3 | 1 | 2 | 1 | | | | | | | | | 2 | |
| **5** | 1 | 3 | 3 | | | | | | | | | | 2 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 10 | 10 | | | 10 |
| UNDERSTAND | 10 | 10 | | | 10 |
| APPLY | 60 | 60 | | | 60 |
| ANALYZE | 20 | 20 | | | 20 |
| EVALUATE | | | | | |
| CREATE | | | | | |

| 24IF2603 | DATABASE TECHNOLOGIES | L | T | P | C |
|----------|------------------------|---|---|---|---|
|          |                        | 3 | 0 | 0 | 3 |

**Preamble**

The Course covers a range of topics, including the foundational concepts of database management, the architecture of different database systems, the role of database management systems (DBMS), and the challenges associated with data security and scalability. Additionally, we'll explore the emergence of NoSQL and NewSQL databases, as well as the principles of distributed ledger technologies.

**Objectives**

1. To understand the fundamentals of databases

2. To have an insight about SQL and NOSQL databases

3. To have an insight about XML and its usage in application development.

4. To understand and apply databases in realtime environment

5. To know about deductive databases

| UNIT I | INTRODUCTION TO DATABASES | 9 |
|--------|---------------------------|---|

Introduction – Functionality of Distributed DBMS (DDBMS) – Architecture – Distributed data storage –query processing – SQL query operations in a relational database – Transaction Management – Concurrency control – Replication Servers – Case study on distributed database design– Implementation

| UNIT II | SQL AND NOSQL DATABASES | 9 |
|---------|-------------------------|---|

NoSQL – CAP Theorem – Sharding - Document based – MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding, Deployment – Using MongoDB with PHP / JAVA – Advanced MongoDB Features – Cassandra: Data Model, Key Space, Table Operations, CRUD Operations, CQL Types – HIVE: Data types, Database Operations, Partitioning – HiveQL – OrientDB Graph database – OrientDB Features

| UNIT III | XML DATABASES FOR APPLICATION DEVELOPMENT | 9 |
|----------|-------------------------------------------|---|

Concepts of ObjectOriented Databases – Need for complex Datatype – Collection Types and Structured Types – ODMG Model – Object Definition Language Object Query Language - Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases – XML Querying – XPath – XQuery

| UNIT IV | INTELLIGENT AND MOBILE DATABASES | 9 |
|---------|----------------------------------|---|

Active DatabasesConcepts and Triggers –Syntax and Semantics – Temporal Databases

– Overview – Spatial Databases – Spatial Representation – Data types – Relationships – Query Processing in Spatial and temporal databaseMobile Databases: Location and Handoff Management – Effect of Mobility on Data Management – Location Dependent Data Distribution – Mobile Transaction Models – Query Processing using mobile database

| UNIT V | DEDUCTIVE DATABASES | 9 |
|---|---|---|

Deductive Databases: Logic of Query Languages – Datalog Recursive Rules-Syntax and Semantics of Data log Languages- Implementation of Rules and Recursion- Recursive Queries in SQL

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS 2. PROBLEM SOLVING | 1. ASSIGNMENT 2. QUIZZES | 1. DESCRIPTIVE QUESTIONS 2. PROBLEM SOLVING |

**Outcomes**

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

CO1– Understand the functional blocks of distributed databases for effective implementation

CO2– Apply DDL/DML queries using different NoSQL databases

CO3–Analyze object-based and XML databases for application development

CO4–Analyze the various data handling mechanisms using intelligent and mobile databases

CO5–Learn queries for deductive databases

**Text Books**

1. Prof.Satish Jain, Shashi Singh, A Level Made Simple – Database Technologies ,Jan 2021.

2. Dr.Sanjeev Sharma, Dr.Jitendra Agrawal, Dr.Shika Agrawal, ―Advanced Database Management System, Dreamtech press, New Delhi, 2017.

3. R. Elmasri, S.B. Navathe, ―Fundamentals of Database Systems, Global Edition, Pearson Education, 2016.

**Reference Books**

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, ―Database System Concepts, 6 th Edition, McGraw Hill, 2013.

2. Shashank Tiwari, "Professional NoSQL", O"Reilly Media, 1st Edition, 2011.

3. International Workshop on Intelligent Techniques in Distributed Systems (ITDS-2014) Distributed Database Design: A Case Study‖, www.sciencedirect.com

4. http://www.ijcstjournal.org/volume-4/issue-5/IJCST-V4I5P28.pdf, ‖ Spatial Data System: Architecture and Applications

**Web Resources**

https://nptel.ac.in/courses/106105175

### CO Vs PO Mapping and CO Vs PSO Mapping

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 3 | | | | | | | | | | | 3 | 2 |
| **2** | 2 | 2 | 2 | 2 | 2 | | | | | | | | 2 | |
| **3** | 2 | 2 | 2 | 2 | 2 | | | | | | | | 2 | |
| **4** | 2 | 2 | 1 | 2 | 2 | | | | | | | | 3 | |
| **5** | 3 | 2 | 2 | 2 | | | | | | | | | 3 | |

### BLOOMS LEVEL ASSESSMENT PATTERN

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| **REMEMBER** | | | | | |
| **UNDERSTAND** | 30 | 30 | 5 | 5 | 30 |
| **APPLY** | 50 | 50 | 10 | 10 | 50 |
| **ANALYZE** | 20 | 20 | 10 | 10 | 20 |
| **EVALUATE** | | | | | |
| **CREATE** | | | | | |

| 24IF2604 | DIGITAL IMAGE PROCESSING AND PATTERN RECOGNITION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

This course explores the fundamental principles and advanced techniques of digital image processing and pattern recognition. Students will gain practical experience in applying these concepts to real-world problems in fields such as computer vision, medical imaging, and remote sensing. Students will be equipped with the knowledge and skills to analyze, interpret, and extract meaningful information from digital images using state-of-the-art techniques.

**Objectives**

1. To understand the basic concepts and algorithms of digital processing.

2. To familiarize the student with the image processing environments and its equivalent open source Image processing environments.

3. To expose the students to a broad range of image processing techniques and issues and their applications, and to provide the student with practical experiences using them.

4. To expose the students about pattern recognition

5. To appreciate the use of image processing in current technologies and to expose the students to real-world applications of the image processing.

| UNIT I | FUNDAMENTALS OF IMAGE PROCESSING | 9 |
|---|---|---|

Introduction – Elements of visual perception, Steps in Image Processing Systems – Digital Imaging System - Image Acquisition – Sampling and Quantization – Pixel Relationships – File Formats – colour images and models - Image Operations – Arithmetic, logical, statistical and spatial operations.

| UNIT II | IMAGE ENHANCEMENT AND RESTORATION | 9 |
|---|---|---|

Image Transforms -Discrete and Fast Fourier Transform and Discrete Cosine Transform ,Spatial Domain - Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – Smoothing and Sharpening filters – Homomorphic Filtering., Noise models, Constrained and Unconstrained restoration models.

| UNIT III | IMAGE SEGMENTATION AND MORPHOLOGY | 9 |
|---|---|---|

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Image Morphology: Binary and Gray level morphology operations - Erosion, Dilation, Opening and Closing Operations- Distance Transforms Basic morphological Algorithms. Features – Textures - Boundary representations and Descriptions Component Labelling – Regional descriptors and Feature Selection Techniques.

| UNIT IV | INTRODUCTION TO PATTERN RECOGNITION | 9 |
|---|---|---|

Component Labelling - Image Features - Textures - Boundary representations and descriptions

| - Regional descriptors - Feature selection and Feature dimensionality reduction. Image Classification and Recognition- Statistical Classifiers _ Clustering Algorithms - Hierarchical and Partitional clustering |

| UNIT V | IMAGE PATTERN RECOGNITION CASE STUDIES | 9 |

Image Understanding – Case Studies in Biometrics, Video Processing, Image Fusion - Image Security - Steganography and Watermarking - Stereo vision - Visual Effects - Image compositing.

| | Total Periods | 45 |

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING | 1. ASSIGNMENT<br>2. QUIZZES | 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING |

**Outcomes**

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

CO1– The students should be able to implement basic image processing algorithms

CO2– Design an application that incorporates different concepts of Image processing

CO3– Apply and explore new techniques in the areas of image enhancement, restoration, segmentation, compression, wavelet processing and image morphology

CO4–critically analyze different approaches to implements mini projects

CO5–Explore the possibility of Appling image processing concepts in various domains

**Text Books**

1. Rafael C. Gonzalez, Richard E. Woods, Pearson Digital Image Processing , Third Edition 2017.

2.Alasdair McAndrew, "Introduction to Digital Image Processing with Matlab", Cengage Learning 2011, India.

3.Anil J Jain, "Fundamentals of Digital Image Processing", PHI, 2011.

**Reference Books**

1. S.Sridhar, "Digital Image Processing", Oxford University Press, 2011, New Delhi.

2. Wilhelm Burger, Mark J Berge, " Digital Image Processing: An algorithmic Introduction using Java", Springer International Edition,2008.

**Web Resources**

https://onlinecourses.nptel.ac.in/noc22_ee116/preview

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 3 | | | | | | | | | | | 3 | 2 |
| **2** | 2 | 2 | 2 | 2 | 2 | | | | | | | | 2 | |
| **3** | 2 | 2 | 2 | 2 | 2 | | | | | | | | 2 | |
| **4** | 2 | 2 | 1 | 2 | 2 | | | | | | | | 3 | |
| **5** | 3 | 2 | 2 | 2 | | | | | | | | | 3 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| **REMEMBER** | | | | | |
| **UNDERSTAND** | 30 | 30 | 5 | 5 | 30 |
| **APPLY** | 50 | 50 | 10 | 10 | 50 |
| **ANALYZE** | 20 | 20 | 10 | 10 | 20 |
| **EVALUATE** | | | | | |
| **CREATE** | | | | | |

| ELECTIVE | | | | | |
|---|---|---|---|---|---|
| **21IF2701** | **STATISTICAL METHOD FOR MACHINE LEARNING** | **L** | **T** | **P** | **C** |
| | | **3** | **0** | **0** | **3** |

**Preamble**

This course, "Statistical Models in Machine Learning," is designed to provide students with a solid foundation in the principles and practices of statistical modeling. Students will learn how to apply statistical techniques to analyze data, make predictions, and solve real-world problems. The course covers key topics such as probability, linear regression, generalized linear models, Bayesian statistics, and advanced modeling techniques. Through practical examples and hands-on projects, students will develop the skills needed to build and evaluate statistical models, preparing them for careers in data science, analytics, and related fields.

**Prerequisites for the course**

- Probability
- Statistics

**Objectives**

1. Understand Basic Concepts: Learn the fundamental principles of probability and statistics essential for statistical modelling.
2. Apply Regression Models: Develop skills to create and interpret linear regression models for predicting outcomes.
3. Use Generalised Linear Models: Gain the ability to build and analyse generalised linear models, such as logistic regression.
4. Implement Bayesian Methods: Understand and apply Bayesian statistical methods to real-world data.
5. Explore Advanced Techniques: Learn advanced statistical modelling techniques, including time series analysis and hierarchical models.

| UNIT I | FOUNDATIONS OF PROBABILITY AND STATISTICS | 9 |
|---|---|---|

Probability and Statistics Fundamentals - Probability Rules and Concepts - Random Variables and Distributions - Descriptive Statistics - Probability Distributions (Discrete and Continuous) - Central Limit Theorem

| UNIT II | LINEAR REGRESSION AND MODEL EVALUATION | 9 |
|---|---|---|

Linear Regression and Model Evaluation - Simple Linear Regression - Multiple Linear Regression - Model Evaluation Techniques - Residual Analysis - Multicollinearity and Model Selection

| UNIT III | GENERALIZED LINEAR MODELS (GLMS) | 9 |
|---|---|---|

Generalized Linear Models (GLMs) - Logistic Regression - Poisson Regression - GLM

Interpretation and Diagnostics - Overdispersion and Zero-Inflation - Model Comparison Techniques

| UNIT IV | BAYESIAN STATISTICS | 9 |
|---|---|---|

Bayesian Statistics - Bayesian Inference - Prior and Posterior Distributions - Markov Chain Monte Carlo (MCMC) Methods - Hierarchical Bayesian Modeling - Bayesian Model Averaging

| UNIT V | ADVANCED TOPICS IN STATISTICAL MODELING | 9 |
|---|---|---|

Advanced Topics in Statistical Modeling - Non-linear Regression - Time Series Analysis - Hierarchical Modeling - Generalized Additive Models (GAMs) - Longitudinal Data Analysis

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING | 1. TUTORIAL PROBLEMS<br>2. ASSIGNMENT<br>3. QUIZZES | 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING |

**Outcomes**

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

CO1: Understand fundamental concepts of probability and statistics, including probability rules, random variables, and distributions.

CO2: Apply linear regression models for prediction and inference, including simple and multiple linear regression techniques.

CO3: Analyze and interpret results from generalized linear models (GLMs) such as logistic regression and Poisson regression.

CO4: Apply Bayesian statistical methods for inference and model comparison, including Markov Chain Monte Carlo (MCMC) techniques.

CO5: Explore advanced topics in statistical modeling, including non-linear regression, time series analysis, and hierarchical modeling.

**Text Books**

1.Introduction to Probability - Joseph K. Blitzstein and Jessica Hwang - 2019 - CRC Press

2.An Introduction to Statistical Learning: with Applications in R - Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani - 2013 - Springer

3.Linear Models with R - Julian J. Faraway - 2014 - Chapman and Hall/CRC

| **Reference Books** |
| --- |
| 1.Bayesian Data Analysis - Andrew Gelman, John B. Carlin, Hal S. Stern, David B. Dunson, Aki Vehtari, and Donald B. Rubin - 2013 - CRC Press |
| 2.Time Series Analysis and Its Applications: With R Examples - Robert H. Shumway and David S. Stoffer - 2017 – Springer |
| **Web Resources** |
| 1.www.analyticsvidhya.com/blog/2015/08/comprehensive-guide-regression/ |
| 2.www.r-bloggers.com/2016/11/introduction-to-generalized-additive-models/ |
| 3.www.theanalysisfactor.com/generalized-linear-models/ |

### CO Vs PO Mapping and CO Vs PSO Mapping

| CO | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 1 | 1 | 1 | | | | | | | | | 3 | |
| **2** | 3 | 3 | 2 | | | | | | | | | | 1 | |
| **3** | 3 | 3 | | | | | | | | | | | 3 | |
| **4** | 3 | 1 | 2 | | | | | | | | | | 3 | |
| **5** | 1 | 3 | 3 | | | | | | | | | | 2 | |

| **BLOOMS CATEGORY** | **CAT 1** | **CAT 2** | **FAT 1** | **FAT 2** | **END SEM EXAM** |
|---|---|---|---|---|---|
| **REMEMBER** | 20 | 20 | 5 | 5 | 20 |
| **UNDERSTAND** | 50 | 50 | 10 | 10 | 50 |
| **APPLY** | 30 | 30 | 10 | 10 | 30 |
| **ANALYZE** | | | | | |
| **EVALUATE** | | | | | |
| **CREATE** | | | | | |

| 24IF2702 | CLOUD COMPUTING TECHNOLOGIES | L | T | P | C |
|----------|------------------------------|---|---|---|---|
|          |                              | 3 | 0 | 0 | 3 |

**Preamble**

This course provides an in-depth understanding of virtualization and cloud computing, essential technologies for modern IT infrastructure. It is designed to cover the fundamentals of virtualization, the architecture and management of cloud platforms, the programming models used in cloud environments, and the critical aspects of cloud security.

**Prerequisites for the course**

**Nil**

**Objectives**

1.To understand the concepts of virtualization and virtual machines

2. To gain expertise in server, network and storage virtualization.

3. To understand and deploy practical virtualization solutions and enterprise solutions

4. To Design Hadoop File System.

5. To understand the security issues in the grid and the cloud environment.

| UNIT I | VIRTUALIZATION | 9 |
|--------|----------------|---|

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization –– Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization

| UNIT II | VIRTUALIZATION INFRASTRUCTURE | 9 |
|---------|-------------------------------|---|

Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines – Desktop Virtualization – Application Virtualization - Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

| UNIT III | CLOUD PLATFORM ARCHITECTURE | 9 |
|----------|------------------------------|---|

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Cloud Environments - Case study: One cloud service provider per service model (eg. Amazon EC2, Google App Engine, Sales Force, Microsoft Azure, Open Source tools)

| UNIT IV | PROGRAMMING MODEL | 9 |
|---------|-------------------|---|

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters,

configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus

| UNIT V | CLOUD SECURITY | 9 |
|---|---|---|

Cloud Security Challenges and Risks – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security, Advances in Cloud- MQTT in Cloud, MQTT working example – Fog Computing basics

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS 2. PROBLEM SOLVING | 1. ASSIGNMENT 2. QUIZZES | 1. DESCRIPTIVE QUESTIONS 2. PROBLEM SOLVING |

**Outcomes**

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

CO1 – Understand the concepts of storage virtualization, network virtualization and its management

CO2 – Apply the concept of virtualization in the cloud computing

CO3 – Identify the architecture, infrastructure and delivery models of cloud computing

CO4 – Develop services using Cloud computing

CO5 – Apply the security models in the cloud environment

**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, 2021

**Reference Books**

1.Danielle Ruest, Nelson Ruest, ―Virtualization: A Beginner‟s Guide‖, McGraw-Hill Osborne Media, 2009.

2.Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005

3.John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010

4.Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

**Web Resources**

https://onlinecourses.nptel.ac.in/noc21_cs14/preview

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 1 | 1 | 1 | | | | | | | | | 3 | |
| 2 | | 3 | 1 | 1 | 1 | | | | | | | | 3 | |
| 3 | 3 | 1 | 1 | 1 | | | | | | | | 3 | | |
| 4 | 1 | 2 | 3 | 1 | 2 | | | | | | | | | |
| 5 | 2 | 1 | 1 | 1 | 2 | 1 | | | | | | 1 | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | 20 | 20 | 5 | 5 | 20 |
| UNDERSTAND | 50 | 50 | 10 | 10 | 50 |
| APPLY | 30 | 30 | 10 | 10 | 30 |
| ANALYZE | | | | | |
| EVALUATE | | | | | |
| CREATE | | | | | |

| 24IF2703 | SOFTWARE DEFINED NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

This course introduces software defined networking, an emerging paradigm in computer networking that allows a logically centralized software program to control the behaviour of an entire network

**Prerequisites for the course**

**NIL**

**Objectives**

1.Differentiate between traditional networks and software defined network

2.Understand advanced and emerging networking technologies

3.Obtain skills to do advanced networking research and programming

4.Learn how to use software programs to perform varying and complex networking tasks

5.Expand upon the knowledge learned and apply it to solve real world problems

| UNIT I | INTRODUCING SDN | 9 |
|---|---|---|

SDN Origins and Evolution – Centralized and Distributed - Control and Data Planes - The Genesis of SDN - SDN Implications - SDN Operations - SDN Controllers

| UNIT II | SDN ABSTRACTIONS | 9 |
|---|---|---|

How SDN Works - The Openflow Protocol - SDN Controllers: Introduction – General Concepts - VMware - Nicira - VMware/Nicira - OpenFlow-Related - Mininet - NOX/POX - Trema - Ryu - Big Switch Networks/Floodlight - Layer 3 Centric - Plexxi - Cisco OnePK

| UNIT III | PROGRAMMING SDN'S | 9 |
|---|---|---|

Network Programmability - Network Function Virtualization – Players in The SDN Ecosystem - NetApp Development- Network Slicing - Emerging Protocol, Controller, and Application Models

| UNIT IV | SDN APPLICATIONS AND USE CASES | 9 |
|---|---|---|

SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System 3

| UNIT V | SDN'S FUTURE AND PERSPECTIVES | 9 |
|---|---|---|

SDN Open Source - SDN Futures - Open Stack, Cloud Stack - Business Ramifications - Major SDN Acquisitions - SDN Startups - Career Disruptions - Potential Novel Applications of Open SDN

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. QUIZZES | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO1 – Differentiate between traditional networks and software defined network

CO2 – Understand advanced and emerging networking technologies

CO3 – Obtain skills to do advanced networking research and programming

CO4 – Learn how to use software programs to perform varying and complex networking tasks

CO5 – Expand upon the knowledge learned and apply it to solve real world problems

**Text Books**

1.Software Defined Networks: A Comprehensive Approach ,30 June 2017 by Paul Goransson , Chuck Black s

2.Software Defined Systems: Sensing, Communication and Computation  5 December 2019

by Deze Zeng , Lin Gu , Shengli Pan , Song Guo

**Reference Books**

1.Software Defined Networking Design and Deployment By Patricia A. Morreale, James M. Anderson, Published September 30, 2020 by CRC Press

2.Software Defined Networks: Architecture and Applications Preeti Nagrath , Bhawna Singla , Anand Nayyar ,ISBN: 978-1-119-85730-3,June 2022

**Web Resources**

https://www.geeksforgeeks.org/software-defined-networking/

### CO Vs PO Mapping and CO Vs PSO Mapping

| CO | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | 3 | 3 | 3 | | | | | | | | 3 | |
| 2 | 2 | 3 | 3 | 2 | 3 | | | | | | | | 2 | |
| 3 | 1 | 3 | 2 | 2 | 1 | | | | | | | | 1 | |
| 4 | 1 | 2 | 1 | 3 | 2 | | | | | | | | 2 | |
| 5 | 2 | 3 | 1 | 2 | 1 | | | | | | | | 1 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | | | | | |
| UNDERSTAND | 50 | 50 | 50 | 50 | 50 |
| APPLY | 50 | 50 | 50 | 50 | 50 |
| ANALYZE | | | | | |
| EVALUATE | | | | | |
| CREATE | | | | | |

| 24IF2704 | SOFT COMPUTING AND FUZZY LOGIC | L | T | P | C |
|----------|-------------------------------|---|---|---|---|
|          |                               | 3 | 0 | 0 | 3 |

**Preamble**

The objective of this course is to introduce basic concepts and applications of soft computing tools such as neural networks, fuzzy logic systems, and several optimization techniques like genetic algorithms, evolutionary computation, simulated annealing etc. Also it covers soft computing based solutions for real-world Electrical Engineering problems

**Prerequisites for the course**

**NIL**

**Objectives**

1. To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.

2. To provide the mathematical background for carrying out the optimization associated with neural network learning

3. To learn various evolutionary Algorithms.

4. To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.

5. To introduce case studies utilizing the above and illustrate the Intelligent behaviour of programs based on soft computing

| UNIT I | INTRODUCTION TO FUZZY LOGIC | 9 |
|--------|------------------------------|---|

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

| UNIT II | NEURAL NETWORKS | 9 |
|---------|------------------|---|

Supervised Learning Neural Networks – Perceptrons - Backpropagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks

| UNIT III | GENETIC ALGORITHMS | 9 |
|----------|---------------------|---|

Chromosome Encoding Schemes -Population initialization and selection methods – Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function

| UNIT IV | NEURO FUZZY MODELING | 9 |
|---------|-----------------------|---|

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum – Analysis of Adaptive Learning Capability

| UNIT V | APPLICATIONS | 9 |
|--------|---------------|---|

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural

networks– Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction.

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. QUIZZES | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO1 - Understand the fundamentals of fuzzy logic operators and inference mechanisms

CO2 – Understand neural network architecture for AI applications such as classification and
 clustering

CO3 – Learn the functionality of Genetic Algorithms in Optimization problems

CO4 – Use hybrid techniques involving Neural networks and Fuzzy logic

CO5 – Apply soft computing techniques in real world applications

**Text Books**

1.Roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018

2.  S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt
    Ltd, 2019.

**Reference Books**

1.Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python With Case Studies and Applications from the Industry, Apress, 2020

2.Samir Roy, Udit Chakraborthy, Introduction to Soft Computing, Neuro Fuzzy and Genetic

Algorithms, Pearson Education, 2013

**Web Resources**

1.https://www.geeksforgeeks.org/fuzzy-logic-introduction/

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | 2 | 3 | 3 | 3 | | | | | | | | 3 | |
| **2** | 2 | 3 | 3 | 2 | 3 | | | | | | | | 2 | |
| **3** | 1 | 3 | 2 | 2 | 1 | | | | | | | | 1 | |
| **4** | 1 | 2 | 1 | 3 | 2 | | | | | | | | 2 | |
| **5** | 2 | 3 | 1 | 2 | 1 | | | | | | | | 1 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| **REMEMBER** | | | | | |
| **UNDERSTAND** | 50 | 50 | 50 | 50 | 50 |
| **APPLY** | 50 | 50 | 50 | 50 | 50 |
| **ANALYZE** | | | | | |
| **EVALUATE** | | | | | |
| **CREATE** | | | | | |

| 24IF2705 | DATA VISUALIZATION AND INTERPRETATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

Effective data visualization is essential for interpreting complex data and making informed decisions. This course equips students with the skills to transform data into clear and impactful visual representations, enhancing understanding and decision-making.

**Prerequisites for the course**

NIL

**Objectives**

1. Understand fundamental principles and processes of data visualization.

2. Explore various data types and their relationships.

3. Gain hands-on experience with R programming for data visualization.

4. Master a range of visualization formats.

5. Apply principles of effective visualization design.

| UNIT I | BASICS OF DATA VISUALIZATION | 9 |
|---|---|---|

Data visualization – visualization process – filtering and processing – translation and visual representation – perception and interpretation – importance of data visualization – key aspects – explaining – exploring – analysing

| UNIT II | DATA TYPES AND RELATIONSHIPS | 9 |
|---|---|---|

Data – kinds of data – quantitative – discrete – continuous – qualitative – ordinal – categorical – data relationships – ranking – deviation – nominal comparisons – correlation – partial and total relationships – series over time – distribution - variables - vectors - Data Frames.

| UNIT III | R PROGRAMMING | 9 |
|---|---|---|

Introduction to R programming - Installing R and R Studio - Working in the Console - Arithmetic Operators - Logical Operations - Installing packages ggplot2 – Rcpp – RcolorBrewer – data types – special values – matrices – data frames – dataset – creating dataset – importing data – exporting data – functions – if else statements – loops – saving plots - using multiple geom.

| UNIT IV | VISUALIZING FORMATS | 9 |
|---|---|---|

Bar chart – vertical column – horizontal column – full stacked column – histograms – pie charts – standard – donut – scatterplots – plots with grid – heat maps – mosaic diagram – colour map – line charts – bubble charts – bubble plot – bubble map – radar charts – waterfall charts – tree maps – area charts – standard are – stacked area - 100% stacked area

| UNIT V | VISUALIZATION PRINCIPLES | 9 |
|---|---|---|

Basic principles of visualization – graphics with an objective – layout and design communicative

elements – visual variables – semantics – colour schemes – monochromatic sequential palettes – diverging palettes – qualitative palette – icons and symbols – pattern priorities

| | |
|---|---|
| **Total Periods** | **45** |

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS 2. PROBLEM SOLVING | 1. TUTORIAL PROBLEMS 2. ASSIGNMENT 3. QUIZZES | 1. DESCRIPTIVE QUESTIONS 2. PROBLEM SOLVING |

**Outcomes**

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

CO1 – Apply techniques for filtering, processing, and translating data into visual representations.

CO2 – Apply methods to explore, rank, and compare data effectively.

CO3 – Apply R programming functions to manage and manipulate datasets.

CO4 - Apply the appropriate visualization format based on data characteristics and communication goals.

CO5 – Analyze basic principles of visualization design.

**Text Books**

Claus O. Wilke, 'Fundamentals of Data Visualization – A primer on making informative and compelling figures', O'reilly Media, 2019.

**Reference Books**

1. Atmajitsinh Gohil, 'R Data Visualization Cookbook', PACKT Publishing, 2015

2. Julie Steele and Noah Iliinsky, 'Beautiful Visualization: Looking at Data Through the Eyes of Experts', O'Reilly Media, First Edition, 2020.

3. Andy Kirk, 'Data Visualisation: A Handbook for Data Driven Design', Sage Publications, Second Edition, 2019.

**Web Resources**

https://data.vk.edu.ee/PowerBI/Opikud/Fundamentals_of_Data_Visualization.pdf

https://haralick.org/DV/Handbook_of_Data_Visualization.pdf

https://cicerocq.wordpress.com/wp-content/uploads/2020/03/gohil-a.-r-data-visualization-cookbook-.pdf

https://www.netquest.com/hubfs/docs/ebook-data-visualization-EN.pdf

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | | 3 | 3 | 3 | | | | | | | | | 3 | |
| **2** | 3 | | 3 | 3 | 3 | | | | | | | | | 3 | |
| **3** | 2 | 2 | 2 | 2 | 2 | | | | | | | | | 2 | |
| **4** | 2 | 2 | 2 | 2 | 2 | | | | | | | | | 2 | |
| **5** | 2 | 2 | 2 | 2 | 2 | | | | | | | | | 2 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| **REMEMBER** | | | | | |
| **UNDERSTAND** | 50 | 50 | 50 | 50 | 50 |
| **APPLY** | 50 | 50 | 50 | 50 | 50 |
| **ANALYZE** | | | | | |
| **EVALUATE** | | | | | |
| **CREATE** | | | | | |

| 24IF2706 | BIG DATA ACQUISITION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

Big data acquisition is a foundational course designed to equip students with the knowledge and skills needed to handle and analyze large datasets. This course covers the origins and definitions of big data, its applications in data science, and the use of NoSQL databases. Students will learn about system optimization techniques within the Hadoop ecosystem, ensuring efficient and effective data processing. The course also addresses security and privacy concerns in big data infrastructure and includes practical case studies to apply the learned concepts in real-world scenarios.

**Prerequisites for the course**

NIL

**Objectives**

1. Understand the origins and fundamental concepts of big data.

2. Explore the various NoSQL database models and their applications.

3. Learn optimization techniques for big data processing systems.

4. Address security and privacy issues related to big data infrastructure.

5. Apply big data analytics through practical case studies.

| UNIT I | BIGDATA FOR DATA SCIENCE | 9 |
|---|---|---|

Origin of big data – defining from 3Vs – big data analytics and cloud computing – big data analytics and machine learning – Google File System – HDFS – Map Reduce -  NLP and its applications – language detection – named entity recognition – text mining – sentiment analysis – recommender systems – anomaly detection.

| UNIT II | NO SQL DATABASES | 9 |
|---|---|---|

Navigational Data Models – Relational Data Models – No SQL Data Models – Key value – Column based – Graph based – document based

| UNIT III | SYSTEM OPTIMIZATION | 9 |
|---|---|---|

Hadoop Ecosystem – Parallel computation – improvements of Map Reduce – task scheduling – load balancing – job scheduling – job management – HBase framework – storage – application optimization – performance enhancement of hadoop system

| UNIT IV | SECURITY AND PRIVACY | 9 |
|---|---|---|

Spatial Aspects of Social Networks – spatial privacy – cloud based big data infrastructure - System Model – Thread Model – Attack Model – secure query scheme in clouds – index based secure query techniques – digital watermarking – access control.

| UNIT V | CASE STUDIES | 9 |
|---|---|---|

Tweets Sentiment Analysis – Weather and Emotion Correlation Analysis – Analysis with Hourly weather data – daily weather data – Traffic Congestion Ranking – Customer Behaviour Identification – Human Object Estimation – Finance Analytics.

| | Total Periods | 45 |
|---|---|---|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS | 1. ASSIGNMENT<br>2. QUIZZES | 1. DESCRIPTIVE QUESTIONS |

**Outcomes**

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

CO1 – Apply big data analytics in conjunction with cloud computing and machine learning.

CO2 – Apply appropriate NoSQL data models to various data scenarios.

CO3 –Analyze the Hadoop ecosystem and improvements to Map Reduce.

CO4 – Apply secure query schemes and access control measures in cloud-based big data infrastructures.

CO5 – Create data-driven insights from practical scenarios

**Text Books**

Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi, 'BIG DATA – Principles and Paradigms' Morgan Kaufmann, Elsevier, 2016.

**Reference Books**

1. David Loshin  "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann, 2nd Edition, 2022

2. Tom White "Hadoop: The Definitive Guide: Storage and Analysis at Internet Scale" O'Reilly Media, 4th Edition, 2021

3. Dan Sullivan "NoSQL for Mere Mortals" Addison-Wesley Professional, 1st Edition, 2020

4. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" Wiley, 1st Edition, 2021

**Web Resources**

https://dhoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/Big%20Data%20Principles%20and%20Paradigms.pdf

**CO Vs PO Mapping and CO Vs PSO Mapping**

| CO | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 3 | | 3 | 3 | 3 | | | | | | | | 3 | |
| **2** | 3 | | 3 | 3 | 3 | | | | | | | | 3 | |
| **3** | 2 | 2 | 2 | 2 | 2 | | | | | | | | 2 | |
| **4** | 2 | 2 | 2 | 2 | 2 | | | | | | | | 2 | |
| **5** | 2 | 2 | 2 | 2 | 2 | | | | | | | | 2 | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| **REMEMBER** | | | | | |
| **UNDERSTAND** | 50 | 50 | 50 | 50 | 50 |
| **APPLY** | 50 | 50 | 50 | 50 | 50 |
| **ANALYZE** | | | | | |
| **EVALUATE** | | | | | |
| **CREATE** | | | | | |

| 24IF2707 | AUGMENTED REALITY AND VIRTUAL REALITY | L | T | P | C |
|----------|----------------------------------------|---|---|---|---|
|          |                                        | 3 | 0 | 0 | 3 |

**Preamble**

The program introduces the application of the Augmented Reality (AR) and Virtual Reality (VR) in the design process to efficiently incorporate user experience, identifying and resolving conflicts in real life like settings and saving on costs etc.

**Prerequisites for the course**

Engineering Graphics, Computer Aided Engineering

**Objectives**

1. Learn the fundamental Computer Vision, Computer Graphics and Human-Computer interaction Techniques related to VR/AR
2. Review the Geometric Modeling Techniques
3. Review the Virtual Environment
4. Discuss and Examine VR/AR Technologies
5. Use of various types of Hardware and Software in Virtual Reality systems
6. Simulate and Apply Virtual/Augmented Reality to varieties of Applications

| UNIT I | INTRODUCTION TO VIRTUAL REALITY (VR) | 9 |
|--------|--------------------------------------|---|

Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception , Requirements and Characteristics, Spatial Display Model. Processors – Role of Processors, Processor System Architecture, Processor Specifications. Tracking & Sensors - Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.

| UNIT II | COMPUTER GRAPHICS AND GEOMETRIC MODELLING | 9 |
|---------|-------------------------------------------|---|

The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Color theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms, Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection

| UNIT III | AUGMENTED REALITY HARDWARE | 9 |
|----------|----------------------------|---|

Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception , Requirements and Characteristics, Spatial Display Model. Processors – Role of Processors, Processor System Architecture, Processor Specifications. Tracking & Sensors - Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.

| UNIT IV | COMPUTER VISION FOR AUGMENTED REALITY & A.R. SOFTWARE | 9 |
|---------|-------------------------------------------------------|---|

Computer Vision for Augmented Reality - Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Simultaneous Localization and Mapping, Outdoor Tracking Augmented Reality Software - Introduction, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

| UNIT V | AR DEVICES & COMPONENTS | 9 |
|--------|-------------------------|---|

AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems

| | Total Periods | 45 |
|--|---------------|-----|

**Suggestive Assessment Methods**

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---------------------------------------|--------------------------------------|-------------------------------|
| 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING | 1. TUTORIAL PROBLEMS<br>2. ASSIGNMENT<br>3. QUIZZES | 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING |

**Outcomes**

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

CO1: Describe how AR systems work and list the applications of AR.

CO2: Understand and analyse the hardware requirement of AR.

CO3: Use computer vision concepts for AR and describe AR techniques

CO4: Analyse and understand the working of various state of the art AR devices

CO5: Acquire knowledge of mixed reality

**Text Books**

1. Norman, K., Kirakowski, J., (2018), "Wiley Handbook of Human Computer Interaction," Wiley-Blackwell, ISBN: 9781118976135
2. Fowler, A., (2019), "Beginning iOS AR Game Development: Developing Augmented Reality Apps with Unity and C#," Apress, ISBN: 9781484246672
3. Hassanien, A. E., Gupta, D., Khanna, A., Slowik, A., (2022), "Virtual and Augmented Reality for Automobile Industry: Innovation Vision and Applications," Springer, ISBN: 9783030941017

**Reference Books**

1. Craig, A. B., (2013), "Understanding Augmented Reality, Concepts and Applications," Morgan Kaufmann, ISBN: 9780240824086

2. Craig, A. B., Sherman, W. R., Will, J. D., (2009), "Developing Virtual Reality Applications, Foundations of Effective Design," Morgan Kaufmann, ISBN: 9780123749437
3. O'Connell, K., (2019), "Designing for Mixed Reality: Blending Data, AR, and the Physical World," O'Reilly, ISBN: 9789352138371
4. Sanni Siltanen, S., (2012), "Theory and applications of marker-based augmented reality," Julkaisija –Utgivare Publisher, ISBN: 9789513874490

**Web Resources**

1.Manivannan, M., (2018), "Virtual Reality Engineering," IIT Madras, https://nptel.ac.in/courses/121106013

2.Misra, S., (2019), "Industry 4.0: Augmented Reality and Virtual Reality," IIT Kharagpur, https://www.youtube.com/watch?v=zLMgdYI82IE

3.Dube, A., (2020), "Augmented Reality - Fundamentals and Development," NPTEL Special Lecture Series, https://www.youtube.com/watch?v=MGuSTAqlZ9Q

4.http://cambum.net/course-2.htm

### CO Vs PO Mapping and CO Vs PSO Mapping

| CO | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 3 | | | | | | | | | | | 2 | 1 |
| 2 | 3 | 3 | 2 | 2 | 2 | | | | | | | | | |
| 3 | 2 | 3 | 3 | 2 | 2 | | | | | | | | | |
| 4 | 2 | 3 | 3 | 2 | 2 | | | | | | | | | |
| 5 | 3 | 3 | 3 | 3 | | | | | | | | | | |

**BLOOMS LEVEL ASSESSMENT PATTERN**

| BLOOMS CATEGORY | CAT 1 | CAT 2 | FAT 1 | FAT 2 | END SEM EXAM |
|---|---|---|---|---|---|
| REMEMBER | | | | | |
| UNDERSTAND | 30 | 5 | 5 | 30 | 30 |
| APPLY | 40 | 10 | 10 | 40 | 40 |
| ANALYZE | 30 | 10 | 10 | 30 | 30 |
| EVALUATE | | | | | |
| CREATE | | | | | |

| 24IF2708 | GENETIC ALGORITHMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Preamble**

Genetic algorithms are heuristic search algorithms that simulate the process of natural selection. They operate on a population of potential solutions, applying operators such as selection, crossover, and mutation to evolve solutions over successive generations. This course will delve into the theoretical foundations of GAs, covering key concepts such as genetic representation, fitness functions, and the mechanics of genetic operators.

**Objectives**

1.To Learn bio-inspired theorem and algorithms

2.To Understand random walk and simulated annealing

3.To Learn genetic algorithm and differential evolution

4.To Learn swarm optimization and ant colony for feature selection

5.To understand bio-inspired application in image processing

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Introduction to algorithm - Newton's method - optimization algorithm - No-Free-Lunch Theorems - Nature-Inspired Mata heuristics -Analysis of Algorithms -Nature Inspires Algorithms -Parameter tuning and parameter control.

| UNIT II | RANDOM WALK AND ANEALING | 9 |
|---|---|---|

Random variables - Isotropic random walks - Levy distribution and flights - Markov chains - step sizes and search efficiency - Modality and intermittent search strategy - importance of randomization- Eagle strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunnelling.

| UNIT III | GENETIC ALOGORITHMS AND DIFFERENTIAL EVOLUTION | 9 |
|---|---|---|

Introduction to genetic algorithms and - role of genetic operators - choice of parameters - GA variants - schema theorem - convergence analysis - introduction to differential evolution - variants - choice of parameters - convergence analysis - implementation.

| UNIT IV | SWARM OPTIMIZATION AND FIREFLY ALGORITHM | 9 |
|---|---|---|

Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - varientsAnt colony optimization toward feature selection

| UNIT V | APPLICATION IN IMAGE PROCESSING | 9 |
|---|---|---|

Bio-Inspired Computation – Fine Tuning Enhanced Probabilistic Neural Networks Using Meta-

heuristic-driven Optimization - Fine-Tuning Deep Belief Networks using Cuckoo Search - Improved Weighted Threshold Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection and Segmentation using Snake Model - Mobile Object Tracking Using Cuckoo Search

| | Total Periods | 45 |
|---|---|---|

## Suggestive Assessment Methods

| Continuous Assessment Test (30 Marks) | Formative Assessment Test (10 Marks) | End Semester Exams (60 Marks) |
|---|---|---|
| 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING | 1. TUTORIAL PROBLEMS<br>2. ASSIGNMENT<br>3. QUIZZES | 1. DESCRIPTIVE QUESTIONS<br>2. PROBLEM SOLVING |

## Outcomes

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

CO1– Implement and apply bio-inspired algorithms

CO2– Explain random walk and simulated annealing

CO3–Implement and apply genetic algorithms

CO4Explain swarm intelligence and ant colony for feature selection

CO5–Apply bio-inspired techniques in image processing.

## Text Books

Eiben,A.E.,Smith,James E, "Introduction to Evolutionary Computing", Springer 2019.

## Reference Books

1.Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", Intech 2014.

2. Xin-She Yang , Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing",Elsevier 2016

3. Xin-She Yang, "Nature Ispired Optimization Algorithm,Elsevier First Edition 2014

4. Yang ,Cui,XIao,Gandomi,Karamanoglu ,"Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013

## Web Resources

NPTEL : https://nptel.ac.in/courses/112105235

**CO Vs PO Mapping and CO Vs PSO Mapping**

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

| 24IF1612 | DATABASE TECHNOLOGIES LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**Pre- requisites for the course**

The students should have the basic knowledge on Database Management Systems

**Objectives**

1. To understand the concepts of Open-Source DBMS.

2. To learn the process of distributing tables across multiple systems

3. To apply the process of storing, retrieving spatial and temporal data

4. To analyze the process of storing, retrieving objects in a database

5. To comprehend the process of storing and retrieving data from an XML Database

| S.NO | LIST OF EXPERIMENTS | CO |
|---|---|---|
| 1 | Data Definition, Manipulation of Tables and Views, Database Querying–Simple queries, Nested queries, Subqueries And Joins. | CO1 |
| 2 | **NOSQL Exercises**<br>a. MongoDB – CRUD operations, Indexing, Sharding, Deployment<br>b. Cassandra: Table Operations, CRUD Operations, CQL Types<br>c. HIVE: Data types, Database Operations, Partitioning – HiveQL<br>d. OrientDB Graph database – OrientDB Features | CO1 |

| 3 | MySQL Database Creation, Table Creation, Query | **CO2** |
|---|---|---|
| 4 | MySQL Replication – Distributed Databases | **CO2** |
| 5 | Spatial data storage and retrieval in MySQL | **CO3** |
| 6 | Temporal data storage and retrieval in MySQL | **CO3** |
| 7 | Object storage and retrieval in MySQL | **CO4** |
| 8 | XML Data bases, XML table creation, XQuery FLWOR expression | **CO4** |
| 9 | Mobile Database Query Processing using open-source DB (MongoDB/MySQL etc) | **CO5** |
| | | **Total Periods: 60** |

**Suggestive Assessment Methods**

| Lab Components Assessments(50Marks) | End Semester Exams(50Marks) |
|---|---|
| • Experiments <br> • Viva | • Experiments <br> • Viva |

**Outcomes:**

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

CO1 Formulate complex queries using SQL.

CO2 Design and Implement applications that have GUI and access databases for backend connectivity

CO3 Use PL/SQL procedures and functions

CO4 Implement the database concept using query processing

CO5 Design and Implement databases.

**Laboratory Requirements**

Standalone desktop, ORACLE, MSSQL Server,

**Reference Books**

1. HenryFKorth,AbrahamSilberschatzandS.Sudharshan,"DatabaseSystemConcepts",Sixth Edition, McGrawHill, 2011.
2. C.J.Date,A.KannanandS.Swamynathan,"AnIntroductiontoDatabaseSystems",Eighth Edition, Pearson Education, 2006.
3. R.Elmasri,S.B.Navathe,"Fundamentals of Database Systems", Fifth Edition, Pearson Education/AddisonWesley,2007.
4. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007.

**Web Resources**

www.coursera.org/specialization/databasesystemswww.gale.com/databases

**CO Vs PO Mapping and COVs PSO Mapping**

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

| 24IF2612 | **Technical Paper Writing and Seminar** | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**Preamble**

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

**Prerequisites for the course**

**NIL**

**Objectives**

1.Selecting a subject, narrowing the subject into a topic

2.Stating an objective.

3.Collecting the relevant bibliography (atleast 15 journal papers)

4.Preparing a working outline.

5.Studying the papers and understanding the authors contributions and critically analysing each paper.

6.Linking the papers and preparing a draft of the paper.

7.Preparing conclusions based on the reading of all the papers.

8.Writing the Final Paper and giving final Presentation

Please keep a file where the work carried out by you is maintained.Activities to be carried out

| Activity | Instructions | Submission week | Evaluation |
|---|---|---|---|
| Selection of area of interest and Topic Stating an Objective | You are requested to select an area of interest, topic and state an objective | 2nd week | **3 %** Based on clarity of thought, current relevance and clarity in writing |

| | | | |
|---|---|---|---|
| Collecting Information about your area& topic | List 2 journals<br>2.      List 2 conferences, symposiaor workshops<br>List 1 thesis title<br>4.      List 3 authors who publish regularly in your area<br>Attach a call for papers (CFP) from your area. | 3rd week | **3%**<br>( the selected information must be area specific and of international and national standard) |
| Collection of Journal papers in the topic in the context of the objective – collect 20 & thenfilter | •      You have to provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar<br>•      When picking papers to read - try to:<br>•      Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them,<br>•      Favour papers from well-known journals and conferences,<br>•      Favour "first" or "foundational" papers in the field (as indicated in other people's survey paper),<br>Favour more recent papers,<br>•      Pick a recent survey of the field so you can quickly gain an overview,<br>•      Find relationships with respect to each other and to your topic area (classification scheme/categorization) | 4th week | **6%**<br>( the list of standard papers andreason for selection) |

| Reading and notes for first 5papers | Reading Paper Process<br>• For each paper form a Table answering the following questions:<br>• What is the main topic of the article?<br>What was/were the main<br>issue(s) the author said they want to discuss? | 5th week | **8%**<br>( the table given should indicate your understanding of the paper and the evaluation is |
|---|---|---|---|
| | • Why did the author claim it was important?<br>• How does the work build on other's work, in the author's opinion?<br>• What simplifying assumptions does the author claim to be making?<br>What did the author do?<br>• How did the author claim they were going to evaluate their work and compare it to others?<br>• What did the author say were the limitations of their research?<br>• What did the author say were the important directions for future research?<br>Conclude with limitations/issues not addressed by the paper ( from the perspective of your survey) | | based on your conclusions about each paper) |
| Reading and notes for next5 papers | Repeat Reading Paper Process | 6th week | **8%**<br>( the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |

| Reading and notes for final 5 papers | Repeat Reading Paper Process | 7th week | **8%** ( the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |
|---|---|---|---|
| Draft outline 1 and Linking papers | Prepare a draft Outline, your survey goals, along with a classification / categorization diagram | 8th week | **8%** ( this component willbe evaluated based on the linking and |

| | | | classification among the papers) |
|---|---|---|---|
| Abstract | Prepare a draft abstract and give a presentation | 9th week | **6%** (Clarity, purpose andconclusion) **6%** Presentation & Viva Voce |
| Introduction Background | Write an introduction and background sections | 10th week | **5%** ( clarity) |
| Sections of the paper | Write the sections of your paper based on the classification / categorization diagram in keeping withthe goals of your survey | 11thweek | **10%** (this component will be evaluated based on the linking and classification among the papers) |
| Your conclusions | Write your conclusions and future work | 12th week | **5%** ( conclusions – clarity and your ideas) |
| Final Draft | Complete the final draft of your paper | 13th week | **10%** (formatting, English, Clarity and linking) **4%** Plagiarism Check Report |
| Seminar | A brief 15 slides on your paper | 14th & 15th week | **10%** (based on presentation and Viva-voce) |