MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI-12

AFFILIATED COLLEGES

MASTER OF SCIENCE in COMPUTER SCIENCE

Learning Outcome based Curriculum Framework (LOCF)

With effect from 2021-2022 onwards

VISION AND MISSION OF THE UNIVERSITY

Vision

"To provide quality education to reach the un-reached"

Mission

- To conduct research, teaching and outreach programmes to improve conditions of human living
- To create an academic environment that honours women and men of all races, caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development
- To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To prepare the students to understand the core concepts in **Computer Science**
2. Enable students to develop problem solving and programming skills in the recent technologies thereby developing strong employability
3. Empower students to prepare themselves to engage in active research
4. Enable students to pursue competitive exams at National and state level such as NET/SLET/GATE

PROGRAM OUTCOMES (POs)

On completion of the M.Sc. (Computer Science) programme, the students will be able to:

PO1: Identify and understand the need for basic mathematical and Computational Concepts and apply them to real world problems.

PO2: Design and develop applications using computers to analyze and solve computer science related problems.

PO3: Design, implement and evaluate a computer-based system, process, component, or programs to meet the stakeholder needs

PO4: Analyze, design and choose efficient algorithms and apply them in appropriate Computational solutions

PO5: Analyze large data sets in the context of real world problems and interpret results using data analytics.

PO6: Understand research methods and apply them to analyze data for decision Making.

PO7 Realize the importance of lifelong learning and continuous professional development.

Programme Specific Outcomes (PSO)

On Successful completion of the M.Sc. (Computer Science) degree programme, students will be able to:

PSO1: Analyze, design and develop solutions to significant computational problems.

PSO2: Utilize tools and techniques necessary for computing practices.

PSO3: Participate in competitive exams such as SET, NET etc. effectively.

PSO4: Design, develop and evaluate novel projects to meet the desired demands of industry and society.

PSO5: Demonstrate best practices and standards to develop user interactive applications.

PSO6: Work with computing technologies and pursue career in the areas related to Computer Science.

PSO7: Function effectively as an individual or in teams involving multidisciplinary environments.

REGULATIONS of the PROGRAMME

Duration of the Programme: Two years (4 Semesters)

Eligibility:

Students with three year Bachelor's degree in Computer Science / Computer Applications / Information Technology or any other degree accepted by the Syndicate of Manonmaniam Sundaranar University as equivalent in the 10+2+3 pattern

SEMESTER WISE COURSE LIST

SEMESTER I					
Semester	**Course No.**	**Course type**	**Course Name**	**Contact Hrs./ Week**	**Credits**
I	1	Core-1	Design and Analysis of Algorithms	5	4
	2	Core-2	Advanced Java Programming	5	4
	3	Core-3	Mathematical Foundation for Computer Science	4	4
	4	Core-4	Compiler Design	4	4
	5	Core - 5	Distributed operating system	4	4
	6	Core - 6 Practical - 1	Algorithm Lab	4	2
	7	Core - 7 Practical - 2	Advanced Java Lab	4	2
			Subtotal	**30**	**24**
SEMESTER II					
Semester (1)	Course No. (2)	Course Type (3)	Course Name (4)	Contact Hrs./ Week (5)	Credits (6)
II	8	Core- 8	Advanced Web Technology	5	4
	9	Core- 9	Machine Learning	5	4
	10	Core- 10	Advanced DBMS	4	4
	11	Core- 11	Cryptography and Network Security	4	4
	12	Elective– 1 (Select any one)	1.Free open source Software 2.Data Mining 3.Data Science and Big Data Analytics	4	3
	13	Core - 12 Practical - 3	Advanced Web Technology Lab	4	2
	14	Core - 13 Practical - 4	Machine Learning Lab using Python	4	2
			Subtotal	**30**	**23**

SEMESTER III					
Semester (1)	Course No. (2)	Course Type (3)	Course Name (4)	Contact Hrs./ Week (5)	Credits (6)

III	15	Core-14	Digital Image Processing	4	4
	16	Core-15	Soft Computing	4	4
	17	Core-16	Advanced Computer Networks	4	4
	18	Core-17	Research Methodology	4	4
	19	Elective - 2 (Select any one)	1. Cloud Computing 2. Mobile Computing 3. Optimization Technique	4	3
	20	Core - 18 Practical - 5	Digital Image Processing using Sci lab	4	2
	21	Core –19	Mini Project	6+2*	6
			Subtotal	**30**	**27**
IV	22	Core – 20	Major Project	30+2*	16
			Subtotal	**30**	**16**
			Cumulative total	**120**	**90**

Scheme of Examination / Question Paper Pattern I - Theory Course:

(Total Marks: 100 (Internal: 25 Marks, External: 75 Marks)

Parameters **Student shall secure pass in both internal and external and also obtain 50 marks together to get a pass**	
CIA- Internal Marks	**End semester Examination - External Marks**
i. Average of best two tests from three: 15 Marks ii. Seminar: 05 Marks iii. Assignment: 05 Marks --- Total : 25 Marks	Total : 75 Marks
Passing minimum 40% i.e. 10 marks	Passing minimum 50% i.e. 38 marks

External (End Semester) examination question pattern:

Time: 3 Hours Max. Marks: 75

Part – A

(10*1=10)

Answer all the questions

Ten Questions, two objective type questions from each unit.

Part – B

(5*5=25)

Answer all the questions

Five Questions, two short answer type questions from each unit with internal choice

(Either ...Or... type)

Part – C

(5*8=40)

Answer all the questions

Five Questions, two descriptive/Analytical type questions from each unit with internal choice

(Either ...Or... type)

Practical Courses

Assessment Components (External: Internal (CIA) – 50: 50)

Passing Criteria for Practical Examinations:

There is **no Passing Minimum for the Continuous Internal Assessment (CIA)** component. But overall (CIA+ External), a student shall secure minimum of 50% or more to get a pass.

End Semester practical Examinations

Practical examinations will be conducted at the end of each semester. The scheme of valuation is to be decided by the respective board of Question setters before the commencement of Practical exams.

Passing Minimum for Mini/Major Project:

There is no Passing Minimum for the CIA component of the Mini/Major Project. But overall (CIA+ External), a student shall secure 50% or more to get a pass.

End Semester Mini/Major Project Examinations

Mini and Major Project viva voce examinations will be conducted at the end of third and fourth semester respectively. Students are required to submit a project report before the viva voce examination.

Mini and Major Project work Evaluation criteria: Please Refer Semester III and Semester IV course details

Semester I

Course No.	Course Type	Course Name	Hours per week	Credits
1	Core-1	Design and Analysis of Algorithms	5	4
2	Core-2	Advanced Java Programming	5	4
3	Core-3	Mathematical Foundation for Computer Science	4	4
4	Core-4	Compiler Design	4	4
5	Core - 5	Distributed operating system	4	4
6	Core - 6 Practical - 1	Algorithm Lab	4	2
7	Core - 7 Practical - 2	Advanced Java Lab	4	2
		Subtotal	**30**	**24**

CORE - 1 DESIGN AND ANALYSIS OF ALGORITHMS [C L T P 4 4 1 0]

Course Objectives:

1. Learn fundamental algorithmic design paradigms
2. Design algorithms using popularly used strategies like greedy, divide and conquer, dynamic programming etc.
3. Analyze the algorithmic procedure to determine the computational complexity of algorithms

Course Prerequisites:

1. Exposure to introductory course on programming languages
2. Basic Concepts of Data Structures
3. Some Basic Mathematics

Course Outcomes (COs):

After the completion of this course, student will be able to

CO1: Identify the Characteristics of an algorithm

CO2: Understand the problem-solving approaches using computers

CO3: Compute the time complexity of an algorithm

CO4: Analyze the performance of an algorithm in solving a problem

CO5: Compare the performance of various algorithms in solving a specific-problem

CO6: Develop algorithms for solving real-time problems

Course Outline: **TOTAL (60 HOURS)**

UNIT-1 **(12 HOURS)**

Introduction: Algorithm-Specification - Performance Analysis. Elementary Data Structure: Stacks and Queues- Trees-Dictionaries-Priority Queues- Graphs

UNIT – II **(12 HOURS)**

Divide and Conquer: General Method-Binary Search- Finding the Maximum and Minimum-Quick sort - Strassen's Matrix Multiplication.

UNIT – III **(12 HOURS)**

The Greedy Method: General Method-Knapsack Problem-Job Sequencing with Deadlines-Minimum Cost Spanning Tree-Single Source Shortest Path. Dynamic Programming: General

Method-Multistage Graph-All Pairs Shortest Path-Optimal Binary Search Tree-0/1 Knapsack-Travelling Salesperson Problem.

UNIT – IV **(12 HOURS)**

Basic Traversal and Search Techniques: Techniques for Binary Trees –Techniques for Graphs-Connected Components and Spanning Trees-Biconnected Components and DFS. Backtracking: General Method-8-Queen Problem, Sum of Subsets Graph Coloring: Hamiltonian Cycle.

UNIT – V **(12 HOURS)**

Branch and Bound: The Method-0/1 Knapsack Problem. NP-Hard And NP - Complete Problem - Basic Concepts - Cook's Theorem -NP - HARD GRAPH Problems - Clique Decision Problem - Chromatic Number Decision Problem NP - HARD Scheduling Problems - Flow Shop Scheduling - Job shop scheduling.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7			**Correlation Level** L/M/H			**PSO addressed** PSO1 to PSO7		**Correlation Level** L/ M/ H		**Cognitive Level** K_1 to K_6
CO1	PO1			H			PSO1		H		K_1
CO2	PO1			M			PSO1		M		K_2
CO3	PO2			H			PSO2		M		K_3
CO4	PO4			H			PSO6		H		K_4
CO5	PO6			M			PSO3	PSO5	H	M	K_5
CO6	PO3	PO5	PO7	M	H	M	PSO5	PSO7	M	H	K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create**)**

Text and Reference books

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, —Fundamentals of Computer Algorithms, 2nd Edition, Universities Press(India) Private Ltd., 2018.
2. Aho, Hoporoft and Ullman, —The Design and Analysis of Computer Algorithm, Pearson Education, Delhi, 2001.
3. Basu S.K., —Design Methods and Analysis of Algorithms, PHI, 2006.
4. M.A.Weiss, —Data Structures and algorithm Analysis in C++, Pearson Education, Asia, 2013.
5. Sandeep Sen and Amit Kumar Design and Analysis of Algorithms: A contemporary perspective, Cambridge University Press, 2019.

CORE- 2 ADVANCED JAVA PROGRAMMING [C L T P 4 4 1 0]

Course Objectives:

1. To design stand-alone desktop-oriented GUI based Java applications using Swing and access the database using JDBC.
2. To understand the networking components to transfer data over networks.
3. To develop web application based on Java uses Servlet, JSP
4. To design applications using pre-built frameworks.

Course Prerequisites:

1. Experience in any of the Object Oriented Programming language
2. Basic understanding of the Java language
3. Basic knowledge on SQL

Course Outcomes (COs):

At the end of the Course, the student will be able to -

CO1: Understand swing components and its usage.

CO2: Implement Networking and Data base connectivity in Java for given application.

CO3: Implement webpage with dynamic content and server side web application using Servlet and JSP.

CO4: Develop Java application using spring framework.

Course Outline **Total** **(60 HOURS)**

Unit I-Applets & Event Handling: **(12 HOURS)**

Applets - Applet Basics, Methods of Building an Applet, Some General Methods of Applet , Displaying Text in Status Bar, Embedding Applet Information, The HTML Applet Tag , Reading Parameters into Applets , Colors in Applet, Getting Document base and Codebase, Interfaces in Applet, Multimedia in Applet **Event Handling**- Model, Event, Event Listeners, Registering Listener with Source, Example programs, Adapter Classes.

Unit II – Swing and GUI Components: **(12 HOURS)**

Swing - Origin of Swing, Creating Windows in Swing, JFrame,Jbutton, JLabel, JToggleButton, JCheckBox, JRadioButton, JList, JScrollBar, JScrollPane, JTextField, JPasswordField, JTextArea, JComboBox, JMenuItem, JMenu, JMenuBar, JDialog, JOptionpane, JFileCheck, JProgressBar, Layout Manager.

Unit III- Networking: **(8 HOURS)**

Networking - InetAddress, Socket Programming, Datagram, URL.

Unit IV- JDBC: **(12 HOURS)**

JDBC- Introduction, Driver Manager, Connection Interface, Statement Interface, Prepared Statement Interface, Callable Statement Interface, Result Set Interface.

Unit V - Servlet & JSP: **(16 HOURS)**

Servlet – Introduction, HTML, Interface Servlet, HttpServlet Class, Servlet Programs, Servelet with I/O Files, Servelet with JDBC, Session Handling, Session Tracking. **JSP** – Introduction, JSP Working Model, Syntax of a JSP Page with Sample Programs.

Mapping of COs to POs and PSOs

Course Outcome	PO Addressed	Correlation Level	PSO Addressed		Correlation Level		Cognitive Level
CO1	PO2	H	PSO1	PSO4	M	H	K_1
CO2	PO3	H	PSO2		H		K_6
CO3	PO3	H	PSO4		H		K_6
CO4	PO2	H	PSO2		H		K_3

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 - Analyze, K_5–Evaluate, K_6 – Create**)**

Text and Reference Books

1. Advanced Programming in Java2, K. Somasundaram, Jaico publishing Company Limited, New Delhi, 2008.
2. Herbert Scheldt, Java 2-The complete reference, 7th Edition McGraw Hill, 2018.
3. Naughton and Herbert Schildt, Java The complete reference, 7th Edition McGraw Hill, 2007.
4. Jim Keogh, The Complete Reference J2EE, Tata McGraw Hill Edition, New Delhi, 2002.
5. Marty Hall, and Larry Brown, Core Servlets and Java Server Pages, 2nd Edition, Pearson Education, 2004.

E-Resources:

1. Advanced Programming in Java2, https://www.researchgate.net/publication/315894230_Advanced_Programming_in_Java2
2. JDBC, Java Database Connectivity, K.Somasundaram, Jaico Publishing House, Mumbai, India, First Edition, 2013.
3. JDBC Connectivity in Java JDK16, June 2021, DOI: 10.13140/RG.2.2.19415.60325 https://www.researchgate.net/publication/352172393_JDBC_Connectivity_in_Java_JDK16

4. Installing Eclipse 2019-12-R and Tomcat 9.0 and Develop a Servlet, June 2021, DOI: 10.13140/RG.2.2.12123.08487
https://www.researchgate.net/publication/352785295_Installing_Eclipse_2019-12-R_and_Tomcat_90_and_Develop_a_Servlet
5. JSP, Java Server Pages, In book: Server Side Programming Chapter: Chapter 25,K.Somasundaram, 2012, DOI: 10.13140/2.1.1715.9365
6. Java Server Pages
https://www.researchgate.net/publication/268076772_Java_Server_Pages

CORE - 3 MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE

[C L T P 4 3 1 0]

Course Objectives:

- To introduce the concepts of sets and perform associated operations on them.
- To introduce the concepts of mathematical logic.
- To provide basic understanding on abstract algebraic structures
- To construct graphs, automata and discuss its applications
- To understand queuing systems and their classifications

Course Prerequisites:

- Basic Knowledge in Mathematics
- Knowledge of the fundamental concepts in the undergraduate level

Course Outcomes (COs):

After the completion of this course, student will be able to

CO1: Evaluate the validity of logical arguments and construct mathematical proofs

CO2: administer all the basic operations with sets

CO3: understand abstract algebraic structure like groups and their properties

CO4: Analyze whether given graphs are isomorphic and apply different algorithms to find the shortest path Apply Mathematical techniques into many areas of Computer science like Algorithms, Computer Networks, and Cryptography etc.

CO5: Apply Mathematical techniques into many areas of Computer science like Algorithms, Computer Networks, and Cryptography etc.

Course Outline **(Total 60 HOURS)**

UNIT-1 **(12 HOURS)**

Mathematical Logic: Introduction-Statements and Notation-Connectives-Normal Forms-The Theory of Inference for the Statement calculus –The Predicate Calculus-Inference theory of the Predicate Calculus

UNIT – II **(12 HOURS)**

Set Theory: Introduction – Basic concepts of Set theory-Relations-Functions.

UNIT – III **(12 HOURS)**

Matrices: Rank of Matrix, Solving System of Equations, Eigen values and Eigen Vectors-Inverse of matrix- Cayley Hamilton Theorem.

UNIT – IV **(12 HOURS)**

Graph Theory: Introduction-Graphs-Application of Graphs-Finite and Infinite Graphs-Incidence and Degree-Isolated Vertex, Pendant Vertex and Null Graph Paths and Circuits: Isomorphism-Sub graphs - Walks, Paths and Circuits-Connected and Disconnected graphs-Components-Euler Graphs-Operation on Graphs -Hamiltonian paths and circuits- Travelling Salesman Problem

UNIT – V **(12 HOURS)**

Trees and Fundamental Circuits: Properties of Trees-Pendant vertices in trees-Distance and centers in a Tree-Rooted and Binary Tree-Spanning Tree-Fundamental circuits—Spanning Tree in the Weighted Graph. Matrix Representation of Graphs: Incidence Matrix-Sub matrices-Circuit Matrix-Path matrix-Adjacency Matrix

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO7		**Correlation Level** L/ M/ H		**Cognitive Level** K_1 to K_6
CO1	PO1		H		PSO6		H		K_4
CO2	PO1		H		PSO6		M		K_3
CO3	PO1		H		PSO1		H		K_2
CO4	PO4		M		PSO4		H		K_4
CO5	PO2	PO6	M	H	PSO2	PSO3	M	H	K_3

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create**)**

Text and Reference books

1. J.P. Trembley and R.Manokar, —Discrete Mathematical Structureswith Applications to Computer Science, Tata McGraw Hill Publications, 2017.
2. NarasinghDeo, — Graph Theory with Applications to Engineering and Computer Science‖, Prentice-Hall of India Private Limited, 2017.
3. Kenneth H. Rosen — Discrete Mathematics and Its Applications with Combinatorics and Graph Theory (SIE) | 7th Edition, Tata McGraw Hill Publications, 2017.

CORE - 4 COMPILER DESIGN [C L T P 4 3 1 0]

Course Objectives:

1. To learn the various phases of compiler
2. To learn the parsing techniques
3. To understand intermediate code generator and runtime environment
4. To learn to implement front end of the compiler
5. To learn the implement code generator

Course Prerequisite:

Basic Knowledge of mathematics and data structure

Course Outcome

C01: Understand the different phases of compiler.
C02: Design a lexical analyzer for a sample language.
C03: Apply different parsing algorithms to develop the parsers for a given Grammar.
C04: Understand syntax-directed translation and run-time environment.
C05: Learn to implement code optimization techniques and a simple code Generator.
C06: Design and implement a scanner and a parser using LEX and YACC tools.

Course Outline: **(Total 60 HOURS)**

UNIT-I LEXICAL ANALYSIS (12 HOURS)

Introduction to Compiling: Language Processors, The Structure of a Compiler. Lexical Analysis: The role of the lexical analyzer - Input buffering Specification of tokens - Recognition of tokens – The Lexical Analyzer Generator Lex - Finite automata - Regular expression to finite automata – Design of Lexical Analyzer Generator - Optimization of DFA - based pattern matchers.

UNIT – II SYNTAX ANALYSIS (12 HOURS)

Syntax Analysis: The role of the parser - Context-free grammars - Writing a grammar - Top down Parsing - Bottom-up Parsing - LR parsers- Parser Generators. Run time environment: Storage Organization – Static Allocation of space.

UNIT – III INTERMEDIATE CODE GENERATION (12 HOURS)

Intermediate Code Generation: Variants of Syntax trees – Three Address code – Types and Declarations - Translation of Expressions – Type checking - Control flow - Back patching - Switch Statements – Intermediate Code for Procedure

UNIT – IV CODE GENERATION (12 HOURS)

Code Generation: Issues in the design of a code generator - The target language – Address in the Target Code – Basic Block and Flow graphs – Optimization of Basic Blocks - A simple code generator – Peephole Optimization.

UNIT – V OPTIMIZATION TECHNIQUES (12 HOURS)

Machine Independent Optimizations: The Principal Sources of Optimization - Introduction to Data Flow analysis – Foundations of data flow analysis – Partial Redundancy Elimination - Loops in flow graph

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO8		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO7		**Correlation Level** L/ M/ H		**Cognitive Level** K_1 to K_6
CO1	PO1		M		PSO1		L		K_1
CO2	PO1	PO2	L	M	PSO1	PSO3	M	H	K_2
CO3	PO5	PO1	H	M	PSO1	PSO4	H	H	K_3
CO4	PO2	PO4	H	M	PSO1		M		K_4
CO5	PO4		H		PSO5		H		K_5
CO6	PO6	PO7	H	H	PSO6		H		K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create**)**

Text and Reference books

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi and Jeffrey D. Ullman, “Compilers-Principles, Techniques,and Tools”, Second Edition, Pearson Education Asia, 2014.
2. KennathC.Louden, Compiler Construction Principles and Practice, Vikas publishing House, 2004.
3. Terence Halsey, Compiler Design Principles, Techniques and Tools, Larsen and Keller Education, 2018
4. Sudha Rani S, Karthi M., Raj Kumar Y - Compiler Design, Wiley 2019.
5. Adesh K Pandey, “Concepts of Compiler Design”, Katson, 2013.

CORE - 5 DISTRIBUTED OPERATING SYSTEM [C L T P 4 3 1 0]

Course Objectives:

To make the students to realize the importance of the operating system in the computing domain.

Emphasis would be to provide the knowledge of communication, synchronization, resource management and security aspect in distributed operating system

Explicitly define and intuitively describe why operating systems virtualize hardware and how the operating system makes it possible for many applications to share resources and to make programming easier for user space applications

Configure a Linux-based operating system and work from the shell

Understand the procedures to manage files and directories in the Linux operating system

Develop and debug systems software

Course Prerequisites:

Knowledge of computer systems organization

Course Outcomes (COs):

After the completion of this course, student will be able to

CO1: Gain knowledge about the history of the Linux operating system, its unique licensing model and the major distributions that are available to use

CO2: start and stop services from running in the Linux operating systems.

CO3: Implement process scheduling algorithms

CO4: Learn to manage files and directories in the Linux operating system

CO5: To use the Linux environment for problem solving

Course Outline: **(Total 60 HOURS)**

UNIT-1 **(12 HOURS)**

Fundamentals: What is Distributed Operating System – Evolution of Distributed Computing System – Distributed Computing System Models – Why are Distributed Computing Systems gaining popularity – What is a Distributed Computing System – Issues in Designing Distributed Computing System – Introduction to Distributed Computing Environment. Introduction to Computer Networks – Network types – LAN –WAN – Communication protocols – Internetworking – ATM Technology

UNIT – II **(12 HOURS)**

Message Passing: Introduction Desirable features – Issues in PC Message Passing – Synchronization – Buffering – Multi datagram Messages – Encoding and Decoding – Process Addressing – Failure Handling – Group Communication

UNIT – III **(12 HOURS)**

Remote Procedure Calls : RPC models – Transparency of RPC–Stub generation–RPC messages–Marshaling arguments and results–Exception Handling–Lightweight RPC; Distributed Shared Memory: Introduction – General Architecture of DSM system – Design and Implementation Issues of DSM – Granularity – Structure of Shared Memory – Consistency Models – Replacement Strategy – Thrashing.

UNIT – IV **(12 HOURS)**

Synchronization: Introduction – Clock Synchronization – Event Ordering – Mutual Exclusion – Deadlock – Election Algorithm–Process Management: Introduction-Process Migration– Threads.

UNIT – V **(12 HOURS)**

Distributed File System: Introduction – Desirable features – File Models – File Accessing Models – File Sharing Semantics – File Caching Schemes – File Replication – Fault Tolerance – Atomic Transactions – Design Principles.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7		**Correlation Level** L/ M/ H		**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1		H		K_1
CO2	PO1	M	PSO1		M		K_2
CO3	PO2	H	PSO2	PSO4	H	M	K_3
CO4	PO4	H	PSO6		H		K_4
CO5	PO6	M	PSO3	PSO5	H	M	K_5

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create**)**

Text and Reference books

1. Pradeep K Sinha, —Distributed Operating Systems – Concepts and Design‖, PHI, 2016
2. Andrew S Tanenbaum , —Distributed Operating Systems‖, First Edition, PHI.2017
3. Abraham Silberchalz Peter B. Galvin, G.Gagne, —Operating Systems Concepts‖,Ninth edition, Addision Wesley Publishing Co., 2018.
4. Coulouris George, Dollimore Jean, Blair Gordon–Distributed systems- concepts and design Pearson 2017.

CORE - 6 ALGORITHM LAB (USE C++/JAVA) [C L T P 2 0 0 4]

Course Objectives:

Implement algorithms using popularly used strategies like greedy, divide and conquer, dynamic programming etc.

Course Prerequisites:

Exposure to introductory course on programming languages
Some Basic Mathematics

Course Outcomes (COs):

At the end of the Course, the student will be able to –

CO: Implement algorithms for solving real-time problems

Course Outline:

(Model List only, please add more algorithms based programmes)

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n.
2. Sort a given set of elements using merge sort method and determine the time required to sort the elements. Repeat the experiment for different of values of n.
3. Write a program to obtain the topological ordering of vertices in a given digraph.
4. Implement travelling salesman problem.
5. Implement the knapsack problem (0/1).
6. Print all the nodes reachable from a given starting node in a digraph using BFS method.
7. Check whether a given graph is connected or not using DFS method.
8. Write a program to implement binary search using divide and conquer technique
9. Write a program to implement insertion sort using decrease and conquer technique
10. Find minimum cost spanning tree of a given undirected path using a Prim's algorithm.
11. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed**PO1 to PO7				**Correlation Level/** M/H				**PSO Addressed** PSO1 to PSO7				**Correlation Level** /M/ H				**Cognitive Level** K_1 to K_6
CO	PO1	PO2	PO3	PO4	L	H	M	M	PSO1	PSO3	PSO6	PSO6	M	H	M	M	K_4,K_5, K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

CORE - 7 ADVANCED JAVA LAB [C L T P 2 0 0 4]

Course Objectives:

1. To design stand-alone desktop-oriented GUI based Java applications using Swing and access the database using JDBC.
2. To understand the networking components to transfer data over networks.
3. To develop web application based on Java uses Servlet, JSP
4. To design applications using pre-built frameworks.

Course Prerequisites :(Specify a minimum of 3 for each course)

1. Experience in any of the Object Oriented Programming language
2. Basic understanding of the Java language
3. Basic knowledge on SQL

Course Outcomes (COs):

At the end of the Course, the student will be able to

CO1: Understand swing components and its usage.

CO2: Implement Networking and Data base connectivity in Java for given application.

CO3: Implement webpage with dynamic content and server side web application using Servlet and JSP.

CO4: Develop Java application using spring framework.

Course Outline:

(This is a model List only, please add more programs)

1. Write a Program in Java to implement Calculator using Swing technology
2. Write a Program that displays two textboxes for entering a students' Roll-no and Name with appropriate labels and buttons
3. Write a Java program that makes a connection with database using JDBC and prints metadata of this connection
4. Include the database connectivity to insert, update, delete and display of student information and display it
5. Write a java program for one way TCP communication for server and client, where server will response to client with current data and time.
6. Write a java program for two way TCP communication for server and client. It should look like a simple chat application
7. Write a java program for UDP Communication where client will send name of

country and server will return the capital of that country

8. Create a simple calculator application that demonstrates the use of RMI. You are not required to create GUI.
9. Create Servlet That Prints Hello World.
10. Create Servlet That Prints Today's Date
11. Create Servlet for login page, if the username and password is correct then prints message "Hello username" else a message"login failed".
12. Create Servlet that uses cookies to store the number of times a user has visited the servlet
13. Create a Servlet for demo of KBC game. There will be continuous two or three pages with different MCQs. Each correct answer carries Rs. 10000. At the end as per user's selection of answers total prize he won should be declared. User should not be allowed to backtrack.
14. Create a Servlet that implements ServletContextAttributeListener interface such that a message dialog is displaued whenever an attribute is added or removed or replaced.
15. Create a Servlet filter that calculates server's response time and add it to response when giving it back to client.
16. Create a jsp that prints hello world.
17. Create jsp that prints current date and time.
18. Create a jsp that add and subtract two numbers.
19. Create a jsp for login module.
20. Create a web page that prints 1 to 10 using JSTL.
21. Create a custom JSP tag that prints current date and time. Use this tag into JSP page.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed**	**Correlation Level**	**PSO Addressed**		**Correlation Level**		**Cognitive Level**
CO1	PO2	H	PSO1	PSO4	M	H	K_1
CO2	PO3	H	PSO2		H		K6
CO3	PO3	H	PSO4		H		K6
CO4	PO2	H	PSO2		H		K3

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

SEMESTER II					
Semester **(1)**	**Course No.** **(2)**	**Course Type** **(3)**	**Course Name** **(4)**	**Contact Hrs./ Week (5)**	**Credits** **(6)**
II	8	Core- 8	Advanced Web Technology	5	4
	9	Core- 9	Machine Learning	5	4
	10	Core- 10	Advanced DBMS	4	4
	11	Core- 11	Cryptography and Network Security	4	4
	12	Elective– 1 (Select any one)	1.Free open source Software 2.Data Mining 3.Data Science and Big Data Analytics	4	3
	13	Core - 12 Practical - 3	Advanced Web Technology Lab	4	2
	14	Core - 13 Practical - 4	Machine Learning Lab using Python	4	2
			Subtotal	**30**	**23**

Core – 8 ADVANCED WEB TECHNOLOGY [C L T P 4 4 1 0]

Course Objectives:

- Explore the backbone of webpage creation by developing .NET skill.
- Enrich knowledge about HTML control and web control classes
- Provide in-depth knowledge about ADO.NET
- Understand the need of usability, evaluation methods for web services

Course Outcomes

CO1: Design a webpage with Web form fundamentals and web control classes

CO2: Recognize the importance of validation control, cookies and session

CO3: Apply the knowledge of ASP.NET object, ADO.NET data access and SQL to develop a client server model.

CO4: Recognize the difference between Data list and Data grid controls in accessing data

(Total 60 HOURS)

UNIT1: OVERVIEW (12 HOURS)

OVERVIEW OF ASP.NET - The .NET framework – Learning the .NET languages Data types – Declaring variables- Scope and Accessibility- Variable operations- Object Based manipulation- Conditional Structures- Loop Structures- Functions and Subroutines. Types, Objects and Namespaces: The Basics about Classes- Value types and Reference types - Advanced class programming-Understanding name spaces and assemblies. Setting Up ASP.NET and IIS

UNIT-II APPLICATIONS (12 HOURS)

Developing ASP.NET Applications - ASP.NET Applications: ASP.NET applications – Code behind- The Global.Asax application file – Understanding ASP.NET Classes-ASP.NET Configuration. Web Form fundamentals: A simple page applet-Improving the currency converter-HTML control classes-The page class – Accessing HTML server controls. Web controls: Web Control Classes – AutoPostBack and Web Control events –Accessing web controls. Using Visual Studio.NET: Starting a Visual Studio.NET Project - Web form Designer-Writing code - Visualstudio.NET debugging. Validation and Rich Controls: Validation – A simple Validation example – Understanding regular expressions - A validated customer forms. State management - Tracing, Logging, and Error Handling.

UNIT–III WORKINGWITHDATA (12 HOURS)

Working with Data - Overview of ADO.NET - ADO.NET and data management- Characteristics of ADO.NET-ADO.NET object model. ADO.NET data access: SQL basics– Select, Update, Insert, and Delete statements-Accessing data- Creating a connection-Using a command with a DataReader - Accessing Disconnected data - Selecting multiple tables – Updating Disconnected data. Data binding: Single value Data Binding- Repeated value data binding- Data binding with data bases. Datalist –Data grid–Repeater –Files, Streams and Email –Using XML

UNIT-IV WEBSERVICES (12 HOURS)

Web Services - Web services Architecture: Internet programming then and now- WSDL–SOAP-Communicating with a web service-Web service discovery and UDDI. Creating Web services: Web service basics- The Stock Quote web service – Documenting the web service- Testing the web service – Web service Data types - ASP.NET intrinsic objects .Using web services: Consuming a web service- Using the proxy class-An example with Terra Service.

UNIT–V ADVANCEDASP.NET (12 HOURS)

AdvancedASP.NET-Component Based Programming: Creating a simple component–Properties and state- Database components- Using COM components. Custom controls: User Controls-Deriving Custom controls. Caching and Performance Tuning: Designing and scalability–Profiling-Catching-Output catching- Data catching. Implementing security: Determining security requirements-TheASP.NET security model – Forms authentication-Windows authentication.

CO mapped with PO and PSO

Course Outcome	PO Addressed		Correlation Level		PSO Addressed		Correlation Level		Cognitive Level
CO1	PO1		H		PSO5		H		K_1, K_2
CO2	PO2	PO3	H	H	PSO5	PSO6	H	H	K6
CO3	PO2	PO3	H	H	PSO3	PSO4	H	H	K6
CO4	PO4	PO5	H	H	PSO4	PSO6	H	H	K_3

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create

Text and Reference Books

1. MathewMacDonald,“ASP.NETCompleteReference”,TMH2005.
2. Crouch Matt J,“ASP.NET and VB.NET Web Programming”, Addison Wesley2002.
3. J.Liberty,D.Hurwitz,“ProgrammingASP.NET”,ThirdEdition,O’REILLY,2006.

Core – 9 MACHINE LEARNING [C L T P 4 4 1 0]

Course Objectives:

- To Learn about Machine Intelligence and Machine Learning applications
- To implement and apply machine learning algorithms to real- world applications.
- To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems.
- To understand how to perform evaluation of learning algorithms and model selection.

Course Outcomes

CO1: Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.

CO2: Have an understanding of the strengths and weaknesses of many popular machine learning approaches.

CO3: Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

CO4: Have an understanding of the strengths and weaknesses of many popular machine learning approaches.

CO5: Be able to design and implement various machine learning algorithms in a range of real- world applications.

Course Outline **(Total 60 HOURS)**

UNIT -1 INTRODUCTION (12 HOURS)

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Linear Discriminants – Perceptron – Linear Separability– Linear Regression.

UNIT - II LINEAR MODELS (12 HOURS)

Multi-layer Perception – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perception in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Spines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines

UNIT– III TREE AND PROBABILISTIC MODELS (12 HOURS)

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms –

Vector Quantization – Self Organizing Feature Map

UNIT- IV DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS (12 HOURS)

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

UNIT – V GRAPHICAL MODELS (12 HOURS)

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

Mapping of COs, POs and PSOs*:*

Course Outcome	**PO Addressed** PO1 to PO7			**Correlation Level** L/M/H			**PSO Addressed** PSO1 to PSO7			**Correlation Level** L/ M/ H			**Cognitive Level** K_1 to K_6
CO1	PO1			H			PSO1			H			K_1
CO2	PO2			M			PSO1	PSO2		H	H		K_2
CO3	PO3			H			PSO3	PSO4		H	H		K_3
CO4	PO3	PO4	PO7	M	M	M	PSO5			H			K_4
CO5	PO5	PO6	PO7	H	H	H	PSO2	PSO3	PSO5	M	M	M	K_5, K_6

*(*L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

Text and Reference books

1. Stephen Marsland, —Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, —Machine Learning‖, First Edition, McGraw Hill Education, 2013.

Core – 10 ADVANCED DBMS [C L T P 4 3 1 0]

Course Objectives:

- Acquire broad understanding of database concepts and database management system software and Emerging Trends in it.
- Learn the method of handling distributed and object databases.

Course Outcomes

CO1: Recognize the importance of Various Data models and Architecture

CO2: Analyze and Design the normalized database schema

CO3: Decide the database for his problem

CO4: Develop database solutions

CO5: Write database queries in SQL, PL SQL and NoSQL

Course Outline **(Total 60 HOURS)**

UNIT -1 (12 HOURS)

Database design and the ER model: Overview – The Entity-Relationship model – Constraints – Removing Redundant Attributes in Entity Sets – Entity Relationship Diagrams-Reduction to relational schemas – Entity Relationship Design Issues – Extended E-R Features. Relational Database Design: Features of good relational Design – Atomic Domains–1NF to 5NF – Denormalization.

UNIT - II (12 HOURS)

Indexing and Hashing: Basic Concepts – Ordered Indices – B + Tree Index Files – B + Tree Extensions – Multiple Key Access – Static Hashing – Dynamic Hashing – Comparison of Ordered Indexing and Hashing – Bitmap Indices. Transactions: Transaction Concept – A simple Transaction model – Storage Structure – Transaction Atomicity and Durability – Transaction Isolation – Serializability.

UNIT– III (12 HOURS)

Concurrency Control: Lock based Protocols – Deadlock Handling – Multiple Granularity – Timestamp Based Protocols – Validation Based Protocols – Multiversion Schemes – Snapshot Isolation – Insert Operations, Delete Operations and Predicate Reads. Recovery Systems: Failure

Classification – Storage – Recovery and Atomicity – Recovery Algorithm – Buffer Management.

UNIT- IV (12 HOURS)

Database System Architecture: Centralized and Client Server Architectures – Server System Architectures – Parallel Systems – Distributed Systems. Parallel Databases: Introduction – I/O parallelism – Inter-query parallelism – Intra-query parallelism – Intra-operation parallelism – Interoperation parallelism – Query Optimization. Distributed Databases: Homogeneous and Heterogeneous Databases – Distributed Data Storage – Distributed Transactions.

UNIT – V (12 HOURS)

Object-Based Databases: Complex Data Types, Structured Types and Inheritance, Table Inheritance, array and Multi-set, Object Identity and Reference Types, Object Oriented versus Object Relational. XML: Motivation-Structure of XML Data- XML document schema-Querying and transformation- Application Program Interfaces to XML –Storage of XML Data- XML Application.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	M	K_2
CO2	PO5	H	PSO1	H	K_4
CO3	PO1	H	PSO2	M	K_4
CO4	PO2	H	PSO1	H	K_3
CO5	PO1	H	PSO1, PSO4	H, M	K_2

(L – Low, M – Medium, H – High); K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create

Text and Reference books

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, — “Database System Concepts”, Sixth Edition, McGrawHill International Edition, 2011.
2. C.J.Date, — “Introduction to Database Systems”, 8th Edition, Pearson Education, 2003.
3. Kogent Learning Solutions "Database Management Systems applications" Dreamtech Press, 2014

Core – 11 CRYPTOGRAPHY AND NETWORK SECURITY [C L T P 4 3 1 0]

Course Objectives:

- To understand security design principles
- To learn secure programming techniques
- To understand the mathematics behind cryptography
- To know the standard algorithms used to provide confidentiality, integrity and authenticity
- To understand the security requirements in operating systems and databases
- To learn about the security applications in wireless environment.

Course Outcomes:

CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities

CO2: Apply the different cryptographic operations of symmetric/asymmetric cryptographic algorithms.

CO3: Analyze various authentication protocols and apply them in real time.

CO4: Analyze the security threats and study the various countermeasures.

CO5: Identify the applications of network security in various fields.

CO6: Design and Develop a security model.

Course Outline **(Total 60 hours)**

UNIT-1 (12 HOURS)

Introduction-Security trends–The OSI security architecture– Security attacks, services and mechanisms– A Model of network security-Security Goals- Cryptographic Attacks—Classical encryption techniques: Symmetric cipher Model-substitution-transposition - steganography-Block cipher and the DES: Block cipher Principles – DES - The strength of DES- Differential and Linear Crypt Analysis-Block Cipher Design Principles.

UNIT – II (12 HOURS)

Advanced Encryption Standard- AES Cipher-More on Symmetric Ciphers: Block Cipher modes of operation-Stream Cipher and RC4.Public-Key Encryption and Hash Function: Prime Numbers-Testing for Primality - The Chinese remainder theorem-Public-Key Cryptography and RSA: Principles of Public Key Cryptosystem- The RSA Algorithm-Key Management -Diffie-Hellman Key Exchange- Message Authentication and Hash Function: Authentication Function – Message Authentication Codes-Hash function – HMAC – CMAC - Digital Signature-Authentication Protocol.

UNIT – III (12 HOURS)

Authentication Applications – Kerberos-x.509AuthenticationService-Public-KeyInfrastructure-Secret Key Algorithm-Security at the Application Layer: Electronic Mail Security-Pretty Good Privacy (PGP)- S/MIME.

UNIT – IV (12 HOURS)

IPSecurity - IPSecurity – Overview - IPSecurity - Architecture,-Authentication-Header-Encapsulating Security Payload- Combining Security Associations. Web Security: Web Security Considerations-Secure Socket Layer (SSL) and Transport Layer Security (TLS)- Secure Electronic Transaction (SET).Network Management Security :Basic Concepts of SNMP, SNMPv1, SNMPv3, VPN.

UNIT – V (12 HOURS)

System Security: Intruders - Intruders, Intrusion Detection- Password Management-Malware. Malicious Software: Viruses and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks. Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for information technology Security Evaluation. Legal and Ethical Issues in Computer Security: Protecting Programs Data-Information and the Law-Redress for Software failures-Selling Correct Software Flaws.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	H	K_1,K_2
CO2	PO2 PO3	M M	PSO2	M	K_3
CO3	PO4 PO7	M M	PSO2, PSO3 PSO4	M M M	K_4,K_5
CO4	PO4 PO5 PO7	M M M	PSO2, PSO3 PSO4	M M M	K_4,K_5
CO5	PO5 PO7	M M	PSO4 PSO5 PSO6	H H H	K_5
CO6	PO2, PO5 PO6	M M M	PSO4, PSO5 PSO6 PSO7	M M M M	K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

Text and Reference books

1. Stallings William, “Cryptographyand Network Security - Principles and Practice 2017.
2. Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata McGraw Hill, 2007, Reprint 2015.
3. Charless P. Pfleeger, Shari Lawrence Pfleeger, “ Security in Computing”, Fourth

Edition, 2007

4. Young Man Rhee, “Internet Security: Cryptographic Principles, Algorithms and Protocols”, Wiley Publications, 2003.
5. William Stallings, “Network Security Essentials Applications and Standards” Third Edition, Pearson Education, 2008.
6. Charles Pfleeger, “Security In Computing”, 4th Edition, Prentice Hall Of India, 2006.
7. Ulysess Black, “Internet Security Protocols”, Pearson Education Asia, 2000.
8. Charlie Kaufman and Radia Perlman, Mike Speciner, “Network Security, Second Edition, Private Communication in Public World”, PHI2002.
9. Bruce Schneier And Neils Ferguson, “Practical Cryptography”, First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
10. Douglas R Simson “Cryptography – Theory and Practice”, First Edition, CRC Press, 1995.

Elective 1- (a) FREE OPEN SOURCE SOFTWARE [C L T P 3 4 1 0]

Course Objectives:

- To familiarize fundamentals of the shell programming, pipes, input and output redirection Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts.
- To impart fundamentals of file concepts kernel support for file, File structure related system calls (file API's).
- To teach principles of operating system including File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking Commands, Basic Linux commands, Scripts and filters.
- To know the basics of algorithmic problem solving
- To read and write simple Python programs. To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries

Course Outcomes

CO1 Ability to use various Linux commands that are used to manipulate system operations at admin level and a prerequisite to pursue job as a Network administrator.

CO2 Ability to write Shell Programming using Linux commands.

CO3 Ability to design and write application to manipulate internal kernel level Linux File System.

CO4 Develop algorithmic solutions to simple computational problems Read, write, execute by hand simple Python programs.

CO5 Structure simple Python programs for solving problems.

CO6 Decompose a Python program into functions

Course Outline **(Total 45 hours)**

UNIT 1: INTRODUCTION TO LINUX AND LINUX UTILITIES **(9 hours)**

A brief history of LINUX - architecture of LINUX - features of LINUX - introduction to vi editor – Basic Linux commands- File handling utilities - Security by file permissions - process utilities - disk utilities - networking commands -Text Processing utilities and backup utilities.

UNIT - II INTRODUCTION TO SHELLS **(9 hours)**

Linux Session - Standard Streams- Redirection – Pipes - Tee Command - Command Execution –

Command Line Editing - Quotes - Command Substitution - Job Control – Aliases - Variables - Predefined Variables – Options - Shell/Environment Customization - Filters: Filters and Pipes - Concatenating files - Display Beginning and End of files - Cut and Paste – Sorting - Translating Characters - Files with Duplicate Lines - Count Characters - Words or Lines - Comparing Files.

UNIT III – ALGORITHMIC PROBLEM SOLVING IN PYTHON (9 hours)

Algorithms, building blocks of algorithms (statements, state, control flow, functions) - notation (pseudo code, flow chart, programming language), algorithmic problem solving - simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list-insert a card in a list of sorted cards - guess an integer number in a range - Towers of Hanoi.

UNIT IV- EXPRESSION, STATEMENTS AND CONTROL STRUCTURES (9 hours)

Python interpreter and interactive mode - values and types - int, float, Boolean, string, and list; variables – expressions – statements - tuple assignment - precedence of operators - comments; modules and functions - function definition and use - flow of execution - parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables. Conditionals: Boolean values and operators - conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass.

UNIT V- FUNCTIONS (9 hours)

Fruitful functions: return values – parameters - local and global scope - function composition - recursion; Strings: string slices - immutability - string functions and methods - string module - Lists as arrays - Illustrative programs: square root, gcd, and exponentiation, sum an array of numbers, linear search, binary search. Files**,** Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	H	K_1, K_2
CO2	PO2 PO3	M M	PSO2	M	K_3
CO3	PO4 PO7	M M	PSO2, PSO3 PSO4	M M M	K_4, K_5
CO4	PO4 PO5 PO7	M M M	PSO2, PSO3 PSO4	M M M	K_4, K_5
CO5	PO5 PO7	M M	PSO4 PSO5 PSO6	H H H	K_5
CO6	PO2, PO5 PO6	M M M	PSO4, PSO5 PSO6 PSO7	M M M M	K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

Text and Reference books

- W. Richard. Stevens (2005), Advanced Programming in the UNIX Environment, 3rd edition, Pearson Education, New Delhi, India.
- Unix and shell Programming Behrouz A. Forouzan, Richard F. Gilberg.Thomson
- Allen B. Downey, "Think Python: How to Think like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
- Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
- Charles Dier bach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
- Gowri shankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

Elective 1- (b) DATA MINING [C L T P 3 4 1 0]

Course Objectives:

- Examine the types of the data to be mined.
- Explore and understand data mining algorithms.

Course Outcomes:

CO1: To evaluate various mining techniques on complex data objects

CO2: To develop applications using Data Mining Tools.

CO3: To develop ability to design various algorithms based on data mining tools.

CO4: To develop further interest in research and design of new Data Mining techniques

Course Outline (Total 45 hours)

UNIT-1 (9 hours)

Data Mining and Data Preprocessing: Data Mining – Motivation – Definition – Data Mining on what Kind of Data –Functionalities – Classification – Data Mining Task Primitives – Major Issues in Data Mining .Data Preprocessing – Definition – Data Cleaning – Integration - Transformation – Data Reduction.

UNIT – II (9 hours)

Data Warehousing: Definition -Data Warehouse Architecture- Multidimensional Data Model. Frequent Patterns, Associations: Market basket analysis - Association Rule, Support and Confidence - apriori algorithm - Generating association rule from frequent itemset - Mining frequent item sets without candidate generation (FP- growth) - Overview of multilevel association rule - Multidimensional association rule- - closed item set - maximal item set.

UNIT – III (9 hours)

Definition of Classification and Prediction – Classification by Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Lazy Learners – K-Nearest Neighbor – Other Classification Methods.

UNIT – IV (9 hours)

Cluster Analysis: Definition – Types of data in Cluster Analysis – Categorization of major Clustering Techniques – Partitioning Methods – Hierarchical Clustering – BIRCH - ROCK – Grid Based Methods – Model Based Clustering Methods – Outlier Analysis.

UNIT – V (9 hours)

Spatial, Multimedia, Text and Web Data: Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web – Data Mining Applications – Trends in Data Mining. Data mining tool – Orange Tool.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	H	K_1,K_2
CO2	PO2 PO3	M M	PSO2	M	K_3
CO3	PO4 PO7	M M	PSO2, PSO3 PSO4	M M M	K_4,K_5
CO4	PO4 PO5 PO7	M M M	PSO2, PSO3 PSO4	M M M	K_4,K_5

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create)

Text and Reference books

1. Jiawei Han and Micheline Kambar, — "Data Mining Concepts and Technique:", Second Edition, Elsevier, Reprinted 2008.
2. Marget H. Dunham, — "Data Mining Introductory and Advanced Concepts" Pearson Education 2003.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, - "Introduction to Data Mining", Pearson Education, 2007.
4. G.K. Gupta, - "Introduction to Data Mining with Case Studies", 3rd Edition, PHI, 2015.
5. http://www.celta.paris-sorbonne.fr/anasem/papers/miscelanea/InteractiveDataMining.pdf

Elective 1- (c) DATA SCIENCE & BIG DATA ANALYTICS [C L T P 3 3 1 0]

Course Objectives:

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

Course Outcomes:

CO1: Work with big data tools and its analysis techniques

CO2: Design efficient algorithms for mining the data from large volumes

CO3: Design an efficient recommendation system

CO4: Design the tools for visualization

CO5: Learn NoSQL databases and management.

Course Outline: ***total 45 hours***

UNIT-1 INTRODUCTION (9 hours)

Introduction to Big Data Analytics : Big Data Overview – Data Structures – Analyst Perspective on Data Repositories - State of the Practice in Analytics – BI Versus Data Science - Current Analytical Architecture – Drivers of Big Data – Big Data Ecosystem - Data Analytics Lifecycle – Data Discovery – Data Preparation – Model Planning – Model Building – Communicate Results – Operationalize.

UNIT – II DATA ANALYTIC METHODS (9 hours)

Basic Data Analytic Methods Using R : Introduction to R programming – R Graphical User Interfaces – Data Import and Export Attribute and Data Types – Descriptive Statistics Exploratory Data Analysis : Visualization Befor Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables Data Exploration Versus Presentation -– Statistical Methods of Evaluation : Hypothesis Testing – Difference of Means – Wilcoxon Rank-Sum Test – Type I and Type II Errors – Power and Sample Size – ANOVA.

UNIT – III ADVANCED METHODS (9 hours)

Advanced Analytical Theory and Methods: Clustering – K Means – Use Cases – Overview – Determining number of clusters – Diagnostics Reasons to choose and cautions – Additional Algorithms - Association Rules: A Priori Algorithm – Evaluation of Candidate Rules Applications of Association Rules – Validation and Testing – Diagnostics. Regression: Linear Regression and Logistic Regression: – Use cases – Model Description – Diagnostics - Additional Regression Models.

UNIT – IV CLASSIFICATION (9 hours)

Classification : Decision Trees – Overview – Genetic Algorithm – Decision Tree Algorithms – Evaluating Decision Tree – Decision Trees in R - Na'ive Bayes – Bayes Theorem – Naïve Bayes Clasifier – Smoothing – Diagnostics – Naïve Bayes in R – Diagnostics of Classifiers – Additional Classification Methods - Time Series Analysis : Overview – Box – Jenkins Methodology – ARIMA Model – Autocorrelation Function – Autoregressive Models – Moving Average Models – ARMA and ARIMA Models – Building and Evaluating and ARIMA Model - Text Analysis :Text Analysis Steps – Example – Collecting – Representing Term Frequency – Categorizing – Determining Sentiments – Gaining Insights.

UNIT – V TECHNOLOGY (9 hours)

Advanced Analytics-Technology and Tools:MapReduce and Hadoop: Analytics for Unstructured Data .- UseCases - MapReduce - Apache Hadoop – The Hadoop Ecosystem – pig – Hive – Hbase – Manout – NoSQL - Tools in Database Analytics : SQL Essentials – Joins – Set operations – Grouping Extensions – In Database Text Analysis - Advanced SQL – Windows Functions – User Defined Functions and Aggregates – ordered aggregates- MADiib – Analytics Reports Consolidation – Communicating and operationalizing and Analytics Project – Creating the Final Deliverables : Developing Core Material for Multiple Audiences – Project Goals – Main Findings – Approach Model Description – Key points support with Data - Model details – Recommendations – Data Visualization

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	H	K_1,K_2
CO2	PO2 PO3	M M	PSO2	M	K_3
CO3	PO4 PO7	M M	PSO2, PSO3 PSO4	M M M	K_4,K_5
CO4	PO4 PO5 PO7	M M M	PSO2, PSO3 PSO4	M M M	K_4,K_5
CO5	PO5 PO7	M M	PSO4 PSO5 PSO6	H H H	K_5

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create)

Text and Reference books

1. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services Published by John Wiley & Sons,
2. Noreen Burlingame , "The little book on Big Data", New Street publishers, 2012.
3. Anil Maheshwari, " Data Analytics", McGraw Hill Education, 2017.
4. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
5. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
6. DietmarJannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
7. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.

Core – 12 (Practical) ADVANCED WEB TECHNOLOGY LAB [C L T P 2 0 0 4]

Course Objectives:

- Explore the backbone of webpage creation by developing .NET skill.
- Enrich knowledge about HTML control and web control classes
- Provide in-depth knowledge about ADO.NET
- Understand the need of usability, evaluation methods for web services

Course Outcomes

CO1: Design a webpage with Web form fundamentals and web control classes

CO2: Recognize the importance of validation control, cookies and session

CO3: Apply the knowledge of ASP.NET object, ADO.NET dataaccess and SQL to develop a client server model.

CO4: Recognize the difference between Data list and Data grid controls in accessing data

List of Exercises Recommended (Not less than 4 hours per week)

(The following are the minimum set of exercises suggested. The course coordinator may include more number of additional exercises in line with the course outcome)

1. Implementing Currency Converter logic in ASP.NET
2. Demonstrate Page Event Tracking in ASP.NET
3. Program to generate online greeting card by using file uploading control
4. Including Advertisement Banners in a website.
5. Program to create a registration page using validation controls
6. Program using Session State variables and set different session timeout
7. Program using Query String in ASP.NET.
8. ASP.NET program to create, read and remove Cookies
9. Program to handle DataGrid and DataList controls in a web page
10. ASP.NET program to search and store student data.
11. Creating a simple web service in ASP.NET
12. Creating User control in ASP.NET and use it in simple web application.
13. Creating a Custom in ASP.NET and use it in simple web application.
14. Implementing web security using forms authentication in ASP.NET

CO mapped with PO and PSO

Course Outcome	PO Addressed		Correlation Level		PSO Addressed		Correlation Level		Cognitive Level
CO1	PO1		H		PSO5		H		K_1, K_2
CO2	PO2	PO3	H	H	PSO5	PSO6	H	H	K6
CO3	PO2	PO3	H	H	PSO3	PSO4	H	H	K6
CO4	PO4	PO5	H	H	PSO4	PSO6	H	H	K_3

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create

Core – 13 (Practical) MACHINE LEARNING LAB USING PYTHON [C L T P 2004]

Course Objectives:

- To apply the concepts of Machine Learning to solve real-world problems
- To implement basic algorithms in clustering & classification applied to text & numeric data
- To implement algorithms emphasizing the importance of bagging & boosting in classification & regression
- To implement algorithms related to dimensionality reduction
- To apply machine learning algorithms for Natural Language Processing applications

Course Outcomes:

CO1: To learn to use Weka tool for implementing machine learning algorithms related to numeric data

CO2: To learn the application of machine learning algorithms for text data

CO3: To use dimensionality reduction algorithms for image processing applications

CO4: To apply CRFs in text processing applications

CO5: To use fundamental and advanced neural network algorithms for solving real-world data

LIST OF EXERCISES RECOMMENDED: (Not less than 4 hours per week)

1. Solving Regression & Classification using Decision Trees
2. Root Node Attribute Selection for Decision Trees using Information Gain
3. Bayesian Inference in Gene Expression Analysis
4. Pattern Recognition Application using Bayesian Inference
5. Bagging in Classification
6. Bagging, Boosting applications using Regression Trees
7. Data & Text Classification using Neural Networks
8. Using Weka tool for SVM classification for chosen domain application
9. Data & Text Clustering using K-means algorithm
10. Data & Text Clustering using Gaussian Mixture Models
11. Dimensionality Reduction Algorithms in Image Processing applications
12. Application of CRFs in Natural Language Processing

Mapping of COs, POs and PSOs*:*

Coure Outcome	**PO Addressed** PO1 to PO7			**Correlation Level** L/M/H			**PSO Addressed** PSO1 to PSO7			**Correlation Level** L/ M/ H			**Cognitive Level** K_1 to K_6
CO1	PO1			H			PSO1			H			K_1
CO2	PO2			M			PSO1	PSO2		H	H		K_2
CO3	PO3			H			PSO3	PSO4		H	H		K_3
CO4	PO3	PO4	PO7	M	M	M	PSO5			H			K_4
CO5	PO5	PO6	PO7	H	H	H	PSO2	PSO3	PSO5	M	M	M	$K_{5,}$ K_6

*(*L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create)

SEMESTER III					
Semester (1)	**Course No (2)**	**Course Type (3)**	**Course Name (4)**	**Contact Hrs./ Week (5)**	**Credits (6)**
III	15	Core-14	Digital Image Processing	4	4
	16	Core-15	Soft Computing	4	4
	17	Core-16	Advanced Computer Networks	4	4
	18	Core-17	Research Methodology	4	4
	19	Elective - 2 (Select any one)	1. Cloud Computing 2. Mobile Computing 3. Optimization Technique	4	3
	20	Core - 18 Practical - 5	Digital Image Processing using Sci Lab	4	2
	21	Core –19	Mini Project	6+2*	6
			Subtotal	**30**	**27**

Core - 14 DIGITAL IMAGE PROCESSING [C L T P 4 3 1 0]

Course Objectives:

- To provide complete knowledge on Digital Image Processing methods, such as image processing methods in Spatial domain and Frequency domain, Edge detection, Compression, Segmentation, and Morphological concepts, which enable the students to understand the concepts and implement them empirically.

Course Outcomes:

CO1: Review the fundamental concepts of a digital image processing system and Analyze images in the frequency domain using various transforms.

CO2: Evaluate the techniques for image enhancement and image restoration. Categorize various compression techniques.

CO3: Interpret Image compression standards, and Interpret image segmentation and representation techniques

CO4: Gain idea to process various image used in various fields such as weather forecasting

CO5: Diagnosis of various disease using image such as tumor, cancer etc.

Course Outline: ***(Total 60 Hours)***

UNIT-1 Introduction and Digital Image Fundamentals *(12 Hours)*

Introduction: What is Digital Image Processing- examples of fields that uses DIP - Fundamental Steps in Digital Image Processing -Components of an Image Processing Digital Image Fundamentals: Elements of Visual Perception -Light and the Electromagnetic Spectrum - Image Sensing and Acquisition - Image Sampling and Quantization - Some Basic Relationships Between Pixels - Introduction to the Basic Mathematical Tools Used in Digital Image Processing.

UNIT – II Image Enhancement and Frequency Domain Filtering *(12 Hours)*

Image Enhancement: Background - Some Basic Intensity Transformation Functions -Histogram Processing - Fundamentals of Spatial Filtering -Smoothing Spatial Filters - Sharpening Spatial Filters - Combining Spatial Enhancement Methods - Using Fuzzy Techniques for Intensity Transformations and Spatial Filtering. Filtering in the Frequency Domain: Background - Preliminary Concepts - Sampling and the Fourier Transform of Sampled Functions - The Discrete Fourier Transform of One Variable - Extensions to Functions of Two Variables - Some Properties of the 2-D DFT and IDF - The Basics of Filtering in the Frequency Domain - Image Smoothing Using Low pass Frequency Domain Filters - Image Sharpening Using High pass Filters - Selective

Filtering - The Fast Fourier Transform.

UNIT – III Image Restoration and Image Transforms *(12 Hours)*

Image Restoration: Model of the Image Degradation/Restoration process – Noise Models - Noise Only—Spatial Filtering - Periodic Noise Reduction Using FDF -Inverse Filtering - Minimum Mean Square Error Filtering -Constrained Least Squares Filtering - Geometric Mean Filter -Image Reconstruction from Projections. Wavelet and Other Image Transforms - Preliminaries - Matrix-based Transforms - Correlation - Basis Functions in the Time-Frequency Plane - Basis Images - Fourier-Related Transforms - Walsh-Hadamard Transforms - Slant Transform -Haar Transform - Wavelet Transforms.

UNIT – IV Color Image Processing and Image Compression *(12 Hours)*

Color Image Processing: Color Fundamentals - Color Models - Pseudo color Image Processing - Basics of Full-Color Image Processing - Color Transformations - Color Image Smoothing and Sharpening - Using Color in Image Segmentation - Noise in Color Images - Color Image Compression. Image Compression and Watermarking - Fundamentals - Huffman Coding - Arithmetic Coding – LZW Coding - Run-length Coding - Symbol-based Coding - Bit-plane Coding Block Transform Coding - Predictive Coding - Digital Image Watermarking.

UNIT – V Morphological Processing & Image Segmentation *(12 Hours)*

Morphological Image Processing - Preliminaries - Erosion and Dilation - Some Basic Morphological Algorithms – Morphological Reconstruction Image Segmentation - Fundamentals - Point, Line, and Edge Detection - Thresholding - segmentation by Region Growing and by Region Splitting and Merging - The Use of Motion in Segmentation

Mapping of COs, POs and PSOs:

Course Outcome	**PO AddressedPO1to PO 7**			**Correlation Level L/M/H**			**PSO AddressedPSO1to PSO7**		**Correlation Level L/ M/ H**		**Cognitive Level K1 to K6**
CO1	PO1	PO2		H	H		PSO1		H		K_1
CO2	PO3	PO4	PO5	M	M	M	PSO1	PSO2	H	H	K5
CO3	PO1	PO6		H	H		PSO3	PSO4	H	H	K3, K4, K6
CO4	PO4			M			PSO4		M		K5,K6
CO5	PO5			M			PSO4		H		K4, K5

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create)

Text and Reference books

1. Digital Image Processing, Fourth Edition, Rafel C. Gonzalez and Richard E. Woods, Pearson Education, 2018.
2. Fundamentals of Digital Image Processing, Chris Solomon & Toby Breckon, Wiley - Blackwell publications, 2011.
3. Digital Image Processing and Analysis, B. Chandra and D. DuttaMajumder, PHI,New Delhi, 2006.
4. Fundamentals of Digital Image Processing, Anil K. Jain, Prentice Hall of India,1989.

Core - 15 SOFT COMPUTING [C L T P 4 3 1 0]

Course Objectives:

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
- Introduce students to artificial neural networks and fuzzy theory from an engineering perspective.

Course Outcomes:

At the end of this course, the students should able to:

CO1: To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations.
CO2: Comprehend the fuzzy logic and the concept of fuzziness Involved in various systems and fuzzy set theory.
CO3: Understand the concept soft fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic.
CO4: Understand appropriate learning rules for each of the architectures and learn several Genetic algorithms paradigms and its applications

Course Outline: **(Total 60 hours)**

UNIT-1 INTRODUCTION *(12 Hours)*

Introduction: Soft Computing Constituents – Soft Computing Vs Hard Computing – Characteristics - Applications - Artificial Neural Network (ANN): Fundamental Concept – Application Scope - Basic Terminologies – Neural Network Architecture – Learning Process – Basic Models of ANN: McCulloch-Pitts Model – Hebb Network – Linear Separability.

UNIT – II SUPERVISED LEARNING NETWORKS *(12 Hours)*

Supervised Learning Networks: Perceptron Networks – Adaline and Madaline Networks – Back Propagation Network – Radial Basis Function Network. Associative Memory Networks – BAM – Hopfield Network - Boltzmann Machine. Unsupervised Learning Networks: Kohonen Self Organizing Network – Counter Propagation Network – ART Network.

UNIT – III FUZZY SETS *(12 Hours)*

Fuzzy Sets: Basic Concept – Crisp Set Vs Fuzzy Set - Operations on Fuzzy Set – Properties of Fuzzy Sets – Fuzzy Relations: Concept – Fuzzy Composition – Fuzzy Equivalence and Tolerance Relation - Membership Functions: Features – Fuzzification – Methods of Membership value assignments

– De-fuzzification – Methods.

UNIT – IV FUZZY CONCEPTS *(12 Hours)*

Fuzzy Arithmetic – Extension Principle – Fuzzy Measures – Fuzzy Rules and Fuzzy Reasoning: Fuzzy Propositions – Formation of Rules – Decomposition of Rules – Aggregation of Rules – Approximate Reasoning – Fuzzy Inference and Expert Systems – Fuzzy Decision Making – Fuzzy Logic Control Systems.

UNIT – V GENETIC ALGORITHM *(12 Hours)*

Genetic Algorithm: Fundamental Concept – Basic Terminologies – Traditional Vs Genetic Algorithm - Elements of GA - Encoding - Fitness Function – Genetic Operators: Selection – Cross Over - Inversion and Deletion - Mutation – Simple and General GA – The Schema Theorem - Classification of Genetic Algorithm – Genetic Programming – Applications of GA.

Mapping of COs, POs and PSOs:

Course Outcome	**PO AddressedPO1to PO 7**			**Correlation Level L/M/H**			**PSO Addressed PSO1 to PSO7**		**Correlation Level L/ M/ H**		**Cognitive Level K1 to K6**
CO1	PO1	PO2		H			PSO1		H		K_1
CO2	PO3	PO4	PO5	M	M	H	PSO1	PSO2	H	H	K_5
CO3	PO1	PO6		H	M		PSO3	PSO4	H	M	K_3, K_4, K_6
CO4	PO1	PO5		M	L		PSO1	PS03	H	M	K_2, K_3, K_4

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create)

Text and Reference books

1. S.N. Sivanandam, S.N. Deepa, “Principles of Soft Computing”, Wiley India, 2007.
2. S. Rajasekaran, G.A.V. Pai, “Neural Networks, Fuzzy Logic, Genetic Algorithms”, Prentice Hall India, 2004.

Core - 16 ADVANCED COMPUTER NETWORKS [C L T P 4 3 1 0]

Course Objectives:

- To study communication network protocols, different communication layer structure
- To learn security mechanism for data communication
- To learn network simulator.

Course Outcomes:

After completion of this course, students will be able to

CO1: Understand fundamental underlying principles of computer networking

CO2: Understand details and functionality of layered network architecture.

CO3: Apply mathematical foundations to solve computational problems in computer networking

CO4: Analyze performance of various communication protocols.

CO5: Compare routing algorithms

CO6: Practice packet /file transmission between nodes.

Course Outline: **(Total 60 hours)**

UNIT-1 *(12 Hours)*

INTRODUCTION TO NETWORKS & COMMUNICATION MEDIA: Uses – Network hardware – Network software – Reference Models. Example Networks: Internet – X.25 -ATM - Transmission media – Wireless Transmission – Telephone system – ISDN, ATM communication – satellite communication.

UNIT – II *(12 Hours)*

DATA TRANSFER & ACCESS PROTOCOLS: Error detection and correction methods – Elementary protocols – Sliding window protocols - IEEE 802.2 Logical Link Control – Bluetooth: architecture – protocol stack – radio layer – baseband layer – L2CAP layer – frame structure.

UNIT – III *(12 Hours)*

NETWORK LAYER PROTOCOLS: Routing algorithms – Congestion control: Principles – policies – Congestion control in VC subnets – congestion control in datagram subnets - Network layer in Internet: Architecture – IP protocol- IP Address – IPv6

UNIT – IV *(12 Hours)*

TRANSPORT PROTOCOLS: Transport service – Transport protocols – Transport protocols in Internet: TCP and UDP

UNIT – V *(12 Hours)*

APPLICATION LAYER ISSUES: Domain Name System – Electronic mail - Network security-Cryptography. Network Simulator: Basics of Computer Network Simulation – Introduction to Network Simulator 2 (NS2) – Basic Architecture – Installation – Directories and Convention – Running NS2 Simulation – Simulation Examples.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1 PSO3	H	K_1
CO2	PO1	H	PSO1	M	K_2
CO3	PO2 PO4 PO5	H M M	PSO2 PSO4	M M	K_3
CO4	PO4 PO5	H M	PSO2	H	K_4, K_5
CO5	PO3 PO5	M H	PSO4 PSO5	H M	K_6
CO6	PO6 PO7	M M	PSO6 PSO7	M M	K_6

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create**)**

Text and Reference books

1. Andrew S.Tanenbaum, “Computer Networks”, PHI, 5 th Edition, 2013
2. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw-Hill, 4th Edition, 2006
3. William Stallings, “Data and Computer Communication”, 7th Edition, Pearson Education, 2007
4. TeerawatUssaruyakul, EkramHossain, Introduction to Network Simulator NS2, Springer, 2009

Core 17 RESEARCH METHODOLOGY [C L T P 4 3 1 0]

Course Objectives:

- To understand the importance of Research Methodology
- To perform exploratory data analysis
- To apply the statistical testing to prove the hypothesis
- To provide the inference using quantitative data analysis
- To make use of computer aids to analyze the data, prepare reports and presentations
  Able to evaluate methodology of teaching

Course Outcomes:

CO1: Ability to apply different research approaches and methodologies
CO2: Develop data collection instrument according to the underlying theoretical framework.
CO3: Analyze quantitative data and qualitative data using software packages
CO4: Construct and document an appropriate research design
CO5: Discuss limitations and potential contribution to theory and practice of research
CO6: Effectively apply the appropriate computer tools in each stage of research
CO7: Ability to perform ICT based Teaching Methods

Course Outline: **(Total 60 hours)**

UNIT-1 *(12 Hours)*

INTRODUCTION OF RESEARCH AND FORMULATION Motivation and Objectives – Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical. Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – Reviews, treatise, monographs, patents –Critical literature review . RESEARCH DESIGN AND METHODS Research design – Basic Principles- Need of research design –– Features of good design – Important concepts relating to research design.

UNIT – II *(12 Hours)*

Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models - Developing a research plan - Exploration, Description, Diagnosis, Experimentation - Determining experimental and sample designs. DATA COLLECTION Execution of the research - Observation and Collection of data - Methods of data collection.

UNIT – III *(12 Hours)*

DATA ANALYSIS Quantitative Methods: Online Quantitative Design and Survey – Descriptive Measures – Probability – Random Variables and Distribution Functions – Discrete Probability Distributions – Continuous Probability Distribution – Sampling Distributions – Theory of Estimation – Hypothesis Testing – Correlation – Regression – Principles of Sample Survey – Types of Sampling – Design of Experiments – CRD-RBD-LSD-Factor Analysis – Cluster Analysis – Discriminant Analysis – Multiple Regression and Correlation – Canonical Correlation – Application of Statistical Software Packages. REPORTING AND THESIS WRITING Reporting and

thesis writing – Structure and components of scientific reports - Types of report – Technical reports and thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables - Bibliography, referencing and footnotes – Use of Oral presentation – Software Packages for thesis Preparation– Planning – Preparation – Practice – Making presentation – Use of visual aids - Importance of effective communication.

UNIT – IV *(12 Hours)*

APPLICATION OF RESULTS AND ETHICS Application of results and ethics - Environmental impacts - Ethical issues - ethical committees - Commercialization – Copy right – royalty –Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism – Application of Plagiarism detection tools - Citation and acknowledgment - Reproducibility and accountability.

UNIT – V *(12 Hours)*

METHODOLOGY OF TEACHING: Teaching – Objectives of Teaching, Phases of Teaching – Teaching Methods: Lecture Method, Discussion Method, Discovery Learning, Inquiry, Problem Solving Method, Project method, Seminar – Integrating ICT in Teaching: Individualized Instruction, Ways for Effective Presentation with PowerPoint – Documentation – Evaluation: Formative, Summative & Continuous and Comprehensive Evaluation – Later Adolescent Psychology: Meaning, Physical, Cognitive, Emotional, Social and Moral Development – Teaching Later Adolescents.

Mapping of Cos to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	M	PSO1	M	K_1
CO2	PO3	M	PSO2	L	K_2
CO3	PO3	M	PSO1	H	K_3
CO4	PO3	H	PSO4	M	K_4, K_5
CO5	PO6	M	PSO2	H	K_6
CO6	PO5	M	PSO1 PSO2	M M	K_6
CO7	PO7	L	PSO7	L	K_3

(L – Low, M – Medium, H – High; K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5– Evaluate, K_6 – Create**)**

Text and Reference books

1. C R Kothari, Paperback “Research Methodology: Methods and Techniques”, 2014
2. Modern Language Association Handbook, Eight Edition, 2016
3. R. Paneerselvam, “Research Methodology” 2nd Edition, PHI, 2014
4. John W Creswel, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 3rd Edition, 2014
5. S.C. Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2014 Edition.

6. S.C. Gupta & V.K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand & Sons. 2014 Edition.
7. Sampath.K, Panneerselvam.A&Santhanam.S (1984), Introduction to Educational Technology (2nd Revised Ed.) New Delhi: Sterling Publishers.
8. Sharma.S.R(2003).Effective Classroom teaching modern methods, tools & techniques, Jaipur: Mangal Deep.
9. Vedanayagam.E.G (1989). Teaching Technology for College Teachers, Newyark: Sterling Publishers.

Elective - 2 (a) CLOUD COMPUTING [C L T P 3 3 1 0]

Course Objectives:

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

Course Outcomes:

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

CO1 : Interpret the key dimensions of the challenges of Cloud Computing
CO2 : Examine the economics, financial, and technological implications for selecting cloud computing for own organization
CO3 : Assessing the technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications
CO4 : Evaluate own organizations' needs for capacity building and training in cloud computing-related IT areas
CO5 : Illustrate Virtualization for Data-Centre Automation

Course Outline: **(Total 45 hours)**

UNIT-1 INTRODUCTION *(9 hours)*

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

UNIT – II CLOUD ENABLING TECHNOLOGIES *(9 hours)*

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

UNIT – III CLOUD ARCHITECTURE, SERVICES AND STORAGE *(9 hours)*

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT – IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD *(9 hours)*

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges –

Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

UNIT – V CLOUD TECHNOLOGIES AND ADVANCEMENTS *(9 hours)*

Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine –– Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO8	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO8	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	L	K_1, K_2
CO2	PO2	L	PSO4	M	K_3
CO3	PO3 PO4	M M	PSO4 PSO5	M M	K_3, K_4
CO4	PO3	H	PSO4	M	K_5
CO5	PO6	H	PSO6	H	K_5

(L – Low, M – Medium, H – High); K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create

Text and Reference books

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

Elective - 2 (b) MOBILE COMPUTING [C L T P 4 3 1 0]

Course Objectives:

- To learn the fundamental technologies that help in the networking of wireless devices.
- To learn about different wireless technologies
- To learn about the evolution of cellular systems
- To understand the various wireless standards

Course Outcomes:

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

CO1 : Describe what Mobile Computing is and how it works today
CO2 : Recognize the factors that contributed to the emergence of Mobile Computing
CO3 : Able to Understand different mobile application paradigms
CO4 :Apply different protocols for mobile communication
CO5 : Define and identify infrastructure requirement for Mobile Applications
CO6 :Ability to conceptualize new ideas and present them as intellectual property

Course Outline ***(Total 45 hours)***

UNIT-1 *(9 hours)*

Introduction: Mobility of bits and bytes–Mobile Device Profiles-Wireless the beginning–Mobile Computing–Dialogue control–Networks–Middle ware and gateways–Applications and services–Developing mobile computing applications. Mobile Computing Architecture: Architecture of Mobile Computing – Three Tire Architecture –Design Consideration for mobile computing – Making existing applications to mobile enabled. Mobile Computing Through Telephony: Multiple Access procedure – Satellite Communication System- Mobile Computing Through Telephone–Developing an IVR Application –Voice XML– Telephony Application Program Interface-Multi Channel and Multi-mode user Interface-Developing Mobile GUI's – VUI's

UNIT – II *(9 hours)*

Emerging Technologies: Introduction – Bluetooth – Radio Frequency Identification(RFID) – Wireless Broadband(WIMAX)– Mobile IP –Internet Protocol version6(IPV6). Global System for Mobile Communication: Introduction – GSM Architecture and Services– GSM Entities –Call Routing in GSM – PLMN interface – GSM addresses and identifiers – Network Aspects in GSM – Mobility Management – GSM frequency allocation – Personal Communication service – Authentication and Security. Short Message Service: Mobile Computing over SMS - Short Message Service (SMS) – SMS Architecture-Value added Services through SMS– Accessing the SMS bearer.

UNIT – III *(9 hours)*

General Packet Radio Service (GPRS): Introduction – GPRS and Packet data Networking –GPRS Network Architecture - GPRS Network Operations – Data Services in GPRS – Applications for GPRS–Limitations of GPRS– Billing and Charging in GPRS– Enhanced Data rate for GSM Evaluation (EDGE).Wireless Application Protocol: Introduction–WAP–MMS –GPRS Applications. CDMA and 3G: Introduction – Spread Spectrum Technology – IS-95 – Wireless Data – Third Generation Networks–Applications of 3G.

UNIT – IV *(9 hours)*

Wireless Networks: Wireless Network and Topology-Cellular Telephony-Wireless Transmission and Wireless LAN - Wireless LAN Advantages–IEEE802.11Standards–Wireless LAN Architecture – Mobility in Wireless LAN – Deploying Wireless LAN – Mobile Adhoc Networks and Sensor Networks – MAC Protocol-Routing Protocol-Transport Layer Protocol – QOS - Dynamic Linking and Services-Communication via Web-Wireless LAN security – Wireless Access in Vehicular Environment –Wireless Local Loop– Hiper LAN–WIFI versus 3G. Intelligent Networks and Interworking: Fundamentals of Call Processing – Intelligence in the Networks – SS#7 Signaling – IN Conceptual Model (INCM) – Soft switch – Programmable Networks– Technologies and Interfaces for IN .Client Programming: Mobile Phones–Features of Mobile phones–PDA–Design constraints in Applications for Handheld devices– Recent Developments in Client Technology.

UNIT – V *(9 hours)*

Programming for the PALM OS: History of PALM OS–PALM OS architecture–Application Development– Communication in PALM OS– Multimedia. Wireless Devices with Symbian OS: Introduction to Symbian OS- Symbian OS Architecture –Security on Symbian OS. Security Issues in Mobile Computing: Information Security– Web Security-Security Techniques and Algorithms – Security Protocols– Public Key Infrastructure.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	M	PSO2	M	K_1, K_2
CO2	PO1 PO2	M H	PSO2	H	K_1
CO3	PO3 PO4	M L	PSO2	M	K_2
CO4	PO3	H M	PSO4 PSO2	M L	K_2
CO5	PO5	M	PSO4	M	K_3
CO6	PO6 PO7	M M	PSO5	M	K_5

(L – Low, M – Medium, H – High); K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create

Text and Reference books

1. AsokeKTalukder, Hasan Ahmed and RoopaRyavagal, "Mobile Computing:Technology, Applications and Service Creation", Second Edition , TMH,2010
2. Jochen Schiller, "Mobile Communications",Second Edition, Pearson Education, 2012
3. T.G. Palanivelu, R. Nakkeeran, Wireless and Mobile Communication, PHI Learning Private Limited, 2009
4. Raj Kamal, "Mobile Computing" ,Second Edition, Oxford University Press, 2012
5. William Stallings, "Wireless Communication and Networks", Pearson Education Asia,2002
6. C.Siva Ram Murthy, B.S. Manoj, "Ad Hoc Wireless Networks –Architectures and Protocols", 2nd Edition, Pearson Education.2004
7. Ashok K Talukder, Roopa R Yavagal, "Mobile Computing", Tata McGraw-Hill, 2005.
8. JochenBurkhardt, Dr. HorstHenn, Klaus Rintdoff, Thomas Schack, "Pervasive Computing", Pearson, 2009.

Elective - 2 (c) OPTIMIZATION TECHNIQUES [C L T P 3 3 1 0]

Course Objectives:

- To get the basic knowledge of Optimization Techniques.
- To study the measurement and scaling techniques.
- To learn about Assignment Problems.

Course Outcomes:

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

CO1: Recognize the areas of problem solving that needs optimization methods
CO2: Describe and develop various optimization algorithms for real-world problems
CO3: Apply algorithms for optimizing mathematical problems and interpret results.
CO4: Identify appropriate problem solving technique based on problem's nature
CO5: Construct scientific research papers and present them in a seminar

Course Outline: **(Total 45 hours)**

UNIT-1 INTRODUCTION *(9 hours)*

Statement of an optimization problems – classification of optimization problem – classical optimization techniques; Single variable optimizations, Multi variable optimization, equality constrains, inequality constraints, No constraints.

UNIT – II LINEAR PROGRAMMING *(9 hours)*

Graphical method for two dimensional problems – central problems of Linear Programming – Definitions – Simples – Algorithm – Phase I and II of simplex Method – Revised Simplex Method. Simplex Multipliers – Dual and Primal – Dual Simplex Method – Sensitivity Analysis – Transportation problem and its solution – Assignment problem and its solution – Assignment problem and its solution by Hungarian method – Karmakar's method – statement, Conversion of the Linear Programming problem into the required form, Algorithm.

UNIT – III NON LINEAR PROGRAMMING *(9 hours)*

NON LINEAR PROGRAMMING (ONE DIMENSIONAL MINIMIZATION: Introduction – Unrestricted search – Exhaustive search – interval halving method – Fibonacci method. NON LINEAR PROGRAMMING: (UNCONSTRAINED OPRIMIZATION): - Introduction– Random search method – Univariate method – Pattern search methods – Hooke and Jeeves method, simplex method- Gradient of a function – steepest descent method – Conjugate gradient method.

UNIT – IV DYNAMIC PROGRAMMING *(9 hours)*

Introduction – multistage decision processes – Principles of optimality – Computation procedures.

UNIT – V DECISION MAKING *(9 hours)*

Decisions under uncertainty, under certainty and under risk – Decision trees – Expected value of perfect information and imperfect information.

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7	**Correlation Level** L/M/H	**PSO Addressed** PSO1 to PSO7	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	H	PSO1	H	K_1,
CO2	PO3	L	PSO4	M	K_5
CO3	PO4	M	PSO1	M	K_4
CO4	PO1	H	PSO1	H	K_1
CO5	PO7	M	PSO7	M	K_6

(L – Low, M – Medium, H – High); K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create

Text and Reference books

1. Kalynamoy Deb, "Optimization for Engineering Design, Algorithms and Examples", Prentice Hall, 2004.
2. Hamdy A Taha, "Operations Research – An introduction", Pearson Education, 2002.
3. An Introduction to optimization Techniques by Vikrant Sharma, Vinod Kumar Jain, Atul Kumar April 20,2021 by Chapman and Hall/CRC
4. H.A. Taha, "Operation Research" Prentice Hall of India,2012

Core - 18 (Practical)

DIGITAL IMAGE PROCESSING LAB USING SCILAB [C L T P 2 0 0 4]

Course Objectives:

- To provide complete knowledge on Digital Image Processing methods, such as image processing methods in Spatial domain and Frequency domain, Edge detection, Compression, Segmentation, and Morphological concepts, which enable the students to understand the concepts and implement them empirically.

Course Outcomes:

CO1: Able to identify the need for various digital images processing techniques apply them and Analyze deferent types of real world images

CO2: Evaluate the techniques for image enhancement and image restoration. Categorize various image compression techniques.

CO3: Interpret Image compression standards, and Interpret image segmentation and representation techniques.

CO4: Apply various morphological operators for image pre and post processing in specific applications.

LIST OF lab EXERCISES RECOMMENDED:

1. Write a program in Scilab to convert Gray Scale image to Binary Image.
2. Write a program in Scilab for finding Negative of an Image.
3. Write a program in Scilab for Histogram Equalization.
4. Write a program in Scilab for Arithmetic Operators using Image.
5. Write a program in Scilab for Gaussian Low pass Filter.
6. Write a program in Scilab for Gaussian High pass Filter.
7. Write a program in Scilab for Homomorphic Filtering.
8. Write a program in Scilab for Edge Detection.
9. Write a program in Scilab for Erosion of an Image.
10. Write a program in Scilab for Dilation of an Image.
11. Write a program in Scilab for conversion between color spaces.
12. Write a program in Scilab for Segmentation using watershed transform

Mapping of COs to POs and PSOs

Course Outcome	**PO Addressed** PO1 to PO7		**Correlation Level** L/M/H		**PSO Addressed** PSO1 to PSO7	**Correlation Level** L/ M/ H	**Cognitive Level** K_1 to K_6
CO1	PO1	PO4	H	H	PSO1	H	K_1, K_4
CO2	PO5		L		PSO2	H	K_5
CO3	PO5		M		PSO5	H	K_2
CO4	PO4		H		PSO6	M	K_3

(L – Low, M – Medium, H – High); K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5–Evaluate, K_6 – Create

Core – 19: Mini Project work

GUIDELINES FOR MINI PROJECT WORK

Objective

The Mini project is aimed to enable the third semester student to study of Project development and permit them to design and develop a small scale solution to some real world problem in any one of the core area of study. Student may undertake the project in her/his own area of interest under the supervision of one of the faculty member, complete within the third semester and the whole mini project work is to be evaluated continuously by the internal examiner (Guide) and by the External examiner during the end semester examination. The mini project enables the student to get a prior exposure to carry out the Major project at Fourth Semester

Mode of Mini Project : Individual Project

Nature of Mini Project: Every student shall undertake a unique project title (Novel Concept/ idea/system or a small research problem, which shall be designed and implemented using available software development tool /programming language) approved by her/his guide.

Guide: Each Student shall be allotted under the Guidance of one Department faculty member by the Programme coordinator/Head

Duration : One semester - (6 hours per week)
Student carryout the Mini Project work in her/his College itself. In case of Company project, students are permitted to do the Mini project work in reputed IT companies without affecting the minimum attendance and other classes of the third semester

Continuous Assessment: Based on periodic reviews (Three reviews during the Semester. Tentative review dates are decided by the department and to be intimated to the students at the beginning of the third Semester)

Evaluation criteria:

Each student is evaluated by the Internal Examiner (Guide) continuously during the respective semester. External Examination will be conducted at the end of the respective semester.

Maximum Marks :	Internal	External
100	50	50

Passing Criteria: Student shall secure a minimum of **50 % marks in the external** evaluation and shall secure a **minimum of 50 % marks in combined Internal and External evaluation**. (There is no passing minimum for the internal evaluation)

<table>
<tr><th colspan="2">Internal (CIA) (50 Marks)
(All the three reviews are mandatory)</th><th colspan="2">External (50 Marks)</th></tr>
<tr><td>Review I
(Problem identification, Title & Abstract submission, Novelty of the idea, proposed outcomes, issues in existing methods, tools to be used)</td><td>15 Marks</td><td colspan="2">Both Internal and External Examiner Shall evaluate the student based on the following criteria at the end of the semester:
(Guide or any other department faculty decided by the HOD shall be internal examiner. External Examiner will be appointed by the COE</td></tr>
<tr><td>Review II
System Design / Database Design or Research Methodology / Algorithms and Techniques/ detailed Implementation plan</td><td>15 Marks</td><td>Internal Examiner

Project Report</td><td>20 Marks</td></tr>
<tr><td>Review III
System Implementation status, Testing, demo of working system and completion of report writing</td><td>20 Marks</td><td>External Examiner shall evaluate under the following criteria
• Presentation of the Mini Project
• Demonstration of the Mini project working
• Viva -voce</td><td>
10 Marks
10 Marks
10 Marks</td></tr>
<tr><td>Total</td><td>50 Marks</td><td></td><td>50 Marks</td></tr>
</table>

Semester IV				
Course NO	Course Type	Course Name	No of Hours per Week	Credits
22	Core – 20	Major Project	30+2*	16
		Subtotal	**30**	**16**

Core - 20 Major Project work

GUIDELINES FOR MAJOR PROJECT WORK

Objective

The Major project is aimed to enable the Fourth semester student to design and develop a standard solution to one of the significant real world problem in any one of the core area of study. Student may undertake the major project in her/his own area of interest under the supervision of one of the faculty member, They may also be permitted to undertake the Major project in a reputed IT firm also with prior permission from the Department Head. The Major project shall be completed within the fourth semester and the whole Major project work shall be evaluated continuously by the internal examiner (Guide) and by the External examiner during the end semester examination. The Major project enables the student to get a prior exposure to project development that enhances their employability skills.

Maximum Marks :	Internal	External
100	50	50

Mode of Major Project: Individual Project

Nature of Major Project: Every student shall undertake a unique project title (Novel Concept/ idea/system or a small research problem, which shall be designed and implemented using available software development tool /programming language) approved by her/his guide.

Guide: Each Student shall be allotted under the Guidance of one Department faculty member by the Programme coordinator/Head

Duration : One semester - (30 hours per week) Major project students may also opt for company projects with prior permission from the Head of the Department/Principal

Continuous Assessment: Based on periodic reviews (Three reviews during the Semester. Tentative review dates are decided by the department and to be intimated to the students at the beginning of the fourth Semester)

Evaluation criteria

Each student is evaluated by the Internal Examiner (Guide) continuously during the respective semester. External Examination will be conducted at the end of the respective semester.

Passing Criteria: Student shall secure a minimum of **50 % marks in the external** evaluation and shall secure a **minimum of 50 % marks in combined Internal and External evaluation**. (There is no passing minimum for the internal evaluation)

<table>
<tr><th colspan="2">Internal (50 Marks)
(All the three reviews are mandatory)</th><th colspan="2">External (50 Marks)</th></tr>
<tr><td>Review I
(Problem identification, Title & Abstract submission, Novelty of the idea, proposed outcomes, issues in existing methods, tools to be used)</td><td>15 Marks</td><td colspan="2">Both Internal and External Examiner Shall evaluate the student based on the following criteria at the end of the semester:
(Guide or any other department faculty decided by the HOD shall be internal examiner. External Examiner will be appointed by the COE</td></tr>
<tr><td>Review II
System Design / Database Design / Methodology / Algorithms and Techniques/ detailed Implementation plan</td><td>15 Marks</td><td>Internal Examiner

Project Report</td><td>

20 Marks</td></tr>
<tr><td>Review III
System Implementation status, Testing, outcomes and report writing</td><td>20 Marks</td><td>External Examiner shall evaluate under the following criteria
• Presentation of the Project
• Demonstration of the working project
• Viva -voce</td><td>

10 Marks

10 Marks

10 Marks</td></tr>
<tr><td>Total</td><td>50 Marks</td><td></td><td>50 Marks</td></tr>
</table>