Maharaja Ranjit Singh Punjab Technical University
Bathinda-151001

FACULTY OF ENGINEERING & TECHNOLOGY

SYLLABUS

FOR

M.TECH. (COMPUTER SCIENCE & ENGINEERING)

2023 BATCH ONWARDS

M.TECH. COMPUTER SCIENCE & ENGINEERING SYLLABUS
2023 BATCH ONWARDS

Study Scheme for M.Tech Regular Programmes.

SEMESTER-1		**Contact Hours**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
MCSES1-101	Mathematical Foundations of Computer Science	4	0	0	40	60	100	4
MCSES1-102	Advanced Data Structures	4	0	0	40	60	100	4
MCSES1-103	Wireless Sensor Networks	4	0	0	40	60	100	4
	Departmental Elective-I	4	0	0	40	60	100	4
MCSES1-111	Machine Learning							
MCSES1-112	Introduction to Intelligent Systems							
MCSES1-113	Big Data Analytics							
	Departmental Elective-II	4	0	0	40	60	100	4
MCSES1-121	Data Science							
MCSES1-122	Distributed Systems							
MCSES1-123	Advanced Wireless and Mobile Networks							
MCSES1-104	LAB-1 (Advanced Data Structures Lab)	0	0	4	60	40	100	2
Total:		**20**	**0**	**4**	**260**	**340**	**600**	**22**

SEMESTER-2	**Contact Hours**	**Marks**	**Credits**

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Subject Code	Subject Name	L	T	P	Internal	External	Total	
MCSES1-201	Advanced Algorithms	4	0	0	40	60	100	4
MCSES1-202	Soft Computing	4	0	0	40	60	100	4
MCSES1-203	Mobile Applications and Services	4	0	0	40	60	100	4
	Departmental Elective- III	4	0	0	40	60	100	4
MCSES1-212	Data Preparation and Analysis							
MCSES1-213	Secure Software Design & Enterprise Computing							
MCSES1-214	Computer Vision							
	Departmental Elective-IV	4	0	0	40	60	100	4
MCSES1-221	Human and Computer Interaction							
MCSES1-222	GPU Computing							
MCSES1-223	Digital Forensics							
MCSES1-204	**LAB-2 (Based on Cores of 2nd Semester)** Advanced Algorithm Lab.	0	0	4	60	40	100	2
MCSES1-205	Soft Computing Lab.							
Total:		**20**	**0**	**4**	**260**	**340**	**600**	**22**

SEMESTER-3		**Contact Hours**			**Marks**			**Credits**
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
XXXX	OPEN ELECTIVE	3	0	0	40	60	100	3
MREM10-101	RM & IPR	4	0	0	40	60	100	4
MCSES1-301	Project	0	0	-	60	40	100	6
MCSES1-302	Seminar	0	0	2	100	--	100	1
Total:		**7**	**0**	**2**	**240**	**160**	**400**	**14**

SEMESTER-4		**Contact Hours**			**Marks**		
Subject Code	**Subject Name**	**L**	**T**	**P**	**Internal**	**External**	**Total**
MCSES1-401	Dissertation	--	--	--	**Satisfactory/not satisfactory as per CBCS-2016**		
Total:		--	--	--			

The evaluation should be carried out by an internal committee of minimum three Ph.D. members and **Satisfactory/not satisfactory report** should be mentioned as per CBCS-2016 of the university.

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Subject Code: MCSES1-101 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

To understand the mathematical fundamentals that is prerequisites for a variety of courses like:

1. Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
2. To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
3. To study various sampling and classification problems.

Course Outcomes: After completion of course, students would be able to:

CO1: To understand the basic notions of discrete and continuous probability.
CO2: To understand the methods of statistical inference, and the role that sampling distributions play in those methods.
CO3: To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.
CO4: Applications of Mathematics in various fields of Computer science and engineering.

UNIT-I (15 Hrs)

Probability mass, density, and cumulative distribution functions, parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains.

UNIT-II (15 Hrs)

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood.
Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.

UNIT-III (15 Hrs)

Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.

UNIT-IV (15 Hrs)

Applications of Mathematics in various fields of Computer science and engineering.
Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.

Recommended Books:

1. John Vince, 'Foundation Mathematics for Computer Science', Springer.
2. K. Trivedi, 'Probability and Statistics with Reliability, Queuing, and Computer Science Applications', Wiley.
3. M. Mitzenmacher and E. Upfal, 'Probability and Computing: Randomized Algorithms and Probabilistic Analysis'.
4. Alan Tucker, 'Applied Combinatorics', Wiley.

ADVANCED DATA STRUCTURES

Subject Code: MCSES1-102 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. The student should be able to choose appropriate data structures, understand the ADT/libraries and use it to design algorithms for a specific problem.
2. Students should be able to understand the necessary mathematical abstraction to solve problems.
3. To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
4. Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes: **After completion of course, students would be able to:**

CO1: Understand the implementation of symbol table using hashing techniques
CO2: Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
CO3: Develop algorithms for text processing applications.
CO4: Identify suitable data structures and develop algorithms for computational geometry problems

UNIT–I (15 Hrs)

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. **Hashing**: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic, Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT–II (15 Hrs)

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists
Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

UNIT–III (15 Hrs)

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

UNIT – IV (15 Hrs)

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees.
Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem.

Recommended Books:

1. Mark Allen Weiss, 'Data Structures and Algorithm Analysis in C++', 2nd Edn., Pearson, **2004**.
2. M.T. Goodrich, Roberto Tamassia, 'Algorithm Design', John Wiley, **2002**.

WIRELESS SENSOR NETWORKS

Subject Code: MCSES1-103 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. Architect sensor networks for various application setups.
2. Devise appropriate data dissemination protocols and model links cost
3. Understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
4. Evaluate the performance of sensor networks and identify bottlenecks.

Course Outcomes:

After completion of course, students would be able to:

CO1: Describe and explain radio standards and communication protocols for wireless sensor networks.
CO2: Explain the function of the node architecture and use of sensors for various applications.
CO3: Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.
CO4: To understand various security issues.

UNIT-I (15 Hrs)

Introduction to Wireless Sensor Networks: Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors,
Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture Hardware Platforms: Motes, Hardware parameters.

UNIT-II (15 Hrs)

Introduction to ns-3: Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example.
Medium Access Control Protocol Design: Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled.
Introduction to Markov Chain: Discrete time Markov Chain definition, properties, classification and analysis.
MAC Protocol: Introduction to analysis of MAC Protocols.

UNIT-III (15 Hrs)

Routing Protocols: Introduction, MANET protocols
Routing Protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast.
Opportunistic Routing Analysis: Introduction to opportunistic routing.

UNIT-IV (15 Hrs)

Security: Possible attacks, countermeasures, SPINS, Static and dynamic key distribution.
ADVANCED TOPICS Recent development in WSN standards, software applications.

Recommended Books:

1. W. Dargie and C. Poellabauer, 'Fundamentals of Wireless Sensor Networks –Theory and Practice', Wiley, **2010.**
2. Kazem Sohraby, Daniel Minoli and Taieb Znati, 'Wireless Sensor Networks -Technology, Protocols, and Applications', Wiley Interscience, **2007**.
3. Takahiro Hara, Vladimir I. Zadorozhny and Erik Buchmann, 'Wireless Sensor Network Technologies for the Information Explosion Era', Springer, **2010**.

MACHINE LEARNING

Subject Code: MCSES1-111 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
2. To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. To explore Deep learning technique and various feature extraction strategies.

Course Outcomes: After completion of course, students would be able to:

CO1: Extract features that can be used for a particular machine learning approach in various IOT applications.
CO2: To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
CO3: To mathematically analyze various machine learning approaches and paradigms.
CO4: To learn various trends of machine learning techniques.

UNIT-I (15 Hrs)

Supervised Learning (Regression/Classification) Basic Methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods Beyond Binary Classification.

UNIT-II (15 Hrs)

Unsupervised Learning Clustering: K-means/Kernel K-means Dimensionality Reduction: PCA and kernel PCA Matrix Factorization and Matrix Completion Generative Models (mixture models and latent factor models)
Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests).

UNIT-III (15 Hrs)

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.
Scalable Machine Learning (Online and Distributed Learning). A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.

UNIT-IV (15 Hrs)

Recent trends in various learning techniques of machine learning and classification methods for IOT applications, Introduction to Various models for IOT applications.

Recommended Books:

1. Kevin Murphy, 'Machine Learning: A Probabilistic Perspective', MIT Press, **2012**.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, 'The Elements of Statistical Learning', Springer, **2009** (freely available online).
3. Christopher Bishop, 'Pattern Recognition and Machine Learning', Springer, **2007**.

INTRODUCTION TO INTELLIGENT SYSTEMS

Subject Code: MCSES1-112 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:
The aim of the course is to introduce to the field of Artificial Intelligence(AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach.

Course Outcomes: After completion of course, students would be:
CO1: Able to demonstrate knowledge of the fundamental principles of intelligent systems and would be able to analyses and compare the relative merits of a variety of AI problem solving techniques.
CO2: To understand the basic concepts of Basic concepts of graph and tree search
CO3: To learn knowledge representation.
CO4: To learn recent trends in Fuzzy logic, Knowledge Representation.

UNIT-I (15 Hrs)

Biological Foundations to Intelligent Systems I: Artificial neural networks, Backpropagation networks, Radial basis function networks, and recurrent networks.
Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

UNIT-II (15 Hrs)

Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill- climbing search. Optimization and search such as stochastic annealing and genetic algorithm.

UNIT-III (15 Hrs)

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.

UNIT-IV (15 Hrs)

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.
Recent trends in Fuzzy logic, Knowledge Representation.

Recommended Books:
1. G.F. Luger and W.A. Stubblefield, 'Artificial Intelligence: Structures and Strategies for Complex Problem Solving', 6th Edn., Addison Wesley, **2008**.
2. S. Russell and P. Norvig, 'Artificial Intelligence: A Modern Approach', 3rd Edn., Prentice-Hall, **2009**.

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BIG DATA ANALYTICS

Subject Code: MCSES1-113 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

Today's world is a data-driven world. Increasingly, the efficient operation of organizations across sectors relies on the effective use of vast amounts of data. Big data analytics helps us to examine these data to uncover hidden patterns, correlations, and other insights. It is a fast-growing field and skills in the area are some of the most in-demand today.

Course Outcomes: On completion of the course the student should be able to
CO1: identify big data application areas
CO2: use big data framework
CO3: model and analyze data by applying selected techniques
CO4: demonstrate an integrated approach to big data

Unit-1: (15 Hrs)

INTRODUCTION TO BIG DATA
Introduction– distributed file system–Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce

Introduction To Hadoop And Hadoop Architecture: Big Data – Apache Hadoop & Hadoop EcoSystem, Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce -, Data Serialization

Unit-2: (15 Hrs)

HDFS, HIVE AND HIVEQL, HBASE
HDFS-Overview, Installation and Shell, Java API; Hive Architecture and Installation, Comparison with Traditional Database, HiveQL Querying Data, Sorting And Aggregating, Map Reduce Scripts, Joins & Sub queries, HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG, Zookeeper , how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper

Unit-3: (15 Hrs)

SPARK
Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib.

NoSQL:What is it?, Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, NewSQL

Unit-4: (15 Hrs)

Data Base for the Modern Web
Introduction to MongoDB key features, Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents , MongoDB Query Language.

Recommended Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007
2. Bill Franks , "Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics", Wiley

3. Anand Rajaraman and Jeff Ullman “Mining of Massive Datasets”, Cambridge University Press,
4. Michael Minelli, Michele Chambers, Ambiga Dhiraj, “Big Data Big Analytics: Emerging Business Intelligence And Analytic Trends For Today's Businesses”, Wiley India
5. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley.
6. Chris Eaton, Dirk derooset al., “Understanding Big data”, McGraw Hill, 2012.
7. BIG Data and Analytics , Seema Acharya, Subhashini Chhellappan, Willey
8. MongoDB in Action, Kyle Banker, Piter Bakkum , Shaun Verch, Dream tech Press
9. Tom White, “HADOOP: The Definitive Guide”, O Reilly 2012.
10. Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packet Publishing 2013.
11. Learning Spark: Lightning-Fast Big Data Analysis Paperback by Holden Karau

DATA SCIENCE

Subject Code: MCSES1-121 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. Provide you with the knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
3. Produce Python code to statistically analyses a dataset
4. Critically evaluate data visualizations based on their design and use for communicating stories from data

Course Outcomes:

On completion of the course the student should be able to
CO1: Explain how data is collected, managed and stored for data science;
CO2: Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists
CO3: Implement data collection and management scripts using MongoDB
CO4: To learn applications of data science.

UNIT-I (15 Hrs)

Introduction to Core Concepts and Technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.
Data Collection and Management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.

UNIT-II (15 Hrs)

Data Analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

UNIT-III (15 Hrs)

Data Visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

UNIT-IV (15 Hrs)

Applications of Data Science, Technologies for visualization, Bokeh (Python)
Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

Recommended Books:

1. Cathy O'Neil and Rachel Schutt, 'Doing Data Science, Straight Talk from the Frontline', O'Reilly.
2. Jure Leskovek, Annand Rajaraman and Jeffrey Ullman, 'Mining of Massive Datasets', Vol.- 2.1, Cambridge University Press.

DISTRIBUTED SYSTEMS

Subject Code: MCSES1-122 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives: Students would be able to learn working of Distributed database .
Course Outcomes: After completion of course, students would be:
CO1: Understand how Distributed database works.
CO2: Design trends in distributed systems.
CO3: Understand the key role of Query optimization and transaction management.
CO4: Students should have an insight of reliability issues and advanced topics of Database systems

UNIT-I (15 Hrs)

Introduction: Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts
Distributed Database Management System Architecture: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

UNIT-II (15 Hrs)

Distributed Database: Design Alternative design strategies; Distributed design issues; Fragmentation; Data allocation. BASICS OF SEMANTIC DATA CONTROL, QUERY PROCESSING ISSUES Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

UNIT-III (15 Hrs)

Distributed Query Optimization: Factors governing query optimization; Centralized query optimization; Ordering of fragment queries;
Transaction Management The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models.
Concurrency Control Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.

UNIT-IV (15 Hrs)

Reliability: Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.
Parallel Database Systems: Parallel architectures; parallel query processing and optimization; load balancing.
Advanced Topics: Mobile Databases, Multi-databases.

Recommended Books:

1. M.T. Ozsu and P. Valduriez, ‘Principles of Distributed Database Systems’, Prentice Hall, **1991**.
2. D. Bell and J. Grimson, ‘Distributed Database Systems’, Addison Wesley, **1992**.

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ADVANCED WIRELESS AND MOBILE NETWORKS

Subject Code: MCSES1-123 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. The students should get familiar with the wireless/mobile market and the future needs and challenges.
2. To get familiar with key concepts of wireless networks, standards, technologies and their basic operations
3. To learn how to design and analyse various medium access
4. To learn how to evaluate MAC and network protocols using network simulation software tools.
5. The students should get familiar with the wireless/mobile market and the future needs and challenges.

Course Outcomes: After completion of course, students would be:

CO1: Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
CO2: Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
CO3: Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
CO4: Design wireless networks exploring trade-offs between wire line and wireless links.
CO5: Develop mobile applications to solve some of the real world problems.

UNIT-I (15 Hrs)

Introduction: Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc. WIRELESS LOCAL AREA NETWORKS: IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF& PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues.

UNIT-II (15 Hrs)

Wireless Cellular Networks: 1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, improving coverage and capacity in cellular systems, Spread spectrum Technologies.

UNIT-III (15 Hrs)

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview
Wireless Sensor Networks: Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.

UNIT-IV (15 Hrs)

WIRELESS PANs Bluetooth AND Zigbee, Introduction to Wireless Sensors.

Security: Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.
Advanced Topics: IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks.

Recommended Books:

1. J. Schiller, 'Mobile Communications', Addison Wesley, **2000.**

2. W. Stallings, 'Wireless Communications and Networks', Pearson Education, **2005.**
3. Stojmenic Ivan, 'Handbook of Wireless Networks and Mobile Computing', John Wiley and Sons Inc., **2002**.
4. Yi Bing Lin and Imrich Chlamtac, 'Wireless and Mobile Network Architectures', John Wiley and Sons Inc., **2000**.
5. Pandya Raj, 'Mobile and Personal Communications Systems and Services', PHI.

LAB.-I (ADVANCED DATA STRUCTURES)

Subject Code: MCSES1-104 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objective:
Students would be able to learn operations on different data structures.
Course Outcomes: After completion of course, students would be:
CO1: To implement various operations on trees
CO2: To be familiar with string matching algorithms.
CO3: To be familiar with hashing, 2D range search and contemporary problems.
CO4: To be able to develop project based on real life problem using data structure and its concepts

Programs may be implemented using C/C++/java
EXP 1: Program to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n. To handle the collisions, use the following collision resolution techniques,
a) Linear probing,
b) Quadratic probing,
c) Double hashing/rehashing,
d) Chaining
EXP 2: Program for Binary Search Tree to implement following operations:
a) Insertion,
b) Deletion,
   i) Delete a node with only child,
   ii) Delete a node with both children
c) Finding an element,
d) Finding Min element,
e) Finding Max element,
f) Left child of the given node,
g) Right child of the given node,
h) Finding the number of nodes, leaves nodes, full nodes, ancestors, descendants.
EXP 3: Program for AVL Tree to implement following operations: (For nodes as integers)
a) Insertion: Test program for all cases (LL, RR, RL, LR rotation),
b) Deletion: Test Program for all cases (R0, R1, R-1, L0, L1, L-1),
c) Display: using set notation.
EXP 4: Program to implement Red-Black trees with insertion and deletion operation for the given input data as Integers/Strings
EXP 5: Program to implement insertion, deletion, display and search operation in m-way B tree (i.e. a non-leaf node can have at most m children) for the given data as integers.
EXP 6: Program to perform string matching using Knuth-Morris-Pratt algorithm.
EXP 7: Program to perform string matching using Boyer-Moore algorithm.
EXP 8: Program to implement 2-D range search over computational geometry problem
EXP 9: Program on latest efficient algorithms on trees for solving contemporary problems.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

SECOND SEMESTER

ADVANCED ALGORITHMS

Subject Code- MCSES1-201 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. Introduce students to the advanced methods of designing and analysing algorithms.
2. The student should be able to choose appropriate algorithms and use it for a specific problem.
3. To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
4. Students should be able to understand different classes of problems concerning their computation difficulties.
5. To introduce the students to recent developments in the area of algorithmic design.

Course Outcomes: After completion of course, students would be able to:

CO1: Analyze the complexity/performance of different algorithms.
CO2: Determine the appropriate data structure for solving a particular set of problems.
CO3: Categorize the different problems in various classes according to their complexity.
CO4: Students should have an insight of recent activities in the field of the advanced data structure.

UNIT-I (15 Hrs)

Sorting: Review of various sorting algorithms, topological sorting Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis. **Matroids**: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT-II (15 Hrs)

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT-III (15 Hrs)

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials.

UNIT-IV (15 Hrs)

Linear Programming: Geometry of the feasibility region and Simplex algorithm. NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Advanced Number Theoretic Algorithm.
Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Recommended Books:

1. Cormen, Leiserson, Rivest, Stein, ‘Introduction to Algorithms’.
2. Aho, Hopcroft, Ullman, ‘The Design and Analysis of Computer Algorithms’.
3. Kleinberg and Tardos, ‘Algorithm Design’.

SOFT COMPUTING

Subject Code: MCSES1-202 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide student hand-on experience on MATLAB to implement various strategies.

Course Outcomes: After completion of course, students would be able to:

CO1: Identify and describe soft computing techniques and their roles in building intelligent machines

CO2: Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.

CO3: Apply genetic algorithms to combinatorial optimization problems.

CO4: Evaluate and compare solutions by various soft computing approaches for a given problem.

UNIT-I (15 Hrs)

Introduction to Soft Computing and Neural Networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

Fuzzy Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT-II (15 Hrs)

Neural Networks: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

UNIT-III (15 Hrs)

Genetic Algorithms: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

UNIT-IV (15 Hrs)

Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.

Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.

Recommended Books:

1. Jyh: Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, 'Neuro: Fuzzy and Soft Computing17', Prentice-Hall of India, **2003**.
2. George J. Klir and Bo Yuan, 'Fuzzy Sets and Fuzzy Logic: Theory and Applications17', Prentice Hall, **1995**.
3. MATLAB Toolkit Manual.

MOBILE APPLICATIONS AND SERVICES

Subject Code: MCSES1-203 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

COURSE OBJECTIVES:

1. This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and PhoneGap/WebOS.
2. It explores emerging technologies and tools used to design and implement feature-rich mobile applications for smartphones and tablets
3. It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile

COURSE OUTCOMES: On completion of the course the student should be able to
CO1 Identify the target platform and users and be able to define and sketch a mobile application
CO2 Understand the fundamentals, frameworks, and development lifecycle of mobile application platforms including iOS, Android, and PhoneGap
CO3 Design and develop a mobile application prototype in one of the platform (challenge project)
CO4: To Study recent trends.

COURSE CONTENT:

UNIT-I (15 Hrs)

Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User
More on Uis: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis, . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider

UNIT-II (15 Hrs)

Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony
Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics

UNIT-III (15 Hrs)

Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android
Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia

UNIT-IV (15 Hrs)

Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions, More on Security, Hacking Android
Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT

RECOMMENDED BOOKS:

1. Wei-Meng Lee, Beginning Android™ 4 Application Development, 2012 by John Wiley & Son

DATA PREPARATION AND ANALYSIS

Subject Code: MCSES1-212 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:
To prepare the data for analysis and develop meaningful Data Visualizations
Course Outcomes: After completion of course, students would be:
CO1: To be familiar with Data Gathering and Preparation issues.
CO2: To learn about data cleaning.
CO3: To be familiar with Exploratory Analysis.
CO4: To be familiar with various Visualization concepts and issues.

UNIT-I (15 Hrs)

Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real-time issues.

UNIT-II (15 Hrs)

Data Cleaning: Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation.

UNIT-III (15 Hrs)

Exploratory Analysis: Descriptive and comparative statistics, Clustering and association, Hypothesis generation.

UNIT-IV (15 Hrs)

Visualization: Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity.

Recommended Books:

1. Glenn J. Myatt, 'Making Sense of Data: A Practical Guide to Exploratory Data Analysis and Data Mining'.

SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING

Subject Code: MCSES1-213 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. To fix software flaws and bugs in various software.
2. To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
3. Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
4. Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

Course Outcomes: After completion of course, students would be able to:

CO1: Differentiate between various software vulnerabilities.
CO2: Software process vulnerabilities for an organization.
CO3: Monitor resources consumption in a software.
CO4: Interrelate security and software development process

UNIT-I (15 Hrs)

Secure Software Design Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, perform security testing and quality assurance.

UNIT-II (15 Hrs)

Enterprise Application Development Describe the nature and scope of enterprise software applications, Design distributed Ntier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

Enterprise Systems Administration Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

UNIT-III (15 Hrs)

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

UNIT-IV (15 Hrs)

Handle insecure exceptions and command/SQL injection, defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.
Case study of DNS server, DHCP configuration and SQL injection attack.

Recommended Books:

1. Theodor Richardson, Charles N Thies, 'Secure Software Design', Jones & Bartlett.
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, 'Enterprise Software Security', Addison Wesley.

COMPUTER VISION

Subject Code: MCSES1-214 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. Be familiar with both the theoretical and practical aspects of computing with images.
2. Have described the foundation of image formation, measurement, and analysis.
3. Understand the geometric relationships between 2D images and the 3D world.
4. Grasp the principles of state-of-the-art deep neural networks.

Course Outcomes: After completion of course, students would be able to:

CO1: Developed the practical skills necessary to build computer vision applications.
CO2: To have gained exposure to object and scene recognition and categorization from images.
CO3:To extract number of features from data and to perform data pre-processing.
CO4: To perform pattern analysis and study the recent trends.

UNIT-I (15 Hrs)

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis.
Edge detection, Edge detection performance, Hough transform, corner detection.

UNIT-II (15 Hrs)

Segmentation, Morphological filtering, Fourier transform.

UNIT-III (15 Hrs)

Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, data pre- processing.

UNIT-IV (15 Hrs)

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi supervised. Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Nonparametric methods.
Recent trends in Activity Recognition, computational photography, Biometrics.

Recommended Books:

1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Deep Learning, by Good fellow, Bengio, and Courville.
3. Dictionary of Computer Vision and Image Processing, by Fisheretal.

HUMAN AND COMPUTER INTERACTION

Subject Code: MCSES1-221 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. Learn the foundations of Human Computer Interaction
2. Be familiar with the design technologies for individuals and persons with disabilities
3. Be aware of mobile Human Computer interaction.
4. Learn the guidelines for user interface.
5. Understand the structure of models and theories of human computer interaction and vision.
6. Design an interactive web interface on the basis of models studied.

Course Outcomes: After completion of course, students would be

CO1: Acquire fundamental concepts of computer components functions regarding interaction with human and vice versa.
CO2:Analyze interface problems to recognize what design approach and interaction styles is required in the light of usability standards and guidelines.
CO3: Utilize basic concepts to construct a user-interaction strategy for a given problem its usability evaluation and to meet desired needs within realistic constraints such as social, political and ethical norms.
CO4:Ability to design and develop an interface by using appropriate HCI techniques that are preferred by the user.

UNIT-I (15 Hrs)

Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models– frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT-II (15 Hrs)

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules– principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.
Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration Models-Hypertext, Multimedia and WWW.

UNIT-III (15 Hrs)

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT-IV (15 Hrs)

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.
Recent Trends: Speech Recognition and Translation, Multimodal System.

Recommended Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, 'Human Computer Interaction', 3rd Edn., Pearson Education, **2004.**
2. Brian Fling, 'Mobile Design and Development', 1st Edn., O17Reilly Media Inc., **2009**.
3. Bill Scott and Theresa Neil, 'Designing Web Interfaces', 1st Edn., O17Reilly, **2009**.

GPU COMPUTING

Subject Code: MCSES1-222 **L T P C** **Duration:60 Hrs.**
4 0 0 4

Course Objectives:
To learn parallel programming with Graphics Processing Units (GPUs).

Course Outcomes: After completion of course, students would be:

CO1: To Define terminology commonly used in parallel computing, such as efficiency and speedup.

CO2: To Describe common GPU architectures and programming models.

CO3: To Implement efficient algorithms for common application kernels, such as matrix multiplication.

CO4: To develop an efficient parallel algorithm to solve it and implement an efficient and correct code to solve it, analyze its performance, and give convincing written and oral presentations explaining the achievements.

UNIT-I (15 Hrs)

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA Open CL/Open ACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps/ Wave fronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D/ 3D thread mapping, Device properties, Simple Programs.

UNIT-II (15 Hrs)

Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multidimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories.

UNIT-III (15 Hrs)

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists,

Linked-lists. Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions, using libraries (such as Thrust), and developing libraries.

UNIT-IV (15 Hrs)

Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning.

Advanced Topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing.

Recommended Books:

1. David Kirk, Wen-meiHwu, Morgan Kaufman, 'Programming Massively Parallel Processors: A Hands-on Approach', (ISBN: 978-0123814722), **2010**.
2. Shane Cook; Morgan Kaufman, 'CUDA Programming: A Developer's Guide to Parallel Computing with GPUs', (ISBN: 978-0124159334), **2012**.

DIGITAL FORENSICS

Subject Code: MCSES1-223 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:

1. Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools.
4. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.

Course Outcomes: After completion of course, students would be able to:

CO1: Understand relevant legislation and codes of ethics
CO2: Computer forensics and digital detective and various processes, policies and procedures
CO3: E-discovery, guidelines and standards, E-evidence, tools and environment.
CO4: Email and web forensics and network forensics.

UNIT-I (15 Hrs)

Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics.

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

UNIT-II (15 Hrs)

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, explain what the normal case would look like, define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

UNIT-III (15 Hrs)

Computer Forensics: Prepare a case, begin an investigation, understand computer forensics workstations and software, conduct an investigation, complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT-IV (15 Hrs)

Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.
Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.

Recommended Books:

1. John Sammons, 'The Basics of Digital Forensics', Elsevier.
2. John Vacca, 'Computer Forensics: Computer Crime Scene Investigation', Laxmi Publications.

ADVANCED ALGORITHMS LAB.

Subject Code: MCSES1-204 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives:
To learn different strategies of algorithms to solve the real life problems.

COURSE OUTCOMES:
At the end of this course, students will be able to
CO1: To implement shortest path algorithm.
CO2: To implement all-pairs shortest path algorithm
CO3: To implement divide and conquer strategy
CO4: To convert base (decimal/hexa) representation to modulo representation.

Programs may be implemented using C/C++/java
Expt. 1: Program to implement Dijkstra's algorithm for single-source shortest path in a weighted directed graph.
Expt. 2: Program to find all-pairs shortest path using Floyd-Warshall algorithm.
Expt. 3: Program to find inverse of a triangular matrix using divide and conquer strategy. **Expt. 4:** Program to convert base (decimal/hexa) representation to modulo representation. **Mini Project:** Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

SOFT COMPUTING LAB.

Subject Code: MCSES1-205 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

COURSE OBJECTIVES

Students would be able to learn the feasibility of applying a soft computing methodology for a particular problem

COURSE OUTCOMES: At the end of this course, students will be able to

CO1: Recognize the feasibility of applying a soft computing methodology for a particular problem
CO2:Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
CO3: Apply genetic algorithms to combinatorial optimization problems
CO4:Apply neural networks to pattern classification and regression problems and Effectively use of existing software tools to solve real problems using a soft computing approach.

Programs may be implemented using Matlab/Python

Expt. 1: Program to implement array operations in Python
Expt. 2: Program to append strings using functions in Python
Expt. 3: Study of Neural Network Tool Box/ use of Library functions
Expt. 4: Study of Fuzzy Logic Tool Box/ use of Library functions
Expt. 5: Program to perform operations on fuzzy sets.
Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

RESEARCH METHODOLOGY AND IPR

Subject Code: MREM10-101 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives:
To learn the fundamentals of Operating Systems and gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols

Course Outcomes: At the end of this course, students will be able to

CO1: Understand research problem formulation, analyze research related information, Follow research ethics

CO2: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO3: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

CO4: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I (15 Hrs)

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT-II (15 Hrs)

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT-III (15 Hrs)

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. Introduction to international Scenario on Intellectual Property, Procedure for grants of patents, Patenting under PCT.

UNIT-IV (15 Hrs)

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases.

New Developments in IPR: Administration of Patent System. New developments in IPR: introduction to IPR of Biological Systems, Computer Software etc. Traditional Knowledge Case Studies, IPR or IITs

Recommended Books:

1. Stuart Melville and Wayne Goddard, 'Research methodology: An Introduction for Science & Engineering Students'.
2. Wayne Goddard and Stuart Melville, 'Research Methodology: An Introduction'.
3. Ranjit Kumar, 2nd Edn., 'Research Methodology: A Step by Step Guide for Beginners'.
4. Halbert, 'Resisting Intellectual Property', Taylor & Francis Ltd., **2007**.
5. Mayall , 'Industrial Design', McGraw Hill, **1992**.
6. Niebel , 'Product Design', McGraw Hill, **1974**.
7. Asimov, 'Introduction to Design', Prentice Hall, **1962**.Robert P. Merges, Peter S. Menell, Mark A. Lemley, 'Intellectual Property in New Technological Age', **2016**.

8. T. Ramappa, 'Intellectual Property Rights Under WTO', S. Chand, **2008.**