MSCCS-Final / MCA 2nd Year
Syllabus

Course Code: MSCCS-201, 07/MCA-201
Course Name: Data Structure and Algorithm

Unit 1: Introduction to Data Structures
Introduction, Data and Information, Definition and Need of Data Structure, Definition of Data Structure, Classification of Data Type, Primitive Data Type, Composite Data Type, Extract Data Type, Implementation of Data Type, Array, Address Calculation in 1D Array, Classification of Data Structure, Simple Data Structure, Compound Data Structure, Linear Data Structure, Non Linear Data Structure, Algorithm Writing and Convention, Characteristics of Algorithm, Analysis and Efficiency of Algorithm, Time and Space Complexity of Algorithm, Algorithm Complexity and Order Notations.

Unit 2: Arrays
Introduction, 2- Dimensional Array, Representation of Array in Memory: Memory Representation of Two Dimensional Array, Memory Representation of 3 Dimensional Array, Memory Representation of Multidimensional Array, Address Calculation Using Column and Row Major Order: Multi Dimensional Array, Row Major Storage Implementation, Column Major Storage Implementation, Simple Matrix Multiplication Algorithm and Their Complexity: Multiplication of Two Matrices, Algorithm for Multiplication of Two Matrices, Sparse Matrices: Different Form of Sparse Matrices, Array Based Representation of Sparse Matrices.

Unit 3: Link Lists
Definition of Linked List, Need of Linked List, Memory Allocation: Static Memory Allocation, Dynamic Memory Allocation, Advantages of Linked List Over Array, Type of Link List, Representation of Linked List in Memory, Implementation of Linked List: Creation of Linked List, Insertion in Linked List, Deletion in Linked List, Traversal of Linked List, Searching in Linked List, Doubly Linked List, Circular Linked List, Linked List Representation of Sparse Matrix.

Unit 4: Stack Data Structure
Introduction, Operation on Stack, Implementation of Stack: Static Implementation of Stack, Dynamic Implementation of Stack, Applications of Stack.

Unit 5 Queue Data Structure
Introduction, Operations on Queue, Implementation of Queue: Static Implementation of Queue, Dynamic Implementation of Queue, Other Type of Queue: Circular Queue, Deque, Priority Queue, Applications of Queue.

Unit 6: Tree Data Structure
Introduction to Tree, Binary Tree, Binary Tree Traversal: Inorder Traversal, Preorder Traversal, Postorder Traversal, Operation on Binary Tree: Searching, Insertion, Deletion, Sort, Applications of Tree: Arithmetic Expression Evolution, Some Operation on Tree: Counting the number of Node in a Binary Tree, Swapping of Left and Right Subtree of a given Binary Tree, Searching for a Target Key in a Binary Search Tree.

Unit 7: Advanced Tree
Introduction, Threaded Binary Tree, AVL Tree, Multiway Tree, B Tree, B+ Tree, Trie and Dictionary.

Unit 8: Graph Theory Fundamentals

Introduction, Definition of Graph, Types of Graph, Data Structure of Graph Representation, Graph Traversal Algorithm: Breadth First Traversal, Depth First Traversal, Shortest Path Algorithm: Dijkstra Single Source Shortest Path Algorithm, Bellman Ford Single Source Shortest Path Algorithm, Floyd-Warshall All-Pairs Shortest Path Algorithm, Minimum Spanning Tree: Prime Algorithm for MST, Kruskal Algorithm for MST.

Unit 9: Graph Theory Algorithms
Introduction, Planarity Detection Technique, Algorithm for Connectivity, Planarity Testing.

Unit 10 Graph Theory Application
Topological Sort Network Flow Problem Traveling Salesman Assignment Problems

Unit 11 Sorting Algorithms
Introduction to Sorting Algorithms and Complexities, Bubble Sort, Selection Sort, Insertion Sort, Heap sort, Quick Sort, Merge Sort, Bucket Sort, Radix Sort.

Unit 12: Algorithm Design Techniques
Introduction, Divide and Conquer strategy, Greedy Methods: Minimal Spanning Tree, Knapsack Problem, Job Sequencing, Optimal Merge Pattern.

Unit 13: Dynamic Programming
Dynamic Programming in Computer Programming, Matrix Chain Multiplication, Branch and Bound Method, Travelling Salesman Problem.

Unit 14: Problem Classes
NP Complete Problem: Solving NP Complete Problem, Decision Problem. Cook Levin Theorem, Vertex Cover.