MCAH104: ADVANCED DATA STRUCTURE AND ALGORITHMS

Hours/Week: 4 I.A. Marks: 30

Credits: 4 Exam. Marks: 70

Course Learning Objectives: Students will try to learn,

1. Understand and remember algorithms and its analysis procedure.
2. Design and implement various data structures algorithms.
3. To introduce various techniques for representation of the data in the real world
4. Compute the complexity of various algorithms.

Course Outcomes: After completing the course, the students will be able to,

CO1: Ensure that the student evolves as a competent programmer capable of design, analyze and implement algorithms and data structures for different kinds of problems.

CO2: Expose the student to the algorithm analysis techniques, to the theory of reductions, and to the classification of problems into complexity classes like NP.

CO3: Design and analyze programming problem statements, choose appropriate data structures and algorithms for a specific problem.

CO4: Understand the necessary mathematical abstraction to solve problems, Come up with analysis of efficiency and proofs of correctness.

CO5: Comprehend and select algorithm design approaches in a problem specific manner.

CO6: Come across the importance of graphs and their features for the applications uses.

CO7: Gathering the real strategies searching and sorting techniques.

12Hrs.

UNIT-I

Review of Basic Data Structures: Arrays, Stack, Queue, Circular Queue, Linked List-Singly Linked List, Doubly Linked List, Circular Linked List. Introduction to Algorithms: Algorithms, Performance Analysis – time complexity and space complexity, O-notation, Omega notation and Theta notation.

UNIT-II

12Hrs.

Introduction to Nonlinear Data Structures, Search Trees: Trees, Binary trees, Binary Tree Traversal, Applications of Binary Trees, Binary Search Trees- Searching, Insertion and Deletion on Binary Search Trees, Balanced Search Trees- AVL Trees- Insertion and deletion on AVL Trees, Red –Black Tress- Representation, Insertion and Deletion on Red –Black Trees, Splay Trees - Representation, Insertion and deletion on Splay Trees, Introduction to B Trees, Comparison of Search Trees. Heaps: Representation, Insertion and Deletion on Heaps.

12Hrs.

UNIT-III

Graphs: Introduction to Graphs, digraphs, Sub-graphs, Paths, Walks, Graphs Representation, Graph Traversals - Depth-first and breadth-first traversal , Applications of graphs - Minimum Spanning Tree – Prim's and Kruskal's algorithms.

Hashing: Introduction to hashing, Hash Table Representation, Hash Functions, Collision Resolution-Separate Chaining, Open Addressing-Linear Probing, Quadratic Probing, Double Hashing.

UNIT-IV **12Hrs.**

Design Strategies: Divide and Conquer- Binary Search, Finding Maximum and Minimum, Merge Sort, Greedy method - Job sequencing with deadlines, Backtracking- 8 Queens problem, Sum of Subsets, Branch and Bound- 0/1 Knapsack problem, Dynamic Programming – Optimal Binary Search Tree, Introduction to NP-Hard and NP-Completeness.

REFERENCE BOOKS:

1. Mark A. Weiss, "Data structures and Algorithm analysis in C++ (Java)", Fourth Edition, PHI ,2013.
2. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms" Pearson Education, 2015.
3. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, 2007.