

## 24CSH102: ADVANCED DATA STRUCTURES AND ALGORITHMS

Hours/Week: 4

I.A. Marks: 30

Credits: 4

Exam. Marks: 70

### Course Learning Objectives:

- Understand and analyze algorithms
- Design and implement various data structures suitable for different applications
- To introduce various techniques for representation of the data in the real world
- Compute the complexity of various algorithms.

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

- Ensure that the student evolves as a competent programmer capable of design, analyze and implement algorithms and data structures for different kinds of problems.
- Expose the student to the algorithm analysis techniques, to the theory of reductions, and to the classification of problems into complexity classes like NP.
- Design and analyze programming problem statements, choose appropriate data structures and algorithms for a specific problem.
- Understand the necessary mathematical abstraction to solve problems, Come up with analysis of efficiency and proofs of correctness.
- Comprehend and select algorithm design approaches in a problem specific manner.
- Come across the importance of graphs and their features for the applications uses.
- Gathering the real strategies searching and sorting techniques.

### UNIT-I

12Hrs.

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.

Search Trees: Introduction to Nonlinear data structure, 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 Trees- Representation, Insertion and Deletion on Red -Black Trees, Heaps: Representation, Insertion and Deletion on Heaps.

### UNIT-III

12Hrs.

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, Merge Sort, Greedy method- Job sequencing with deadlines, Dynamic Programming – Optimal Binary Search Tree, Backtracking- 8 Queens problem, Introduction to NP-Hard and NP-Completeness.

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#### REFERENCE BOOKS:

1. Mark A. Weiss, "Data structures and Algorithm analysis in C++(Java)", Fourth Edition, PHI , 2013.
2. Anany Levitin, "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.

