ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Code: 13IT2104 **L P C**
4 0 3

Pre requisites:

1. Computer Programming through C.
2. Data Structures.
3. Design and Analysis of Algorithms.

Course Outcomes:

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

CO 1: Use abstract data type.
CO 2: Implement priority queues and sorting algorithms.
CO 3: Discover solutions for graph problems.
CO 4: Devise solutions using algorithm design techniques.
CO 5: Implement advanced data structures.

Unit-I

Lists, Stacks, Queues and Trees: Lists, Stacks and Queues: Abstract Data Types (ADTs), The List ADT, Vector and list in the STI, Implementation of vector, Implementation of list, The Stack ADT, The Queue ADT.

Trees: The Search Tree ADT – Binary Search Trees, AVI. Trees, Splay Trees, B-Trees.

Hashing: Hashing: General idea, Hash Function, Separate Chaining, Hash Tables Without Linked Lists, Rehashing, Extendible Hashing.

Unit-II

Priority Queues: Implementations, Binary Heap, Applications of Priority Queues, *d*-Heaps, Leftist Heaps, Skew Heaps, Binomial Queues.

Sorting: Sorting: A Lower Bound for Simple sorting Algorithms, Shellsort, Heapsort, Mergesort, Quicksort, Indirect Sorting, A General Lower Bound for sorting, Bucket Sort, External Sorting.

Unit-III

The Disjoint Set Class: Equivalence Relations, The Dynamic Equivalence Problem, Basic Data Structure, Smart Union Algorithms, Path Compression, Worst Case of Union-by-Rank and Path Compression, An Application.

Graph Algorithms: Definitions, Topological sort, Shortest-Path Algorithms, Network Flow Problems, Minimum Spanning Tree, Applications of Depth-First Search, introduction to NP-Completeness.

Unit -IV

Algorithm Design Techniques: Greedy Algorithms, Divide and Conquer, Dynamic Programming, Randomized Algorithms, Backtracking Algorithms.

Amortized Analysis: An Unrelated Puzzle, Binomial Queues, Skew Heaps, Fibonacci Heaps, Splay Trees.

Unit-V

Advanced Data Structures and Implementation: Top-Down Splay Trees, Red-Black Trees, Deterministic Skip lists, AA-Trees, Treaps, *k*-d Trees, Pairing Heaps.

Text Books:

1. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C++*, 3rd Edition, Pearson Education, 2007.

References:

1. Sartaj Sahni, *Data Structures Algorithms and Applications in C++*, 2nd Edition, Universities Press, 2007.
2. Ellis Horowitz, Sartaj Sahni, Rajasekharan, *Fundamentals of Algorithms*, 2nd Edition, Universities Press, 2009.
3. Aho V Alfred, Hapcroft E John, Ullman D Jeffry, *Data Structures and Algorithms*, 1st Edition, Pearson Education, 2002.
4. Adam Drozdek, Thomson, *Data Structures and Algorithms in JAVA*, 3rd Edition, Cengage Learning , 2008.
5. Horowitz, Sahni, Mehta, *Fundamentals of Data Structures in C++*, 2nd Edition, Universities Press, 2007.

Web references:

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