# DATA STRUCTURES AND ALGORITHMS

**Course code: 13CS2101**

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**Pre requisites: Graph Theory, Design and Analysis of Algorithms, C**

**Course Outcomes:**

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

CO1: Use the appropriate abstract data type for formulating solution for the given problem.

CO2 : Design priority queues using heaps and compare the complexities of various sorting algorithms.

CO3 :Examine the solution for dynamic equivalence problem using find and smart union algorithms and discover solutions for various graph problems.

CO4 :Extrapolate various algorithm design techniques with examples and compute amortized analysis for skew heaps, binomial queues, splay trees.

CO5 :Apply various advanced data structures like red-black trees, heaps, AA trees, k-d trees etc in relevant application needed.

**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.

**UNIT-II**

Hashing and Priority Queues Hashing: General idea, Hash Function, Separate Chaining, Hash Tables Without Linked Lists, Rehashing, Extendible Hashing Priority Queues: Implementations, Binary Heap, Applications of Priority Queues, *d*-Heaps, Leftist Heaps, Skew Heaps, Binomial Queues.

**UNIT-III**

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

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.

**UNIT-IV**

Graph Algorithms Definitions, Topological sort, Shortest-Path Algorithms, Network Flow Problems, Minimum Spanning Tree, and Applications of Depth-First Search. Greedy Algorithms, Divide and Conquer, Dynamic Programming, Randomized Algorithms, Backtracking Algorithms.

**UNIT-V**

Amortized Analysis An Unrelated Puzzle, Binomial Queues, Skew Heaps, Fibonacci Heaps, Splay Trees.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, 2007.

**References:**

1. Sartaj Sahni, "Data Structures Algorithms and Applications in C++", 2nd Edition, Universities Press, 2007.
2. Ellis Horowitz, Sartaj Sahni, S. Rajasekharan , "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press, 2008.
3. A. V. Aho, J. D. Ullman, "Data Structures and Algorithms" , 1st Edition, Pearson Publication, 2003.
4. Adam Drozdek ; "Data Structures and Algorithms in C++", 3rd Edition, Cengage, 2006.
5. Horowitz Sahni, Mehta, "Fundamentals of Data Structures in C++", 2nd Edition, University Press 2007.