(CS605) DATA STRUCTURES & ALGORITHMS

Objective of the Course :

The course will introduce data structures to students by comparing how data actually stored in a computer with abstract structures that programmers use. Students will learn how to use & manipulate several core data structures like arrays, linked lists, trees, stacks & queues.

UNIT - I

Analysis : Mathematical Background, RAM Model- notations, Recurrence analysis, What to Analyze, Running Time Calculations. Master's theorem and its proof, Amortized analysis. Disjoint sets, Union by rank and path compression

UNIT - II

Lists, Stacks, and Queues : Abstract Data Types (ADTs), The List ADT, Lists in the Java Collections API, Implementation of ArrayList, Implementation of LinkedList, The Stack ADT, The Queue ADT.

Trees : Preliminaries, Binary Trees, The Search Tree ADT–Binary Search Trees, AVL Trees, Splay Trees, Red black trees, Tree Traversals (Revisited), B-Trees, Sets and Maps in the Standard Library.

UNIT - III

Hashing : Hashing General Idea, Hash Function, Separate Chaining, Hash Tables Without Linked Lists, Rehashing, Hash Tables in the Standard Library, Extendible Hashing.

Priority Queues (Heaps) : Model , Simple Implementations, Binary Heap, Applications of Priority Queues, *d*-Heaps, Leftist Heaps, Skew Heaps, Binomial Queues, Priority Queues in the Standard Library

UNIT - IV

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

Graph Algorithms & Complexity: Matroid theory, All-pairs shortest paths, maximum flows and Bipartite matching.

UNIT - V

Complexity classes: NP-Hard and NP-Complete problems- cook's theorem NP completeness reductions. Approximation Algorithms: polynomial time and full polynomial time approximation schemes

TEXT BOOKS :

- 1. Horowitz Sahni and Rajasekaran, "Computer algorithms/c++, Galgotia publications", 2004.
- 2. Mark Allenweiss, "Data Structures and Algorithms Analysis", 2nd ed., Pearson Education, 2006.
- 3. John R Hubbard, "Data Structures with Java", 2nd ed., Schaum's outlines, 2009

REFERENCE BOOKS:

- 1. A. V. Aho, J. E. Hopcroft, J. D. Ullman, "The Design and Analysis of Computer Algorithms". 1st ed., Addison-Wesley, 1983.
- 2. T.H. Cormen, C.E. Leiserson, R.L. Rivest, "Introduction to Algorithms", 2nd ed., Prentice Hall India, 2001.