

## PCS104 ADVANCED DATA STRUCTURES AND ALGORITHMS

L	T	P	Cr
3	0	4	5.0

**Course Objective:** To learn the advanced concepts of data structure and algorithms and its implementation .The course has the main ingredients required for a computer science graduate and has all the necessary topics for assessment of data structures and algorithms.

**Introduction to Basic Data Structures:** Importance and need of good data structures and algorithms, Arrays, Linked lists, Stacks, Queues, Priority queues, Heaps; Strategies for choosing the appropriate data structures.

**Advanced Data Structures:** AVL Trees, Red-Black Trees, Splay Trees,B-trees, Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures.

**Algorithms Complexity and Analysis:** Probabilistic Analysis, Amortized Analysis, Competitive Analysis, Internal and External Sorting algorithms:Linear Search, Binary Search, Bubble Sort, Selection Sort, Insertion Sort, Shell Sort, Quick Sort, Heap Sort, Merge Sort, Counting Sort, Radix Sort.

**Graphs & Algorithms:** Representation, Type of Graphs, Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, , Depth- and breadth-first traversals, Minimum Spanning Tree: Prim's and Kruskal's algorithms, Shortest-path Algorithms: Dijkstra's and Floyd's algorithm, Topological sort, Max flow: Ford-Fulkerson algorithm, max flow – min cut.

**String Matching Algorithms:** Suffix arrays, Suffix trees, tries, Rabin-Karp, Knuth-Morris-Pratt, Boyer-Moore algorithm.

**Approximation algorithms:** Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms;Knapsack, TSP, Set Cover, Open Problems.

**Randomized algorithms:** Introduction,Type of Randomized Algorithms, Quick Sort, Min- Cut, 2-SAT; Game Theoretic Techniques, Random Walks.

**Online Algorithms:** Introduction,Online Paging Problem, Adversary Models, k-server Problem.

**Laboratory Work:** To Implement in detail the data structures and algorithms given above in a high level programming language.

**Recommended Books:**

1. Thomas Cormen, "Introduction to Algorithms", Third edition, Prentice Hall of India (2009).
2. Kleinberg J., Tardos E., "Algorithm Design", 1<sup>st</sup> Edition, Pearson, 2012.
3. Motwani R., Raghavan P., "Randomized Algorithms", Cambridge University Press, 1995.
4. **Vazirani**, Vijay V., "Approximation Algorithms", Springer, 2001.

### COURSE LEARNING OUTCOMES (CLOs)

Students will be able to:

CLO1	Understand data structures, needs, basic types of data structures, selection the data structures at assessment level.
CLO2	Assess the concepts of types of advanced data structures, Internal and External Sorting algorithms
CLO3	Assess the concepts of Graph algorithms: Representation, type of Graphs, Paths and Circuits and traversal.
CLO4	Assess the concept of String Matching Algorithms, implement the different Approximation algorithms, Randomized and Online algorithms

### Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	20
2.	EST	40
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40