PCS108 ADVANCED DATA STRUCTURES

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

Introduction: Overview of various linear and non-linear data structures.

Complexity Analysis: Introduction to asymptotic complexity, Complexity of recursive algorithms, Amortized complexity, Complexity analysis of various sorting and searching techniques, Sorting in linear time.

Tree Structures: AVL Trees, Red-Black Trees, Splay Trees, B-trees, B+ Trees, Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures, Self-Adjusting Data Structures, Temporal data structures, Succinct data structures, Dictionaries and cuckoo hashing.

Data Structures for Graphs and Related Algorithms: Representation, Type of graphs, Paths and circuits:, Euler graphs, Hamiltonian paths and circuits, Cut-sets, Connectivity and separability, Planar graphs, Isomorphism, Graph colouring, Covering and partitioning, Depth- and breadth-first traversals, Minimum spanning tree: Primôs and Kruskalôs algorithms, Shortest-path Algorithms: Dijkstraôs and Floydôs algorithm, Topological sort, Max flow: Ford-Fulkerson algorithm, Max flow-min cut.

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

Recommended Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, The MIT Press.
2. Y. Langsam, M. J. Augenstein, and A. O. Tenenbaum, Data Structures Using C and C++, Pearson Education India.
3. Peter Brass, Advanced Data Structures, Cambridge University Press.
4. J. Kleinberg and E. Tardos, Algorithm Design, Pearson Education India.
5. E. Horowitz, S Sahni, & S. Rajasekaran, Computer Algorithms, Computer Science Press.

Course Learning Outcomes (CLOs): After the completion of this course the student will be able to:

CLO1	Analyse the algorithms associated with advanced data structures.
CLO2	Implement basic data structures and analyse them to solve fundamental problems.
CLO3	Implement different tree data structures and differentiate themwith respect to their applications.
CLO4	Identify properties of graphs and employ them to model a variety of real-world problems.