23CS21T1 - ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS
(Common to CSE, CSE (DS), CSE (AI&ML), AI&DS, and IT)

Course Category:	Professional Core	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practical:	3-0-0
Prerequisite:	Data Structures, Algorithms, and Strong programming skills in at least one high-level language	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	30 70 100
Objectives:	- To provide knowledge on advance data structures frequently used in Computer Science domain. - To develop skills in algorithm design techniques popularly used. - To understand the use of various data structures in the algorithm design.		

	Upon successful completion of the course, the students will be able to:	
Course Outcomes	CO1	Illustrate the working of the advanced tree data structures and their applications (L2). Analyze algorithms with respect to space and time complexities (L4).
	CO2	Understand the Graph data structure, traversals and apply them in various contexts. (L2)
	CO3	Use greedy methods and dynamic programming to solve optimization problems.(L3)
	CO4	Use backtracking and branch and bound for solving scheduling, resource allocation, and pathfinding problems.(L3)
	CO5	Understand the fundamental concepts of NP-Hard and NP-Complete problems (L2) and will be able to analyze NP-Hard problems in graph theory. (L4)
Course Content	**UNIT-I** **Introduction**: Introduction to Algorithm Analysis, Space and Time Complexity Analysis, Asymptotic Notations. **AVL Trees**: Creation, Insertion, Deletion operations and Applications. **B Trees:** Creation, Insertion, Deletion operations and Applications. **UNIT-II** **Heap Trees (Priority Queues):** Min and Max Heaps, Operations and Applications. **Graphs:** Terminology, Representations, Basic Search and Traversals, Connected Components and Bi connected Components, applications. **Divide and Conquer**: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull. **UNIT-III** **Greedy Method**: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths - Dijkstra's. **Dynamic Programming**: General Method, All pairs shortest paths, Optimal Binary Search Trees, 0/1Knapsack, String Editing, Travelling Salesperson problem.	

	UNIT-IV **Backtracking:** General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem. **Branch and Bound:** The General Method, 0/1 Knapsack Problem, Travelling Sales person problem. **UNIT-V** **NP Hard and NP Complete Problems:** Basic Concepts, Cook's theorem (Without Proof). **NP Hard Graph Problems:** Clique Decision Problem (CDP), Traveling Salesperson Decision Problem (TSP) **NP Hard Scheduling Problems:** Scheduling Identical Processors.
Text Books & References Books	**TEXT BOOKS:** 1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh 2nd Edition Universities Press 2. Fundamentals of algorithms, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran 2nd Edition University Press. **REFERENCE BOOKS:** 1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia 2. An introduction to Data Structures with Applications, Trembley & Sorenson, McGraw-Hill 3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997. 4. Data Structures using C : Langsam, Augenstein & Tanenbaum, Pearson, 1995 5. Algorithms + Data Structures &Programs:,N.Wirth, PHI 6. Data structures in Java: Thomas Standish, Pearson Education Asia
E-Resources	1. https://www.tutorialspoint.com/advanced_data_structures/index.asp 2. http://peterindia.net/Algorithms.html 3. Abdul Bari, 1. Introduction to Algorithms (youtube.com)