# 23CS21T1 - ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS

(Common to CSE, CSE (DS), CSE (AI&ML), AI&DS, and IT)

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| 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: | 3070100 |
| 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.
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| Course Outcomes | Upon successful completion of the course, the students will be able to: |
| 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 &ReferencesBooks | **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

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| 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)
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