II Year B.Tech. AI & ML – I Semester

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3	0	0	3

(23A05302T) ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS

Course Objectives: The main objectives of the course is to
- provide knowledge on advance data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

Course Outcomes: After completion of the course, students will be able to
- Illustrate the working of the advanced tree data structures and their applications (L2)
- Understand the Graph data structure, traversals and apply them in various contexts. (L2)
- Use various data structures in the design of algorithms (L3)
- Recommend appropriate data structures based on the problem being solved (L5)
- Analyze algorithms with respect to space and time complexities (L4)
- Design new algorithms (L6)

UNIT – I:
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 Biconnected 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
Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, 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 Salesperson problem

UNIT – V:
NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem

NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)
NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Textbooks:
1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh 2nd Edition Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran2nd 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 & C++: Langsam, Augenstein&Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures &Programs:,N.Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni& Mehta, Galgottia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia

Online Learning 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)