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Date:

MC460304

*Design and Analysis of Algorithms*

L-T-P-Cr: 3-0-2-4

**Pre-requisites:** Data Structures, Knowledge of Programming languages.

**Objectives:**

1. To introduce and implement various techniques for designing algorithms and advanced data structures.
2. To learn space and time complexity analysis of algorithms.

**Course Outcomes:**

At the end of the course, students will be able to:

Sl. No.	Outcome	Mapping to POs
1.	Analyze the best, average, and worst-case running times of algorithms using asymptotic analysis.	PO2, PO1
2.	Understand and analyze the divide-and-conquer technique of writing the algorithms and the situation to apply this technique.	PO2, PO3
3.	Understand and analyze the greedy technique of writing the algorithms and the situation to apply this technique.	PO2, PO3
4.	Understand and analyze the dynamic programming technique of writing the algorithms and the situation to apply this technique.	PO2, PO3
5.	Understand and analyze the backtracking and branch & bound techniques of writing the algorithms and the situation to apply this technique	PO2, PO3
6.	Understand and analyze various graph algorithms and the real-life situations to apply these algorithms	PO2, PO3
7.	Analyzing capability for a given problem and decision about choosing efficient algorithm type to solve	PO2, PO3

**UNIT I: Introduction:**

**Lectures: 07**

Algorithm, performance evaluation of algorithms, space & time complexity, notion of optimality, Master's Theorem. **Divide and Conquer:** General Concept, Finding the maximum and minimum, Quick Sort, Merge Sort, Binary Search, Strassen's matrix multiplication.

**UNIT II: Greedy Algorithm:**

**Lectures: 08**

General Concept, Knapsack Problem (Fractional Knapsack), Job Sequencing with Deadline, Huffman's Codes, Minimum Cost Spanning Tree- Kruskal's Algorithm, Prim's Algorithm, Single Source Shortest Path-Dijkstra's Algorithm.

**UNIT III: Dynamic Programming:****Lectures: 08**

General Concept, Matrix-Chain Multiplication, Knapsack Problem DP solution, Activity selection problem DP solution, Single Source Shortest Path- Bellman Ford Algorithm, All pairs shortest paths, Traveling salesman problem.

**UNIT IV: Backtracking:****Lectures: 08**

Basic idea, 8-Queens problem, Graph Coloring, Hamiltonian Cycles. **Branch-And-Bound:** Basic idea, LC search, the 15-puzzle problem, LC Branch-and-Bound, 0/1 Knapsack Problem.

**UNIT V: Graph Algorithms:****Lectures: 08**

Breadth First Search (BFS), Depth First Search (DFS), Strongly Connected Components, Bi-Connected Components and DFS, Minimum Spanning Tree---Kruskal's and Prim's Algorithms; Hamiltonian Path and Hamiltonian Circuit, Euler Tour, Topological sort.

**UNIT VI: Introduction to NP-Completeness:****Lectures: 03**

Basic concepts on NP- hard and NP-Complete Problems, Discussion on one NP- hard graph problem- CDP.

**Text/Reference Books:**

- 1) *Introduction to Algorithm*, 2e, by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, PHI
- 2) *Beginning Algorithms* by Simen Harris, James Ross, Wiley India.
- 3) *Fundamentals of Computer Algorithms* by E. Horowitz and S. Sahni, Galgotia,