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***CS4403 Design and Analysis of Algorithms***

**L-T-P-Cr: 3-1-0-4**

**Pre-requisites:** None

**Objectives:**

* To provide a solid foundation in algorithm design and analysis.
* Apply important algorithmic design paradigms and methods of analysis.
* Synthesize efficient algorithms in common engineering design situations.

**Course Outcomes:**

At the end of the course, a student should have:

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| **Sl. No.** | **Outcome** | **Mapping to POs** |
|  | Analyze worst-case running times of algorithms using asymptotic analysis. | PO2, PO1 |
|  | Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. | PO2, PO3 |
|  | Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. | PO2, PO3 |
|  | Describe the greedy paradigm and explain when an algorithmic design situation calls for it. | PO2, PO3 |
|  | Analyzing capability for a given problem and decision about choosing efficient algorithm type to solve | PO2, PO3 |

**UNIT I: Introduction: 9 Lectures**

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**: **8 Lectures**

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: 8 Lectures**

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: 9 Lectures**

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: 7 Lectures**

Breadth First Search (BFS), Depth First Search (DFS), Strongly Connected Components, Bi-Connected Components and DFS, Euler Tour, Minimum Spanning Tree- Kruskal's Algorithm, Prim's Algorithm.

**UNIT VI: Introduction to NP-Completeness: 3 Lectures**

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,