# **15 MAMC 402 Design Analysis and Algorithms**

## Module-I

Basics of Algorithms and Mathematics: (2)

What is an algorithm?, Mathematics for Algorithmic Sets, Functions and Relations, Vectors and Matrices, Linear Inequalities and Linear Equations.

Analysis of Algorithm: (8)

The efficient algorithm, Average, Best and worst case analysis, Amortized analysis, Asymptotic Notations, Analyzing control statement, Loop invariant and the correctness of the algorithm, Sorting Algorithms and analysis: Bubble sort, Selection sort, Insertion sort, Shell sort Heap sort, Sorting in linear time : Bucket sort, Radix sort and Counting sort

### Module-II

Divide and Conquer Algorithm: (6)

Introduction, Recurrence and different methods to solve recurrence, Multiplying large Integers Problem, Problem Solving using divide and conquer algorithm - Binary Search, Max-Min problem, Sorting (Merge Sort, Quick Sort), Matrix Multiplication, Exponential.

Dynamic Programming: (5)

Introduction, The Principle of Optimality, Problem Solving using Dynamic Programming – Calculating the Binomial Coefficient, Making Change Problem, Assembly Line-Scheduling, Knapsack problem, All Points Shortest path, Matrix chain multiplication, Longest Common Subsequence.

## Module-III

Greedy Algorithm: (5)

General Characteristics of greedy algorithms, Problem solving using 05 20 Greedy Algorithm - Activity selection problem, Elements of Greedy Strategy, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Graphs: Shortest paths, The Knapsack Problem, Job Scheduling Problem, Huffman code.

Exploring Graphs: (4)

An introduction using graphs and games, Undirected Graph, Directed Graph, Traversing Graphs, Depth First Search, Breath First Search, Topological sort, Connected components,

Backtracking and Branch and Bound: (3)

Introduction, The Eight queens problem , Knapsack problem, Travelling Salesman problem, Minimax principle

#### Module-IV

String Matching: (3)

Introduction, The naive string matching algorithm, The Rabin-Karp algorithm, String Matching with finite automata, The Knuth-Morris-Pratt algorithm.

Introduction to NP-Completeness: (5)

The class P and NP, Polynomial reduction, NP- Completeness Problem, NP-Hard Problems. Travelling Salesman problem, Hamiltonian problem, Approximation algorithms

#### **Reference Books:**

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, PHI.

- 2. Fundamental of Algorithms by Gills Brassard, Paul Bratley, PHI.
- 3. Introduction to Design and Analysis of Algorithms, Anany Levitin, Pearson.
- 4. Foundations of Algorithms, Shailesh R Sathe, Penram
- 5. Design and Analysis of Algorithms, Dave and Dave, Pearson.