CSE408:DESIGN AND ANALYSIS OF ALGORITHMS

Course Outcomes: Through this course students should be able to

CO1 :: explain the basic techniques of analyzing the algorithms using space and time complexity, asymptotic notations

CO2 :: analyse various string matching algorithms and understand brute force algorithm design technique

CO3 :: understand divide and conquer algorithm design technique using various searching and sorting algorithms

CO4 :: define dynamic programming and greedy algorithm design technique and solve various all pair and single source shortest path problems

CO5 :: apply the backtracking method to solve some classic problems and understand branch and bound algorithm design technique

CO6 :: define various number theory problems and understand the basics concepts of complexity classes

Unit I

Foundations of Algorithm : Algorithms, Fundamentals of Algorithmic Problem Solving:, Basic Algorithm Design Techniques, Analyzing Algorithm, Fundamental Data Structure:, Linear Data Structure, Graphs and Trees, Fundamentals of the Analysis of Algorithm Efficiency:, Measuring of Input Size, Units for Measuring Running Time, Order of Growth, Worst-Case, Best-Case, and Average-Case Efficiencies, Asymptotic Notations and Basic Efficiency Classes:, O(Big-oh)-notation, Big-omega notation, Big-theta notation, Useful Property Involving the Asymptotic Notations, Using Limits for Comparing Orders of Growth

Unit II

String Matching Algorithms and Computational Geometry : Sequential Search and Brute-Force String Matching, Closest-Pair and Convex-Hull Problem, Exhaustive Search, Voronoi Diagrams, Naiva String-Matching Algorithm, Rabin-Karp Algorithm, Knuth-Morris-Pratt Algorithm

Unit III

Divide and Conquer and Order Statistics : Merge Sort and Quick Sort, Binary Search, Multiplication of Large Integers, Strassen's Matrix Multiplication, Substitution Method for Solving Recurrences, Recursion-Tree Method for Solving Recurrences, Master Method for Solving Recurrence, Closest-Pair and Convex-Hull Problems by Divide and Conquer, Decrease and Conquer: Insertion Sort, Depth-First Search and Breadth-First Search, Connected Components, Topological Sort, Transform and Conquer: Presorting, Balanced Search Trees, Minimum and Maximum, Counting Sort, Radix Sort, Bucket Sort, Heaps and Heapsort, Hashing, Selection Sort and Bubble Sort

Unit IV

Dynamic Programming and Greedy Techniques : Dynamic Programming: Computing a Binomial Coefficient, Warshall's and Floyd's Algorithm, Optimal Binary Search Trees, Knapsack Problem and Memory Functions, Matrix-Chain Multiplication, Longest Common Subsequence, Greedy Technique and Graph Algorithm: Minimum Spanning Trees, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Code, Single-Source Shortest Paths, All-Pairs Shortest Paths, Iterative Improvement: The Maximum-Flow Problem, Limitations of Algorithm Power: Lower-Bound Theory

Unit V

Backtracking and Approximation Algorithms : Backtracking: n-Queens Problem, Hamiltonian Circuit Problem, Subset-Sum Problem, Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesman Problem, Vertex-Cover Problem and Set-Covering Problem, Bin Packing Problems

Unit VI

Number-Theoretic Algorithms and Complexity Classes : Number Theory Problems: Modular Arithmetic, Chinese Remainder Theorem, Greatest Common Divisor, Optimization Problems, Basic Concepts of Complexity Classes- P, NP, NP-hard, NP-complete Problems

Text Books:

1. INTRODUCTION TO THE DESIGN AND ANALYSIS OF ALGORITHM by ANANY LEVITIN, PEARSON

References:

1. INTRODUCTION TO ALGORITHMS by C.E. LEISERSON, R.L. RIVEST AND C. STEIN, THOMAS TELFORD LTD.

2. THE DESIGN AND ANALYSIS OF COMPUTER ALGORITHMS by A.V.AHO, J.E. HOPCROFT AND J.D.ULLMAN, PEARSON

3. COMPUTER ALGORITHMS - INTRODUCTION TO DESIGN AND ANALYSIS by SARA BAASE AND ALLEN VAN GELDER, PEARSON

4. FUNDAMENTALS OF COMPUTER ALGORITHMS by HOROWITZ, S. SAHNI, GALGOTIA PUBLICATIONS