CAP538:ALGORITHM DESIGN AND ANALYSIS

L:3 T:0 P:0 Credits:3

Course Outcomes: Through this course students should be able to

CO1 :: understand the need of different algorithm design techniques

CO2 :: apply specific algorithms for solving a number of computational problems like sorting, searching, shortest-path and graph problems

CO3 :: analyze the asymptotic performance of algorithms

CO4 :: design and implement algorithms by using divide and conquer, greedy approach, dynamic programming and backtracking

Unit I

Introduction : Elementary Data Structures, Basic computational models, Analysis of algorithms: best case, average case and worst-case behavior, Asymptotic Notations: Big O Notation, Recursion, Recurrence relations to analyze recursive algorithms

Unit II

Divide and Conquer and Greedy Method : Divide and Conquer: General Method, Binary Search, Merge Sort, Quick Sort, Arithmetic with large integers, Greedy Method: General Method, Knapsack problem, Minimal Spanning Trees - Prim's and Kruskal's Algorithm, Single Source Shortest Paths

Unit III

Dynamic Programming and Backtracking : Dynamic Programming: General Method, Chained Matrix Multiplication, Optimal Storage on Tapes, All-Pairs Shortest Paths, Optimal Binary Search Trees, Backtracking: General Method, the 8-Queens Problem, Graph Coloring, Hamiltonian Cycles

Unit IV

Branch and Bound and Pattern Matching : Branch and Bound: General Method, 0/1 Knapsack problem, Travelling Salesperson, Design of algorithms for Pattern Matching problems: Brute Force, Knuth-Morris-Pratt, Boyer Moore algorithms, Huffman Coding and Data compression problems

Unit V

Lower Bound Theory and Approximation : Comparison tree, Oracles and Adversary arguments, Lower Bounds through Reductions, Approximation Basics, Task Scheduling, Bin Packing

Unit VI

Intractable Problems : Basic Concepts, Non-deterministic Algorithms, NP Completeness, Examples of NP-Hard and NP-Complete problems, Cook's Theorem, Problem Reduction

Text Books:

1. FUNDAMENTALS OF COMPUTER ALGORITHMS by E. HOROWITZ AND S. SAHANI, GALGOTIA PUBLICATIONS

References:

1. DESIGN AND ANALYSIS OF ALGORITHMS by HIMANSHU B. DAVE, PEARSON

2. DESIGN & ANALYSIS OF ALGORITHMS by R.C.T. LEE, MCGRAW HILL EDUCATION

3. DESIGN AND ANALYSIS OF COMPUTER ALGORITHMS by JOHN E. HOPCROFT, ADDISON-WESLEY