3/4 B.Tech - FIRST SEMESTER

IT5T2 DESIGN METHODS AND ANALYSIS OF ALGORITHMS Credits: 3
Lecture: 3 Periods/week Internal assessment: 30 marks
Practice/Interaction: 1Period/week Semester end examination: 70 marks

Objectives:

- To explain the paradigms and approaches used to analyze and design algorithms.
- To discuss efficient algorithms for simple computational tasks.
- To give an idea of time and space complexities of an algorithm.
- To get familiar with the behavior of algorithms for analyzing tractable and intractable problems.

Outcomes:

Students will be able to

- Design an algorithm and analyze its efficiency.
- Apply Brute Force techniques and perform various searching and sorting methods.
- Understand different techniques like Divide & Conquer, Decrease & Conquer and Transform & Conquer.
- Know a variety of greedy algorithms, dynamic programming approaches used to test for optimality.
- Understand Backtracking, Branch and Bound techniques and the basics of P and NP problems.

Prerequisites:

Discrete Mathematics, Probability& Statistics and Data Structures.

Syllabus:

UNIT-I

INTRODUCTION: Notion of Algorithm, Fundamentals of Algorithmic Problem Solving- Understanding the problem, deciding on appropriate data structures, Algorithm Design techniques, Methods of specifying an algorithm, proving an algorithm's correctness, Analyzing and coding an Algorithm. Fundamentals of the Analysis of Algorithm Efficiency Analysis framework and Asymptotic Notations and Basic Efficiency Classes

UNIT-II

BRUTE FORCE AND EXHAUSTIVE SEARCH: Selection sort, Bubble sort, Sequential search, Brute-Force String Matching. Exhaustive search- Travelling salesman problem, knapsack problem and Assignment problem.

UNIT-III

DIVIDE-AND-CONQUER: Mergesort, Quicksort, Binary Search, Binary Tree Traversals and Related Properties, Multiplication of large integers, Strassen's Matrix Multiplication.

DECREASE-AND-CONQUER & TRANSFORM-AND-CONQUER: DECREASE-AND-CONQUER Insertion Sort, Topological Sorting, Decrease-by-ConstantFactor Algorithms fake-coin problem, Josephus problem. TRANSFORM-AND-CONQUER Presorting, Heaps and heap sort, Horner's rule.

UNIT-IV

GREEDY TECHNIQUE: Prim's Algorithm, Kruskal's Algorithm Disjoint Subsets and Union-Find Algorithms, Dijkstra's Algorithm, Huffman trees.

DYNAMIC PROGRAMMING: Elements of DP, Matrix- chain multiplication, The Knapsack Problem and Memory Functions, Optimal Binary Search Trees, Warshall's and Floyd's Algorithms.

UNIT-V

LIMITATIONS OF ALGORITHM POWER: Decision Trees Decision Trees for Sorting Algorithms and Decision Trees for Searching Sorted Array. P, NP, and NP-complete Problems.

COPING WITH THE LIMITATIONS OF ALGORITHM POWER : Backtracking n-queens problem, Hamiltonian Circuit problem, Subset-sum problem. Branch-and-Bound Assignment Problem, Knapsack Problem and Travelling Salesman problem.

Text Book:

Introduction to The Design & Analysis of Algorithms, Anany Levitin, 2nd Edition, Pearson Education, 2007.

Reference Books:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 2ndEdition, PHI, 2006.
2. The design and Analysis of Computer Algorithms, 2nd Edition, Ellis Horowitz, SartajSahni and Rajasekharam, Galgotia publications.
3. Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, McGraw Hill.

e- Learning Resources:

1. http://nptel.ac.in/courses/106101060/ .
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-introduction-to-algorithms-sma-5503-fall-2005/video-lectures/ .