Design and Analysis of Algorithms

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
18CST42	4:0:0:0	4	CIE:50 SEE:50	3 Hours	FC

Course Objectives:

This course will enable students to:

- Acquire the knowledge of Algorithm and problem solving technique.
- Learn how to analyze the complexity of an algorithm in terms of time and space.
- Understand different techniques like divide and conquer, decrease and conquer etc., to solve problems.
- Understand different techniques like dynamic programming.
- Describe the limitations of algorithms.

Syllabus

Module - I

Introduction: What is an algorithm? Fundamentals of algorithmic problem solving, Fundamentals of the analysis of algorithm efficiency, Asymptotic Notations and basic efficiency classes, Mathematical Analysis of Non-Recursive and Recursive Algorithms Brute Force Approaches: Introduction, Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching. **10 Hours**

Module - II

Divide and conquer: Divide and Conquer: General Method, Binary Search, Merge Sort, Quick Sort and its performance.

The greedy method: The General Method, Job Sequencing with Deadlines, Minimum- Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm, Single Source Shortest Paths. **10 Hours**

Module - III

Decrease and conquer approaches: Introduction, Insertion Sort, Depth First Search and Breadth First Search, Topological Sorting.

Transfer and conquer: Introduction, Balanced search trees, Heap and Heap sort. **10 Hours**

Module - IV

Space-Time Trade-offs: Introduction, Sorting by Counting, Input Enhancement in String Matching (Horspool algorithm).

Dynamic programming: The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, The Travelling Salesperson problem, Computing a Binomial co-efficient. **10 Hours**

Module - V

Limitations of algorithmic power and coping with them: Lower-Bound Arguments, Decision Trees.

Backtracking: n - Queens problem, Subset – Sum Problem.

Hashing: Introduction, Open hashing, Closed hashing.

Branch and bound: Assignment problem, Knapsack problem. **10 Hours**

Course Outcomes:

On completion of this course, the students are able to :

- Identify asymptotic notations and basic efficiency classes.
- Solve problems using various techniques like greedy and divide-and-conquer.
- Compute problems using various techniques like decrease-and-conquer and transfer-and-conquer.
- Use different algorithms like TSP, Floyd's etc. to solve real world problems.
- Develop solutions for n - Queens problem, Subset – Sum Problem, Assignment problem, Knapsack problem etc.

Text Books:

1. Anany Levitin: "Introduction to The Design and Analysis of Algorithms", (Chapters 1-5,7,9,11), Pearson Education, Delhi, 2nd Edition, 2007, ISBN: 9780321358288.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran: "Fundamentals of Computer Algorithms", (Chapters 1,3-8,10-12), Universities Press, Hyderabad, 2nd Edition, 2007, ISBN: 10: 8173716129.

.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: "Introduction to Algorithms", PHI, London, England, 3rd Edition, 2010, ISBN: 9780262033848.
2. R.C.T. Lee, S.S. Tseng, R.C. Chang and Y.T. Tsai: "Introduction to the Design and Analysis of Algorithms A Strategic Approach", McGraw-Hill Higher Education, USA, International Edition, 2005, ISBN-13: 978-0071243469.

E-Resources:

1. http://www.pearsonhighered.com
2. http://www.citc.ui.ac.ir/zemoni/cls.pdf
3. http://cs.gmu.edu/~pwiegand/cs483-Spring06/lecturenotes/cs483-l1pf.pdf
4. http://www.cs.cornell.edu/~kozen/papers/daa.pdf