DESIGN AND ANALYSIS OF ALGORITHMS

COURSE CODE: 20CA3109 **L T P C**

3 0 0 3

Pre-Requisites: Problem Solving Using C, Data Structures & Algorithms

COURSE OUTCOMES:
At the end of the course, a student will be able to

CO1: Analyze complexity of Algorithms.
CO2: Distinguish time complexity using Divide & Conquer and Apply Greedy methods.
CO3: Illustrate various Dynamic programming techniques.
CO4: Link backtracking Methodology to appropriate problems.
CO5: Correlate NP Algorithms to problems.

UNIT-I **(12 Lectures)**

INTRODUCTION:
Algorithm, Algorithm Specification, Performance Analysis-Space complexity, Time complexity, Asymptotic Notations, Probabilistic analysis.
Randomized Algorithms - An informal description, Identifying repeated element, Advantages and Disadvantages.
Sets and Disjoint Set Union – Introduction, union and find operations.

Learning Outcomes:
At the end of the module, student will be able to

1. Apply various Asymptotic Notations on an algorithm. (L3)
2. Solve Problems using Randomized Algorithms. (L3)
3. Analyze algorithms related to union and find operations. (L4)

UNIT-II **(10 Lectures)**

DIVIDE AND CONQUER:
General method, Binary search, Quick sort, Merge sort, Strassen'smatrix multiplication.
GREEDY METHOD:
General method, knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm, Single source shortest paths.

Learning Outcomes:
At the end of the module, student will be able to

1. Apply Divide and Conquer strategy on searching and sorting. (L3)
2. Analyze the difference between Traditional Matrix Multiplication with Strassen's Multiplication using Divide and Conquer.(L4)
3. Solve Spanning trees and Single Source shortest paths using Greedy method. (L3)

UNIT-III **(10 Lectures)**

DYNAMIC PROGRAMMING:

General method, Matrix chain multiplication, All pairs shortest path, Optimal binary search trees, 0/1 knapsack problem, Reliability design, Travelling sales person problem.

Learning Outcomes:

At the end of the module, student will be able to

1. Apply Dynamic Programming on Matrix chain multiplication (L3)
2. Analyze optimal binary search trees. (L4)
3. Illustrate strategies in Reliability Design and travelling sales person problem. (L4)

UNIT-IV **(8 Lectures)**

BACKTRACKING:

General method, The 8-queens problem, sum of subsets, graph coloring, Hamiltonian cycles. Branch and Bound: Introduction, FIFO branch and bound, LC branch and bound.

Learning Outcomes:

At the end of the module, student will be able to

1. Analyze 8-queens problem using backtracking. (L4)
2. Correlate backtracking to sum of subsets and Hamiltonian cycles. (L4)
3. Apply trees using FIFO and LC branch and bound functions. (L3)

UNIT-V **(10 Lectures)**

BRANCH AND BOUND:

0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution, Travelling sales Person.

NP-HARD AND NP-COMPLETE PROBLEMS:

Basic concepts, Non deterministic algorithms, the classes NP - Hard and NP - Complete, Cook's theorem.

Learning Outcomes:

At the end of the module, student will be able to

1. Apply LC Branch and Bound function on 0/1 knapsack problem. (L3)
2. Examine Non deterministic algorithms for NP Problems. (L3)
3. Analyze complexities using Cook's theorem. (L4)

TEXT BOOK:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekharam,"*Fundamentals of Computer Algorithms"*, 2nd Edition, Univesity Press, 2008.

REFERENCES:

1. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein "*Introductionto Algorithms"*, 3rd Edition, PHI / Pearson Education, 2009.
2. R.C.T.Lee, S.S.Tseng, R.C.ChangandT.Tsai, *"Introduction to Design and Analysis of Algorithms A strategic approach"*, 2nd Edition, Tata McGrawHill, 2009.
3. Allen Weiss, "*Data structures and Algorithm Analysis in C++"*, 2nd Edition, Pearson Education, 2009.
4. Aho, Ullman and Hopcroft, *"Design and Analysis of algorithms"*, 3rd Edition, Pearson Education, 2008.

WEB REFERENCE:

1. http://nptel.iitm.ac.in/courses/106101060/