

DESIGN AND ANALYSIS OF ALGORITHMS

II Year II Semester: CSE/IT/CSIT

Course Code	Category	Hours / Week			Credits		Maximum Marks		
		L	T	P	C	CIE	SEE	Total	
A5CS08	PCC	3	1	-	4	30	70	100	

COURSE OBJECTIVES:

The course should enable the students to:

1. To demonstrate performance of algorithms with respect to time and space complexity.
2. To explain graph and tree traversals.
3. To explain the concepts greedy method and dynamic programming. Applying for several applications like knapsack problem, job sequencing with deadlines, and optimal binary search tree, TSP and so on respectively.
4. To illustrate the methods of backtracking and branch bound techniques to solve the problems like n-queens problem, graph colouring and TSP respectively.
5. To familiarize the concepts of deterministic and non-deterministic algorithms.

COURSE OUTCOMES:

At the end of this course students will be able to:

1. Identify various Time and Space complexities of various algorithms
2. Understand Tree Traversal method and Greedy Algorithms
3. Apply Dynamic Programming concept to solve various problems
4. Apply Backtracking, Branch and Bound concept to solve various problems
5. Implement different performance analysis methods for non deterministic algorithms

UNIT-I INTRODUCTION

Classes: 10

Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

UNIT-II FUNDAMENTAL ALGORITHMIC STRATEGIES – Part I

Classes: 12

DIVIDE AND CONQUER: General method, applications-analysis of binary search, quick sort, merge sort, AND OR Graphs.

GREEDY METHOD: Heuristics –characteristics, Applications-job sequencing with deadlines, 0/1 knapsack problem, minimum cost spanning trees, Single source shortest path problem.

UNIT-III FUNDAMENTAL ALGORITHMIC STRATEGIES – Part II

Classes: 16

DYNAMIC PROGRAMMING: General method, applications - optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.

BACKTRACKING: Heuristics –characteristics, Applications- n-queen problem, Sum of subsets problem, Graph coloring, 0/1knapsack problem, and Hamiltonian cycles.

BRANCH AND BOUND:General method, applications - travelling sales person problem, 0/1 knapsack problem- LC branch and bound solution, FIFO branch and bound solution.

UNIT-IV GRAPH AND TREE ALGORITHMS

Classes: 12

GRAPHS (Algorithm and Analysis): Breadth first search and traversal, Depth first search and traversal, Spanning trees, connected components and bi-connected components, Articulation points, Shortest path algorithms, Transitive closure, Topological sorting, Network Flow Algorithm.

UNIT-V TRACTABLE AND INTRACTABLE PROBLEMS

Classes: 10

Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques, Approximation algorithms, Randomized algorithms.

Text Books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

Reference Books:

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

Web References:

1. <https://www.hackerrank.com/domains/algorithms>
2. <https://discuss.codechef.com/questions/48877/data-structures-and-algorithms>
3. <http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms>
4. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorithms_tutorial.pdf
5. <http://nptel.ac.in/courses/106101060/>

E-Text Books:

1. <http://www.trips-to-morocco.com/introduction-to-algorithms-3rd-edition-mit-press-english.pdf>
2. <https://comsciers.files.wordpress.com/2015/12/horowitz-and-sahani-fundamentals-of-computer-algorithms-2nd-edition.pdf>
3. https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/Algorithm%20Design_%20Foundations%2C%20Analysis%2C%20and%20Internet%20Examples%20%5BGoodrich%20%26%20Tamassia%202001%5D.pdf

MOOC Course:

1. https://onlinecourses.nptel.ac.in/noc17_cs27/preview
2. <https://www.coursera.org/courses?languages=en&query=Algorithm+design+and+analysis>