

DESIGN AND ANALYSIS OF ALGORITHMS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	15CS43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to			
<ul style="list-style-type: none"> • Explain various computational problem solving techniques. • Apply appropriate method to solve a given problem. • Describe various methods of algorithm analysis. 			
Module 1			Teaching Hours
Introduction: What is an Algorithm? (T2:1.1), Algorithm Specification (T2:1.2), Analysis Framework (T1:2.1), Performance Analysis: Space complexity, Time complexity (T2:1.3). Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples (T1:2.2, 2.3, 2.4). Important Problem Types: Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. Fundamental Data Structures: Stacks, Queues, Graphs, Trees, Sets and Dictionaries. (T1:1.3,1.4)			10 Hours
Module 2			
Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum (T2:3.1, 3.3, 3.4), Merge sort, Quick sort (T1:4.1, 4.2), Strassen's matrix multiplication (T2:3.8), Advantages and Disadvantages of divide and conquer. Decrease and Conquer Approach: Topological Sort. (T1:5.3)			10 Hours
Module 3			
Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines (T2:4.1, 4.3, 4.5). Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm (T1:9.1, 9.2). Single source shortest paths: Dijkstra's Algorithm (T1:9.3). Optimal Tree problem: Huffman Trees and Codes (T1:9.4). Transform and Conquer Approach: Heaps and Heap Sort (T1:6.4).			10 Hours
Module 4			
Dynamic Programming: General method with Examples, Multistage Graphs (T2:5.1, 5.2). Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem ((T1:8.2, 8.3, 8.4), Bellman-Ford Algorithm (T2:5.4), Travelling Sales Person problem (T2:5.9), Reliability design (T2:5.8).			10 Hours
Module 5			
Backtracking: General method (T2:7.1), N-Queens problem (T1:12.1), Sum of subsets problem (T1:12.1), Graph coloring (T2:7.4), Hamiltonian cycles (T2:7.5). Branch and Bound: Assignment Problem, Travelling Sales Person problem (T1:12.2), 0/1 Knapsack problem (T2:8.2, T1:12.2): LC Branch and Bound solution (T2:8.2), FIFO Branch and Bound solution (T2:8.2). NP-Complete and NP-Hard problems: Basic			10 Hours

concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes (T2:11.1).	
Course Outcomes: After studying this course, students will be able to	
<ul style="list-style-type: none"> • Describe computational solution to well known problems like searching, sorting etc. • Estimate the computational complexity of different algorithms. • Devise an algorithm using appropriate design strategies for problem solving. 	
Graduate Attributes	
<ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Design/Development of Solutions • Conduct Investigations of Complex Problems • Life-Long Learning 	
Question paper pattern:	
<p>The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.</p>	
Text Books:	
<p>T1. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009. Pearson. T2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press</p>	
Reference Books:	
<ol style="list-style-type: none"> 1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI 2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education) 	

Sachin

H.O.D.

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