

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA VIZIANAGARAM
III B. Tech I Semester Supplementary Examinations, April/May -2025
DESIGN AND ANALYSIS OF ALGORITHMS
(CSE)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

UNIT-I			
1.	a)	Define an algorithm. Explain the characteristics of a good algorithm with suitable examples.	[7M]
	b)	Write an algorithm for finding the maximum element in an array and analyze its time complexity.	[7M]
(OR)			
2.	a)	Explain the different types of asymptotic notations. Compare Big-O, Big-Ω, and Big-Θ with suitable examples.	[7M]
	b)	Discuss the role of input size in algorithm performance. How does it influence time and space complexity?	[7M]
UNIT-II			
3.	a)	Explain the divide and conquer strategy. Illustrate the method using the merge sort algorithm and derive its time complexity.	[7M]
	b)	Describe the greedy strategy. How does it differ from divide and conquer? Illustrate the approach using the Fractional Knapsack problem.	[7M]
(OR)			
4.	a)	Write the algorithm for binary search. Analyze its best, average, and worst-case time complexities.	[7M]
	b)	Explain how the greedy method is used to find the shortest paths from a single source using Dijkstra's algorithm.	[7M]
UNIT-III			
5.	a)	Describe the solution to a multistage graph problem using dynamic programming. Provide an example with a diagram.	[7M]
	b)	Explain how the Traveling Salesperson Problem (TSP) is solved using dynamic programming. What is its time complexity?	[7M]
(OR)			
6.	a)	What is an Optimal Binary Search Tree (OBST)? Explain how dynamic programming is used to construct an OBST.	[7M]
	b)	Solve the 0/1 Knapsack problem using dynamic programming for the following instance: Weights = {2, 3, 4}, Profits = {4, 5, 6}, Capacity = 5.	[7M]
UNIT-IV			
7.	a)	Explain the general method of backtracking. How does it differ from brute force and dynamic programming?	[7M]
	b)	Explain the graph coloring problem. How is backtracking used to color a graph using m colors?	[7M]
(OR)			
8.	a)	Describe the 8-Queens problem. Write a backtracking algorithm to solve it and explain how the solution space is pruned.	[7M]
	b)	Solve the Sum of Subsets problem using backtracking. Explain the	[7M]

		conditions for pruning the state space tree.	
		<u>UNIT-V</u>	
9.	a)	Explain the importance of Cook's Theorem in computational complexity theory. What does it establish?	[7M]
	b)	Differentiate between NP-Hard and NP-Complete problems. Can an NP-Hard problem be in NP? Justify your answer.	[7M]
		(OR)	
10.	a)	Discuss the concept of polynomial-time reducibility. How is it used to prove NP-Completeness?	[7M]
	b)	Why are NP-Complete problems considered intractable? Discuss the implications if $P = NP$.	[7M]

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