JHARKHAND Rai University
RANCHI

End Semester/Reappear (Semester IV) Examination May 2025

Programme: B. Tech (CSE)

Course: Design and Analysis of Algorithms **Full Marks: 70**

Course Code:3PCCCS205 **Time: 3 Hrs.**

Enrolment no. _____

Q.No.	Questions	CO	Bloom Taxonomy Category	Marks
	Section I			
1	**Short Answer type questions.**			**4 x 5 = 20**
a	Differentiate between time complexity and space complexity with examples.	CO1	Remember	
	or			
	Define the term "asymptotic analysis" in the context of algorithm analysis.	CO1	Understand	
b	State one key difference between Backtracking and Branch-and-Bound.	CO2	Remember	
	or			
	Why Brute-Force is considered inefficient for solving NP-complete problems?	CO2	Understand	
c	Define Minimum Spanning Tree. Mention two algorithms to compute it.	CO3	Understand	
	or			
	State the condition under which Dijkstra's algorithm fails to work correctly.	CO3	Remember	
d	Name any two standard NP-complete problems with example.	CO4	Remember	
	or			
	How is reduction used to prove that a problem is NP-Complete?	CO4	Understand	
	Section II			
	Long Answer type questions.			**3 x 10 = 30**
2	Given the recurrence relation: $T(n)= 2T(n/2)+ n$, Analyze the time complexity using the Master's Theorem and interpret the result.	CO1	Apply	
	or			
	Describe the characteristics of a good algorithm. How do these characteristics ensure efficient problem-solving in real-world applications?	CO1	Analyze	
3	Describe the use of Brute-Force in solving the Bin Packing Problem with given data sets size: 5, 6, 4, 2, 1, 10, 3 and bins of capacity 10. What are the limitations of this approach in large-scale problem instances?	CO2	Analyze	
	or			
	What are Heuristics in the context of algorithm design? Discuss their characteristics and explain with examples where heuristic methods are more appropriate than exact algorithms.	CO2	Analyze	
4	Given a graph represented as an adjacency matrix, describe how Warshall's algorithm can be used to compute its transitive closure. Why is this approach efficient for dense graphs?	CO3	Analyze	
	or			
	Explain Kruskal's algorithm for finding the Minimum Spanning Tree of a connected graph. Compare it with Prim's algorithm in terms of approach and performance.	CO3	Analyze	
	Section III			
	Application based questions			**1 x 20 = 20**
5	Evaluate the relationship between P, NP, NP-Complete, and NP-Hard problem classes. How does this classification affect algorithm design and real-world problem solving?	CO4	Evaluate	
	or			
	Demonstrate how a known NP-complete problem can be reduced to another NP-complete problem. Explain the steps involved in the transformation and why it proves NP-completeness.	CO4	Analyze	

COURSE OUTCOME

CO1 For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

CO2 Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

CO3 Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation

CO4 Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational Complexity.

CO5 For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems. Explain the ways to analyze randomized algorithms (expected running time, probability of error).Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).