Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

MCA DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025

First Semester

Master of Computer Applications

PMCT2401 - Advanced Data Structures and Algorithms

Regulations - 2024

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BTL*	*CO*	*Marks*
1.	Define time complexity and space complexity, with one short example of each.	L1	1	2
2.	Explain the importance of efficient algorithms in computing.	L2	1	2
3.	Describe the structure of Fibonacci heaps.	L2	2	2
4.	Illustrate any two applications of Disjoint Sets with suitable examples.	L2	2	2
5.	What is topological sorting in graphs?	L1	3	2
6.	Explain the significance of Strongly Connected Components in graphs.	L2	3	2
7.	Define dynamic programming and its relevance in algorithm design.	L1	4	2
8.	Interpret how overlapping subproblems lead to dynamic programming solutions.	L2	4	2
9.	Name two classic NP-Complete problems.	L1	5	2
10.	Interpret the significance of reducibility in proving NP-Completeness.	L2	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	Explain the significance of asymptotic notations (*O, Ω, Θ*) by giving examples, and describe how they are used to compare algorithm efficiency.	L2	1	16
		Or			
	b	Illustrate the recursion-tree method for solving recurrence relations and show how it helps in analyzing the time complexity of divide-and-conquer algorithms.	L2	1	16
12.	a	Demonstrate insertion and deletion in Red-Black Trees with diagrams and explain how balance is preserved.	L2	2	16
		Or			
	b	Summarize the key operations of B-Trees with examples, highlighting their importance in managing large datasets efficiently.	L2	2	16
13.	a	Apply Prim's algorithm step by step to construct a Minimum Spanning Tree for a weighted graph, and justify the correctness result obtained.	L3	3	16
		Or			
	b	Construct the shortest path solution for a given graph using Dijkstra's algorithm and demonstrate how the algorithm updates the distance table.	L3	3	16

14.	a	Develop a dynamic programming solution for the Matrix Chain Multiplication problem and explain the recursive relation used in the solution process.	L3	4	16
		Or			
	b	Apply the greedy method to the Activity Selection problem and demonstrate its optimal solution with an example.	L3	4	16
15.	a	Analyze polynomial-time verification and explain how it is used in proving NP-Completeness.	L4	5	16
		Or			
	b	Distinguish between NP, NP-Complete, and NP-Hard problems with appropriate examples, and examine their implications in computational complexity theory.	L4	5	16