Name:

Enrolment No:

UPES

End Semester Examination, December 2023

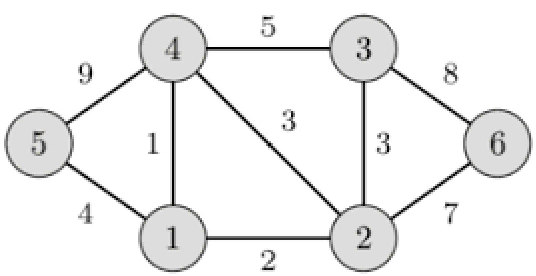
Course: Algorithm Design and Analysis — **Semester: 1**

Program: M.Tech CSE — **Time : 03 hrs.**

Course Code: CSEG 7001 — **Max. Marks: 100**

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	How do you justify that divide and conquer algorithms takes less time complexity in comparison with brute force algorithms.	**4**	**CO1**
Q2	Analyze the Merge Sort algorithm in terms of time and space complexity. Justify your analysis with concrete examples.	**4**	**CO2**
Q3	Assess the strengths of dynamic programming in contrast to the divide and conquer method for computing the Fibonacci series.	**4**	**CO3**
Q4	Compute MST for the following graph using Kruskal's algorithm. 	**4**	**CO3**
Q5	Define the classes P, NP, and NP-Completeness, and explain their significance in computational complexity theory. Provide examples of problems that belong to each class.	**4**	**CO4**

SECTION B
(4Qx10M= 40 Marks)

S. No.		Marks	CO
Q6	Determine the computational complexity of applying the quick sort algorithm to sort an array of size n, where all elements in the array are identical, denoted as A[1] = A[2] = A[3] = ... = A[n] = x.	**10**	**CO2**
Q7	Using Dijkstra's algorithm, determine the minimum distance from starting point 'A' to destination 'D,' while passing through intermediate points 'B' and 'C' within a road network. Given the following distances: A to B: 4 km, A to C: 2 km, B to C: 3 km, B to D: 5 km, and C to D: 7 km, calculate the optimal route and its length.	**10**	**CO3**

Q8	Let G = (V, E) where V = {A, B, C, D, E} and E = {(A, B), (A, C), (B, D), (C, D), (C, E)} and suppose that k = 2. Devise an algorithm such that adjacent nodes receive different colors while minimizing the number of colors used. Describe the algorithm step by step and apply it to the given graph, providing the color assignment for each vertex. (OR) Draw the state space tree for 4 queen's problem.	**10**	**CO4**
Q9	How the failure function of KMP algorithm works?	**10**	**CO2**
SECTION-C **(2Qx20M=40 Marks)**			
Q10	In a DBMS server with a processing capacity of 10 units, you have a set of database queries with execution times [4, 6, 3, 5] and query priorities [9, 7, 10, 6]. Use dynamic programming to determine the optimal selection of queries to maximize DBMS efficiency while respecting the processing capacity constraints. (OR) Find the optimal order of multiplication for the matrices A (4x2), B (2x3), C (3x5), and D (5x1) to minimize the total scalar multiplications. Calculate the minimum number of scalar multiplications required for the optimal order and specify the dimensions of the resulting product matrix	**20**	**CO3**
Q11	Devise Branch and Bound technique to solve the knapsack problem with a capacity of 15 Kgs and the following items: Item 1 (4 Kgs, Rs. 10), Item 2 (5 Kgs, Rs. 12), Item 3 (8 Kgs, Rs. 20), Item 4 (3 Kgs, Rs. 8), and Item 5 (6 Kgs, Rs. 15). Determine the optimal selection of items to maximize value while staying within the capacity, and provide the total value achieved in Rs.	**20**	**CO3**