QP Code: R262F007 | Reg. No | | | | | | | | | | | AY 23

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

M.C.A. (Second Semester - Regular) Examinations, May – 2026

MCA252001 – Design and Analysis of Algorithms

Time:3 hrs | Maximum: 60 Marks

(The figures in the right-hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions

		CO #	Blooms Level
a.	Is $2^{n+1} = O(2^n)$? Justify.	CO-1	K-5
b.	What are the maximum and minimum numbers of elements in a heap of height h?	CO-2	K-3
c.	Which data structure is used in BFS and DFS?	CO-3	K-4
d.	Which technique is used to solve the N Queen problem?	CO-4	K-1
e.	List the name of at least 4 NP-Complete problems	CO-5	K-2

PART – B **(10 x5=50 Marks)**

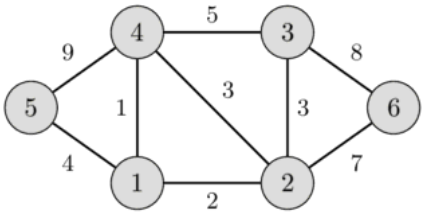
Answer ***ALL*** questions

		Marks	CO #	Blooms Level
2. a.	What is asymptotic notation? Why the asymptotic notation is used? Explain different asymptotic notations briefly.	5	CO-1	K-1
b.	Solve the following recurrence relation using the recursion tree method. $T(n) = 4T(n/2) + n$	5	CO-1	K-2
	(OR)s			
c.	Explain the different characteristics of the algorithms. How is the performance of an algorithm evaluated?	5	CO-1	K-1
d.	Solve the following Recurrence relation using the Master method (i) $T(n) = 2T(n/4) + \sqrt{n}$ (ii) $T(n) = 16T(n/4) + n^3$	5	CO-1	K-2
3. a.	Sort the following array using Heap-Sort Technique A = {25, 18, 32, 90, 20, 10, 45}	5	CO-2	K-3
b.	Find an optimal Parenthesization of Matrix-Chain Multiplication whose sequence of dimensions is A_1 [2 × 4], A_2 [4 × 6], A_3 [6 × 3], and A_4 [3 × 5] by using the dynamic programming method.	5	CO-2	K-4
	(OR)			
c.	Write the Quick Sort algorithm and find the best-case and worst-case time complexity.	5	CO-2	K-3
d.	Find out the Longest Common Subsequence of the following two strings by using the dynamic programming method. X = {B, C, D, A, A, C, D} Y = {A, C, D, B, A, C}	5	CO-2	K-4

4. a. For the given set of items and knapsack capacity = 60 kg, find the optimal solution for the fractional knapsack problem by using the greedy approach. 5 CO-3 K-5

Item	I_1	I_2	I_3	I_4	I_5
Weight	5	10	20	30	40
Value	30	20	100	90	160

b. Compute and construct the Minimum-cost Spanning Tree for the following undirected weighted graph by using Kruskal's Algorithm. 5 CO-3 K-5



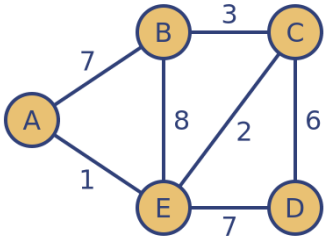
(OR)

c. Given 10 activities along with their Start (S_i) and Finish (F_i) time as follows: 5 CO-3 K-4

A_i	A_1	A_2	A_3	A_4	A_5	A_6	A_6	A_8	A_9	A_{10}
S_i	1	2	3	4	7	7	9	9	11	12
F_i	3	5	4	7	10	9	11	13	12	14

Compute a schedule where the maximum number of activities takes place.

d. Using Dijkstra's single-source-shortest-path algorithm find out the shortest path from source vertex "A" to all other vertices from the following graph. 5 CO-3 K-5



5. a. How many spurious hits and valid hits does the Rabin-Karp matcher encounter in the text T = 314159265358923 when looking for the pattern P = 92 with the working modulo q = 11? 5 CO-4 K-5

b. Using the backtracking approach find the subset sum where Sum = 14 from the given set S = {2, 4, 6, 8}. 5 CO-4 K-3

(OR)

c. Write down the Naive string-matching algorithms. 5 CO-4 K-2

d. How to find Chromatic Numbers in Graph colouring problems? 5 CO-4 K-2

6. a. Write an approximation algorithm for solving the Travelling Salesman Problem. 5 CO-5 K-1

b. Define P, NP, NP-hard, and NP-complete and represent their relation with the Venn diagram with proper labelling. 5 CO-5 K-2

(OR)

c. What is the difference between P and NP? 5 CO-5 K-1

d. What are the characteristics of an approximation algorithm? 5 CO-5 K-2

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