

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 4 – EXAMINATION – SUMMER 2026

Subject Code: BE04000241

Date: 16/06/2026

Subject Name: Analysis and Design of Algorithms

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1** (a) Define Following terms **03**
1. Space Complexity
2. Universal Quantifier
3. Vector
- (b) Explain the characteristics of a good algorithm. **04**
- (c) Explain asymptotic notations (Big-O, Big-Theta, Big-Omega) with graphs and examples. **07**
- Q.2** (a) Calculate the number of comparisons in linear search when the element is at:
(1) first position **03**
(2) last position
- (b) Describe time complexity and explain theoretical vs empirical analysis. **04**
- (c) Analyze Bucket Sort and Counting Sort algorithms with example. **07**
- OR
- Q.2** (c) Explain amortized analysis and its techniques in detail. **07**
- Q.3** (a) Write general method of recurrence. **03**
- (b) Solve recurrence using Master Theorem: **04**
1) $T(n) = 2T(n/2) + n$
2) $T(n) = 3T(n/2) + n^2$
- (c) Write and analyze Binary Search algorithm. Demonstrate for: $A = \{3, 7, 8, 10, 11, 15, 20, 25, 30\}$, Key = 15 **07**
- OR
- Q.3** (a) Explain the Principle of Optimality? **03**
- (b) Solve Making Change problem using Dynamic programming: **04**
Coins = {1, 3, 4}, Amount = 6.
- (c) Explain Matrix Chain Multiplication using Dynamic programming. **07**
- Q.4** (a) List characteristics of Greedy Algorithms. **03**
- (b) Solve Fractional Knapsack using greedy method: Weights = {10, 20, 30} Values = {60, 100, 120} Capacity = 50. **04**

- (c) Find the Minimum Spanning Tree using Kruskal's Algorithm for the given graph: **07**
Consider a graph with vertices edge weights:
GH: 8, GI: 2, GJ: 5, GK: 3, HI: 1, HJ: 7, HK: 4, IJ: 5, IK: 9, JK: 10

OR

- Q.4** (a) Define Activity Selection problem? **03**
(b) Find an optimal Huffman code for the following set of frequency. a: 50, b: 20, c: 15, d: 30. **04**
(c) Find the Minimum Spanning Tree using Prim's Algorithm starting from vertex A for the graph: **07**
Vertices: A, B, C, D, E. Consider a graph with vertices edge weights:
AB:2, AC:3, AD:6, BC:1, BD:4, BE:5, CD:2, CE:7, DE:3.

- Q.5** (a) Define Following **03**
1. Articulation point
2. Graph
3. Tree
(b) Compare DFS and BFS. **04**
(c) Explain topological sorting with algorithm and example. **07**

OR

- Q.5** (a) Explain polynomial reduction? **03**
(b) Differentiate NP-Complete and NP-Hard problems. **04**
(c) Explain Backtracking Method. What is N-Queens Problem? Give solution of 4-Queens Problem using Backtracking Method. **07**
