

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S7 (S,FE) Examinations May 2026 (2019 Scheme)



Course Code: RAT401

Course Name: ALGORITHMS AND DATA STRUCTURES

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

Marks

- | | | |
|----|---|-----|
| 1 | Differentiate between linear data structures and non-linear data structures. | (3) |
| 2 | Explain the concept of asymptotic notations and their role in analyzing algorithm efficiency. | (3) |
| 3 | Illustrate with example the representation for sparse matrix. | (3) |
| 4 | Describe the process of reversing a string using a stack with a step-by-step explanation. | (3) |
| 5 | Differentiate between spanning tree and minimum spanning tree | (3) |
| 6 | Explain the in-degree and out-degree of a graph? Discuss the concept with an example. | (3) |
| 7 | Differentiate between hash tables and dictionary. | (3) |
| 8 | Explain what is meant by sorting and different types of sorting algorithms. | (3) |
| 9 | Discuss different types of randomized algorithms. | (3) |
| 10 | Describe the concept of NP complete problems. | (3) |

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

- | | | |
|----|--|-----|
| 11 | a) Explain the notion of recursive algorithms? Explain any four types of recursive algorithms with examples? | (7) |
| | b) Mention various methods for solving recurrence relation. Explain forward substitution method for recurrence relation in detail. | (7) |

OR

- | | | |
|----|---|-----|
| 12 | a) Explain the classification of data structures into primitive, non-primitive, linear, and non-linear types with examples. | (6) |
| | b) Illustrate with examples various data structure operations. | (8) |

Module II

- 13 a) Explain the different types of linked list. Explain the advantages of linked list over arrays. (6)
- b) Design algorithms to perform the following operations on a singly linked list: (8)
- Insert a node with value y at the beginning of the list.
 - Delete the last node of the list.

OR

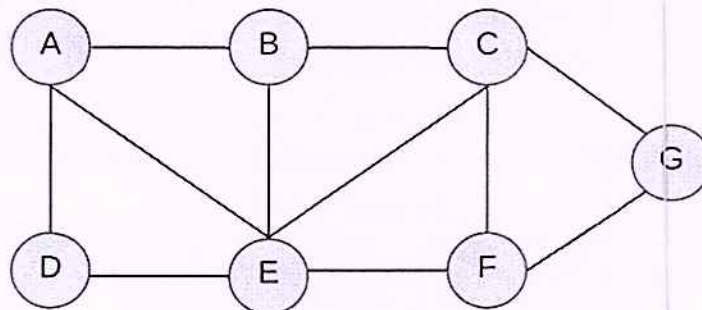
- 14 a) Write an algorithm to implement push and pop operations for stacks using arrays. (6)
- b) Apply the infix to postfix algorithm to get the equivalent postfix expression for the given expression: $(A + (B * C - (D / E^F) * G) * H)$ (8)

Module III

- 15 a) Discuss the inorder, preorder and post order tree traversal recursive algorithms/pseudocodes with suitable examples. (9)
- b) Define expression tree. Construct an expression tree for the expression $(a + b * c) + ((d * e + f) * g)$. (5)

OR

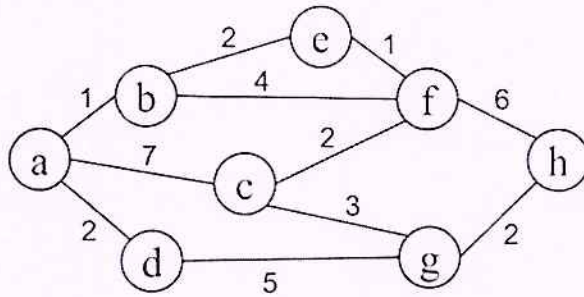
- 16 a) Illustrate with necessary examples the various ways of representing a graph bringing out the advantages and disadvantages of each representation. (6)
- b) Design an algorithm to traverse a graph using Depth First Search (DFS). (8)
- Apply DFS for the graph given below.

**Module IV**

- 17 a) Write an algorithm to perform binary search on a given set of 'n' numbers. (8)
- Using the algorithm search for the element 23 in the set [12, 23, 34, 44, 48, 53, 87, 99]
- b) Consider a Hash Table of size 10 using Linear Probing with hash function $h(k) = k \% 10$. Insert the following keys: 12, 18, 13, 2, 3, 23, 5 and 15. Show the Hash Table after each insertion with step-by-step calculations. (6)

OR

- 18 a) Write an algorithm to sort the given array in ascending order using insertion sort: (7)
 42,26,68,12,22,45,88.
 b) Apply Dijkstra's algorithm to find the shortest path from vertex 'a' to all other vertices in the graph. (7)



Module V

- 19 a) Illustrate with example the concept of backtracking. (7)
 b) Describe the divide and conquer approach with suitable example. (7)

OR

- 20 a) Examine the use of dynamic programming for solving problems. (7)
 b) Describe greedy approach with suitable example. (7)
