(b) Describe the procedure to delete a node from a doubly linked list at the beginning. Explain, how links between the remaining nodes are maintained. **7**

Unit III

6. (a) Explain the preorder, inorder and postorder traversals of a binary tree. Discuss their order of visiting nodes and mention one practical application of each traversal. **7**

(b) What is the balance factor in an AVL tree ? Explain, how is it calculated for a node and how it helps in maintaining the tree balanced ? **7**

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B. Tech. EXAMINATION, 2026

(Third Semester)

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

24-BTPC-302

Data Structures

Time : 3 *Hours*] [*Maximum Marks :* 70

Before answering the question-paper, candidates must ensure that they have been supplied with correct and complete question-paper. No complaint, in this regard will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

1. (a) What is a data structure ? Explain its importance in organizing and storing data. **4**

(b) What is dynamic storage management ? **3**

(c) What is a trie tree ? Explain, how is it used for efficient string searching. **4**

(d) What is a graph ? Explain the difference between directed and undirected graphs. **3**

Unit I

2. (a) Write the algorithm for Binary Search. Explain its best, average and worst-case time complexity. **7**

(b) Explain, how algorithmic notation helps in representing system behaviour. Illustrate with an example. **7**

3. Explain the Heap Sort algorithm and its working, write the algorithm/pseudocode and sort the following 12 elements using Heap Sort showing all intermediate steps :

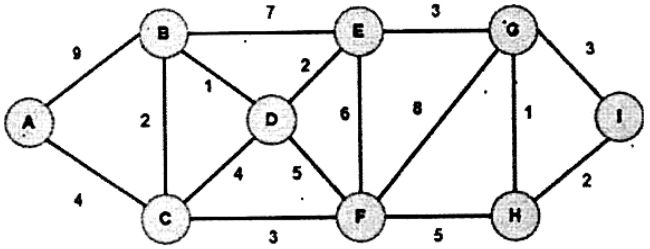
52, 18, 91, 36, 27, 64, 85, 14, 73, 6, 48, 29. **14**

Unit II

4. Explain the stack data structure in detail. Describe its operations (push, pop, peek) with algorithms. Implement stack using array and explain its applications with suitable example. **14**

5. (a) Explain the method to insert a node in a circular singly linked list at the end. Show how the circular link is maintained after each insertion. **7**

(b) Define a spanning tree. Using Prim's algorithm, find the minimum spanning tree of a given weighted connected graph and show all steps : **7**



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7. What is a B-Tree ? Explain the upper and lower bounds on its height and discuss their significance in search, insertion and deletion operations. **14**

Unit IV

8. (a) Explain the concept of transitive closure of a relation or a graph. Discuss its purpose, how can it be computed and mention at least two applications. **7**

(b) Explain external sorting in data structures. Discuss, why is it needed, the general procedure and describe at least two techniques used for sorting large datasets that do not fit in main memory. **7**

9. (a) Explain Depth-First Search (DFS) in a graph. Discuss its working, traversal order and applications and mention its time and space complexity. **7**