Course Code & Name	26CAPC2002 Data Structures		
Teaching Hours /week (L: T:P: R)	3 :1: 0: 0	Credits	4
CIE Marks	40	ESE Marks	60
Course Type	Theory(PCC)	Exam Hours	3
Prerequisites (if any)	26CAPC1002		

Course Objectives:

1. To develop an understanding of basic data structure concepts.
2. To gain comprehensive knowledge of various data structures and their applications.

Course Outcomes (COs)

At the end of the course students should be able to:

CO#	Course Outcomes	Bloom's Knowledge Level (KL)
CO 1	Apply the fundamental concepts of Data Structures and implement standard algorithms of searching and sorting	3
CO 2	Implement the static and dynamic variants of basic data structures like stack and queue.	3
CO 3	Implement linked list algorithms	3
CO 4	Compare the concept of trees and graphs and implement using basic data structures and algorithms	2

Note: *K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	2	-	-	-	-	1
CO 2	3	2	2	-	-	-	-	2
CO 3	3	3	3	-	-	-	-	2
CO 4	2	2	2	-	-	-	-	1

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), - : No Correlation*

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE)

Attendance	Assignment/ Micro-project	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
8	12	10	10	40 Marks

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

PART A	PART B	TOTAL
■ 2 Questions from each module. ■ Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	■ Each question carries 9 marks. ■ Two questions will be given from each module, out of which 1 question should be answered. ■ Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60 Marks**

SYLLABUS

Module #	Syllabus Description	Hours
1	**Introduction to Data Structures:** Definition, Concept of Data Structures, Overview of different Data structures, Time and space complexity. **Arrays:** Concept of Arrays, Representation of Linear Arrays in Memory- One dimensional array, Two dimensional array. **Searching and Sorting Techniques:** Concept of search, Linear Search, Binary search, Comparison of linear and binary search, Sorting –Bubble sort, Selection sort, Insertion sort,quick sort, merge sort.	12
2	**Stacks:** Definition and concept, Operations on Stacks - Push and	12

	Pop, Static and Dynamic implementation of Stack, Applications of stacks- postfix expression evaluation. **Queues:** Definition and concept, Operations on queue-Enqueue and Dequeue, Static and Dynamic implementation of Queue, Types of queues, Applications of queue.	
3	**Linked Lists**: Definition, Comparison with Arrays, Representation, Types of Linked lists- Singly linked list, doubly linked list & circular linked list (Definition, Insertion, Deletion, Traversal)	**12**
4	**Trees:** Definition, Operations in trees, Binary Trees, Binary Search Tree, Inserting, Deleting and Searching in Binary Search Tree, Height Balanced Trees: AVL Trees, M way search trees- B trees. **Graph:** Definition, Graph Representation, Graph Traversals: BFS and DFS, Minimum Cost Spanning tree.	**12**

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition & Year**
1	Classic Data Structures	Debasis Samanta	PHI Learning Pvt. Ltd. (Prentice-Hall of India)	Second Edition, 2006
2	Data Structures using C	Rohit Khurana	Vikas Publishing House	First Edition, 2014

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition & Year**
1	Fundamentals of Data Structures in C	Ellis Horowitz, Sartaj Sahni, Dinesh Anderson-Freed	W.H. Freeman and Company	Second Edition, 2008

2	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	Prentice Hall India	3rd Edition, 2004

Web References/ Video Links (NPTEL, SWAYAM…)	
Sl.No	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc22_cs92/preview
2	https://www.coursera.org/learn/data-structures
3	https://www.coursera.org/learn/data-structures-in-c
4	https://www.coursera.org/specializations/boulder-data-structures-algorithms
5	https://www.geeksforgeeks.org/data-structures/
6	https://www.javatpoint.com/data-structure-tutorial
7	https://www.tutorialspoint.com/data_structures_algorithms/index.htm

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the concept of data structures and differentiate primitive and non-primitive data structures with examples.
2. Describe the characteristics of arrays and explain how one-dimensional and two-dimensional arrays are represented in memory.
3. Differentiate linear search and binary search in terms of performance, technique, and applicability.
4. Apply bubble sort or selection sort to sort a given list of numbers and show all intermediate steps.
5. Analyze the time complexity of linear search, binary search, and sorting algorithms and justify which algorithm is optimal for different situations.

Course Outcome 2 (CO2):

1. Explain the concept of a stack and describe push and pop operations with an example.
2. Differentiate between static and dynamic implementations of stacks with memory representation.

3. Demonstrate enqueue and dequeue operations for a queue implemented using an array or linked list.
4. Analyze the working of circular queues, priority queues, and double-ended queues (deque) with examples.
5. Evaluate real-life applications of stacks and queues (e.g., expression evaluation, task scheduling, print spooling) and justify which ADT fits best in each scenario.

Course Outcome 3 (CO3):

1. Explain the structure of a singly linked list and compare it with an array in terms of memory usage and operations.
2. Demonstrate insertion and deletion operations in a singly linked list with diagrams or step-by-step explanation.
3. Describe the differences between singly, doubly, and circular linked lists with suitable examples.
4. Analyze the traversal mechanism in each type of linked list and discuss their efficiency.
5. Evaluate the suitability of different linked list types for applications such as undo operations, playlists, and real-time data buffers

Course Outcome 4 (CO4):

1. Explain the structure of a binary tree and describe the different types of tree traversals with examples.
2. Demonstrate insertion, deletion, and searching in a Binary Search Tree (BST) using a sample data set.
3. Analyze the need for height-balanced trees and explain how AVL rotations maintain balance.
4. Describe B-trees and M-way search trees, highlighting their relevance in database and file systems.
5. Compare BFS and DFS graph traversal techniques and evaluate their use cases in real-world problems such as shortest path, network crawling, or AI search.

Model Question Paper

Reg No.:_____ Name:_____

FEDERAL INSTITUTE OF SCIENCE AND TECHNOLOGY

MCA Integrated S2 (R) Examination, ……..(2026 Scheme)

Course Code: 26CAPC2002

Course Name: Data Structures

Max. Marks: 60 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

		CO	Marks
1	Define data structure. List different types of data structures with examples.	CO1	(3)
2	Differentiate between linear search and binary search.	CO1	(3)
3	What are the advantages of linked lists over arrays?	CO2	(3)
4	Write the steps to insert a node at the beginning of a singly linked list.	CO2	(3)
5	Define stack. What are the applications of stacks?	CO3	(3)
6	Explain ring buffer.	CO3	(3)
7	Define binary tree and binary search tree.	CO4	(3)
8	What is the difference between BFS and DFS traversals?	CO4	(3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module I

9	Explain the memory representation of one-dimensional and two-dimensional arrays with suitable examples.	CO1	9

OR

10	Describe and compare bubble sort, selection sort, and insertion sort algorithms with their time complexities.	CO1	9

Module II

11	Explain the structure and operations of a doubly linked list with suitable diagrams.	CO2	9

OR

12	Describe circular linked lists. Write algorithms for insertion and deletion operations.	CO2	9

Module III

13	Explain the array and linked list implementation of stacks with push and pop operations.	CO3	9

OR

14	Describe the operations of a circular queue and discuss its advantages over a linear queue.	CO3	9

Module IV

15	Explain insertion, deletion, and searching operations in a Binary Search Tree with examples.	CO4	(9)

OR

16	What are AVL trees? Explain how rotations are used to maintain balance in AVL trees.	CO4	(9)

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