

Branch Name:	MCA
Program Code:	CS201
Course Name:	Data Structures and Algorithms
Course Code:	4CS2010103T
Pre-requisite Course:	Basic knowledge of Programming Languages like C, C++

Course Objectives:

1. To understand and apply linear data structures such as arrays, stacks, queues, and linked lists.
2. To analyse and implement non-linear data structures like trees and graphs.
3. To develop efficient algorithms for sorting techniques including bubble, insertion, merge, and quick sort.
4. To implement and evaluate searching algorithms such as linear and binary search.
5. To select and use appropriate data structures and algorithms for solving real-world problems efficiently.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	-	-	3	60	40	-	-	100

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Introduction to Data Structures	11	25
	- Definition and importance		
	- Classification of data structures: primitive and non-primitive		
	- Linear vs. Non-linear data structures		
	Data Types and Storage Structures		
	- Static vs. Dynamic memory allocation		
	- Memory representation of data structures		
	- Role of pointers in data structures		
	Algorithms and Their Complexity		
	- Concept of algorithms		
	- Time and space complexity		
	Applications in various domains:		
	- database systems		
	- operating systems		
	- compilers, etc.		
2	Linear Data Structure	11	25
	- Array		
	- Definition and memory representation		
	- Operations: insertion, deletion, traversal, searching		

	- Stack - Concept and need for stack - Stack operations: push, pop - Stack implementation using arrays and linked lists - Applications: expression evaluation, recursion handling - Queue - Definition - Queue operations: enqueue, dequeue - Simple Queue - Circular Queue - Double Ended Queue (Deque) - Implementation using arrays and linked lists - Applications of queues in real-world problems - Linked List - Definition - Operations: insertion, deletion, traversal - Types: singly, doubly, and circular linked lists - Comparison with arrays - Applications of linked list in real world problems		
3	Non-Linear Data Structure - Tree - Basic Terminology: node, root, leaf, degree, level, height - Types of Trees: - Binary Tree - Binary Search Tree (BST) - AVL Tree - General Tree and Expression Trees - Tree Traversals: - Inorder, Preorder, Postorder (recursive and non-recursive) - Operations on Binary Trees: - Insertion, deletion, searching - Applications of Trees: - Expression evaluation, hierarchical data representation, file system structure - Graph - Basic Terminology: vertex, edge, degree, path, cycle, connected components - Representation of Graphs: - Adjacency Matrix - Adjacency List - Types of Graphs: - Directed, Undirected, Weighted, Unweighted	11	25

	- Graph Traversal Algorithms: - Breadth-First Search (BFS) - Depth-First Search (DFS) - Applications of Graphs: - Social networks, pathfinding, dependency resolution		
4	Introduction to Searching - Linear Search - Binary Search (Iterative and Recursive) - Comparison of Linear and Binary Search - Introduction to Sorting - Internal vs. External Sorting - Basic Sorting Algorithms - Bubble Sort - Selection Sort - Insertion Sort - Merge Sort - Quick Sort	12	25

Text Books:

1. Fundamentals of Data Structures in C **Authors:** Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed **Publisher:** Silicon Press **Year of Publication:** 2008 **Number of Pages:** 617 **ISBN:** 978-0-929306-40-7
2. Data Structures Using C **Author:** Reema Thareja **Publisher:** Oxford University Press **Year of Publication:** 2018 (2nd Edition) **Number of Pages:** 560 **ISBN:** 978-0198099307
3. Data Structures Through C **Author:** Yashavant Kanetkar **Publisher:** BPB Publications **Year of Publication:** 2023 (5th Edition) **Number of Pages:** 310 **ISBN:** 978-9355515612
4. Advanced Algorithms and Data Structures **Author:** Marcello La Rocca **Publisher:** Manning Publications **Year of Publication:** June 2021 **ISBN:** 978-1617295485

Reference Books:

1. *A Common-Sense Guide to Data Structures and Algorithms* (2nd Edition) **Author:** Jay Wengrow **Publisher:** Pragmatic Bookshelf **Year of Publication:** September 2020 **Number of Pages:** 508 **ISBN:** 978-1680507225
2. Advanced Data Structures and Algorithms **Authors:** Abirami A, Priya R L **Publisher:** BPB Publications **Year of Publication:** March 2023 **Number of Pages:** 194 **ISBN:** 978-9355517937
3. *Introduction to Algorithms* (4th Edition) **Authors:** Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein **Publisher:** The MIT Press **Year of Publication:** April 2022 **Number of Pages:** 1312 **ISBN:** 978-0262046305

List of Open-Source Software/learning website:

<https://www.geeksforgeeks.org>
<https://www.w3schools.com>
<https://jquery.com/>
<https://www.tutorialspoint.com>
<https://getbootstrap.com/>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Define and classify data structures; describe their significance in problem-solving.	2. Understand
CLO2	Explain and illustrate memory allocation strategies and the role of pointers in data handling.	2. Understand 3 Applying,
CLO3	Implement linear data structures (arrays, stacks, queues, linked lists) and perform basic operations.	3 Applying 5. Analyze
CLO4	Analyze non-linear data structures (trees, graphs) for different applications and traverse them efficiently.	5. Analyze 6. Evaluate
CLO5	Compare and evaluate searching and sorting algorithms based on their time and space complexity.	6. Evaluate 3 Applying,
CLO6	Design and develop data structure-based solutions for real-world problems using appropriate algorithms.	7 Create 3 Applying 5. Analyze

Mapping of CLOs with Pos & PSOs

Course Learning Outcomes	Program Outcomes(POs)												Program Specific Outcomes(PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	H	M	-	-	-	-	L	-	-	-	-	-	H	M
CLO2	H	H	M	-	M	-	L	-	-	-	-	-	H	M
CLO3	H	H	H	L	M	-	L	-	-	-	-	L	H	H
CLO4	H	H	H	M	M	-	L	-	-	-	-	L	H	H
CLO5	H	H	M	L	M	-	M	-	-	-	-	M	M	H
CLO6	H	H	H	M	H	L	M	M	M	L	M	H	H	H

H:High, M:Medium, L:Low