Course Code	Course name	L	T	P	C
	Data Structures and Algorithms	4	0	0	4
Total Units to be Covered: 6		**Total Contact Hours: 60**			
Prerequisite(s):	Programming in C	**Syllabus version: 1.0**			

Course Objectives

1. Provide a clear understanding of the importance of data structures in organizing and manipulating data efficiently.
2. To introduce students to fundamental data structures and the properties, memory management, and basic operations of each data structure.
3. To offer practical experience in implementing data structures, common sorting, and searching algorithms.
4. Emphasize the use of data structures as tools for algorithmic problem-solving and apply their knowledge of data structures to solve real-world problems.

Course Outcomes

Upon completion of the course, the students will be able to

CO 1. State the significance and properties of the fundamental data structures.

CO 2. Implement common data structures while ensuring proper memory management and error handling.

CO 3. Illustrate expertise in understanding the common sorting and searching techniques with their complexities and implement them.

CO 4. Analyse real-world problems by understanding the trade-offs involved in identifying the appropriate data structure(s) based on problem requirements and using them to solve the problems efficiently.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1		2	1								1			

CO 2	1	1	2	1											
CO 3	1	1	2	1								2			
CO 4	1	2	2	2								2			
Average	1	1	2	1.25								1.25			

1 – Weakly Mapped (Low) **2 – Moderately Mapped (Medium)**

3 – Strongly Mapped (High) **"_" means there is no correlation**

Syllabus

Unit I: INTRODUCTION **12 Lecture Hours**

Overview, classification, and Importance of data structures in Programming/problem-solving, Basic terminology, and concepts: elements, operations, storage, memory allocation, garbage collection, and compaction. Iterative & Recursive approaches. Basic analysis of algorithms: Amortized analysis and Asymptotic Analysis. Array: Memory representation (1D and 2D), Array operations: insertion, deletion, searching. Applications of Array. Structure: Nested Structure, Function pointer as member of a structure, Self-referential structure. Anonymous Unions, ADTs.

Unit II: LINKED LIST **10 Lecture Hours**

Singly-Linked List, Doubly-Linked List, Circular Linked List, Header List, and its operations. Sentinel node. Generalized Linked List. Skip List. Applications of Linked Lists: polynomial manipulation, implementation of other data structures.

Unit III: STACK & QUEUE **10 Lecture Hours**

Stack data structure and operations. Queue data structure and operations. Implementation of Stack and Queue using Array and Linked List. Circular Queue. Deque and its types. Priority Queue. Applications: Stacks (Conversion of Infix to

Prefix/Postfix, Expression evaluation, a note on DFS in graph), Queues (Job scheduling, a note on BFS in graph).

Unit IV: TREE **10 Lecture Hours**

Introduction to Tree data structure and its terminologies, Binary Tree: properties, traversal algorithms (level-order, in-order, pre-order, post-order). Threaded Binary Tree. Binary Search Trees (BST): properties, operations (insertion, deletion, searching). Balanced BSTs. AVL Tree: properties, rotations, operations (insertion, deletion). Red-Black Tree. Multi-way search Tree: properties. B-Tree: properties, operations (search, insertion, and deletion). Applications of AVL Tree and B-Tree. Binary Heaps: properties, heapify operations, Heap sorting.

Unit V: HASH TABLE & GRAPH **10 Lecture Hours**

Hashing and hash functions. Hash table data structure: structure, collisions, collision resolution techniques, maintaining load factor. Applications of hash tables: dictionaries, symbol tables.

Introduction to graph data structure and its terminologies. Graph representations: adjacency matrix, adjacency list. Graph traversal algorithms: depth-first search, breadth-first search (BFS). Connected Components. Minimum spanning tree. Shortest path.

Unit VI: SORTING & SEARCHING **8 Lecture Hours**

Stability and In-place properties, Internal and external sorting. Simple comparison-based sorting algorithms: bubble sort, selection sort, insertion sort. Lower bound for comparison-based sorting algorithms. Recursive implementation of merge sort, quicksort, and binary search. Complexities of common sorting and searching algorithms.

Total lecture Hours 60

Textbooks

1. S. Lipschutz, "Data Structures with C", Schaum's Outline Series, McGraw-Hill Education (India) Pvt. Limited, 2017.

2. Y. P. Kanetkar, "Data structures through C", 4rd Edition, New Delhi: BPB, 2022.

Reference Books

1. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", New Delhi: Pearson Education, 2003.

2. E. Horowitz, and S. Sahni, "Fundamentals of Data Structures in C", 2nd Edition, Hyderabad: University Press, 2008.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme

Components	IA	MID SEM	End Sem	Total
Weightage (%)	50	20	30	100

Detailed breakup of Internal Assessment

Internal Assessment Component	Weightage in calculation of Internal Assessment (100 marks)
Quiz 1	15%
Quiz 2	15%
Class Test 1	15%
Class Test 2	15%
Assignment 1/Project	20%
Assignment 2/Project	20%