Data Structure (2301CS301)

Semester	Credit	Contact Hours			Examination Scheme (Marks)				Total
					Theory		Practical		
		L	T	P	SEE	CE	SEE	CE	
3	5	3	-	4	40	30	20	10	100

Course Objective

To learn the basic types of Data Structures, their implementation, and their applications. To understand the importance of using suitable data structures for efficient programming. To develop the skill to identify appropriate data structures in problem-solving.

Prerequisite

Basic Programming

Course Outcome

At the end of this course, students will be able to:

1. understand the importance of data structure for efficient programming.　(BL-2)
2. analyze the linear data structures and their applications.　(BL-4)
3. implement the non-linear data structures and perform different operations on them.　(BL-3)
4. describe the hashing functions and file structures.　(BL-2)
5. differentiate the working of searching and sorting techniques.　(BL-4)

Course Content

T: Teaching Hours, **W:** Weightage

Sr.	Topics	T	W
1	**Introduction to Data Structure & Linear Data Structures: Array and Stack**	9 hr	20 %
	Data Structure: Data Management concepts, Data Types (Primitive & Non-primitive), Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best and worst case analysis), Order Notations, Types of Data Structures (Linear & Non Linear Data Structures) **Array:** Representation of Arrays, Sparse Matrix and its representation, Applications of Array **Stack:** Definitions & Concepts, Operations on Stack, Applications of Stack: Polish Expression and their compilation, Polish Notations, Conversion of Infix Expression to Polish Notations, Evaluation of Polish Expressions, Recursion		
2	**Linear Data Structures : Queue and Linked List**	8 hr	20 %
	Queue: Representation of Queue, Operations on Queue, Circular Queue, Priority Queue, Double Ended Queue, Applications of Queue **Linked List:** Singly, Doubly & Circular Linked List - Representation and Operations		
3	**Nonlinear Data Structures : Tree and Graph**	12 hr	20 %
	Tree: Definitions and Concepts, Representation of Binary Tree, Conversion of General Tree to Binary Tree, Binary Tree Traversal (Preorder, Inorder & Postorder), Threaded Binary Tree, Binary Search Tree (BST), Balanced Trees: Height Balanced Tree (AVL Tree,2- 3 Tree), Weight Balanced Tree, Multiway Search Tree (B-Tree, B+ Tree), Applications of Tree **Graph** - Matrix Representation of Graph, Graph Traversals : Breadth First Search (BFS) & Depth First Search (DFS), Spanning Trees, Minimum Spanning Tree, Prim's Algorithm, Kruskal's Algorithm, Finding the Shortest Path, Dijkstra's Algorithm		
4	**Hashing and File Structures**	8 hr	20 %
	Hashing: The symbol table, Hashing Functions, Collision-Resolution Techniques **File Structure:** Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods		

Sr.	Topics	T	W
5	**Sorting and Searching**	8 hr	20 %
	Sorting: Bubble Sort, Selection Sort, Insertion Sort, Bucket Sort, Radix Sort, Shell Sort, Counting Sort, Merge Sort, Quick Sort, Heap Sort, Sorting on multiple keys, Sorting without comparison **Searching:** Linear Search, Binary Search		

Reference Books

1. An Introduction to Data Structures with Applications
   | *by Jean-Paul Tremblay & Paul G. Sorenson* | *Tata McGraw Hill*
2. Data Structures using C & C++
   | *by Aaron M. Tanenbaum* | *PHI Learning*
3. Fundamentals of Computer Algorithms
   | *by Ellis Horowitz, Sartaj Sahni, Sanguthever Rajasekaran* | *Universities Press (India) Private Limited* | *Ed. 2001*
4. Fundamentals of Data Structures in C++
   | *by Sartaj Sahani* | *Ed. 2nd*
5. Data and File Structures using C
   | *by Reema Thareja* | *Oxford University Press*

Suggested List of Practicals / Tutorials

1. Hands-on practice to get familiar with basic programming concepts
2. Hands-on practice to get familiar with advanced programming concepts
3. Regular operations on 1-D Array Data Structure
4. Advanced operations on 1-D Array Data Structure
5. Operations on 2-D Array Data Structure
6. Implementation of OOP concepts Class and Object
7. Implementation of Data Structure Stack
8. Implementation of Applications of Stack
9. Implementation of Data Structure Queue
10. Implementation of Data Structure Singly Linked List
11. Implementation of Stack & Queue Data Structure using Linked List
12. Advanced operations on Singly Linked List Data Structure
13. Implementation of Data Structure Circular and Doubly Linked List
14. Implementation of Non-Linear Data Structure Binary Search Tree (BST)
15. Operations on Non-Linear Data Structure Binary Search Tree (BST)
16. Implementation of Non-Linear Data Structure Graph
17. Implementation of Data Structure Hash Table
18. Implementation of different Searching techniques (Linear Search & Binary Search)
19. Implementation of Bubble Sort & Insertion Sort
20. Implementation of Selection Sort & Radix Sort
21. Implementation of Quick Sort & Heap Sort

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