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No:- Date:

CS34104 Data Structures

L-T-P-Cr: 3-0-2-4

Pre-requisites: Knowledge of any programming language

Objectives/Overview:

- To understand the different data structures.
- To learn which data structure should be used to make the algorithm simpler, easier to maintain, and faster.
- To improve the proficiency of students in applying the basic knowledge of programming to solve different problems.

Course Outcomes:
At the end of the course, a student should able to:

	Outcome	**Mapping to POs**
CO-1	Understand the characteristics of data structures, operations performed on data structures and also be able to analyze the complexity of algorithms.	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO12
CO-2	Design and analyze the algorithms for arrays, stacks and queues including their operations and applications.	PO1, PO2, PO3, PO4, PO5, PO6, PO9
CO-3	Develop and analyze algorithms for binary search tree operations and be able to apply graph algorithms like shortest path algorithms, minimum spanning tree algorithms on a given graph.	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO12
CO-4	Apply searching and sorting algorithms and also understand hashing techniques.	PO1, PO2, PO3, PO4, PO5, PO6, PO7

UNIT I: Introduction **Lectures: 5**

Characteristics of data structures, Creating, manipulating and operating on data structures, Types of data structures – linear and nonlinear. Introduction to algorithms: Asymptotic notations, Analysis of algorithms: Time complexity and Space complexity.

UNIT II: Arrays **Lectures: 5**

1-D arrays, multi-dimensional arrays, operating on arrays, Dynamic memory allocation, Storage – Column major order and Row major order, Address calculation of 1-D, 2-D, different form of matrix, Sparse Matrix. Linked lists – singly, doubly and circularly linked lists, operations on linked lists.

UNIT III: Stacks **Lectures: 5**

Basics of Stack data structure, Implementation of stack using array and linked list, Operations on stacks, Applications of Stacks, Notations – infix, prefix and postfix, Conversion and evaluation of arithmetic expressions using Stacks.

UNIT IV: Queues **Lectures: 3**

Basics of Queue data structure, Implementation of queue using array and linked list, Operations on queues, Types of queues – queue, double ended queue, priority queue and Implementation of these.

UNIT V: Trees & Graph **Lectures: 8**

Binary tree, Binary search tree, Threaded binary tree, AVL Tree, B Tree, Tries, Heaps, Hash tables. Graph and its implementation, Graph traversals: Breadth First Search, Depth First Search, Spanning Tree – Prim's algorithm and Kruskal's algorithm, shortest path- Dijkstra's algorithm and Bellman Ford algorithm. Union-find data structure and applications, Topological sorting for Directed Acyclic Graph.

UNIT VI: Searching and Sorting **Lectures: 8**

Linear search, Binary search, Hashing. Algorithms and data structures for sorting: Insertion Sort, Bubble sort, Selection Sort, Merge sort, Quick Sort, Heap sort, Bucket sort.

Text/Reference Books

1) *Fundamentals of Data Structures*. E. Horowitz, S. Sahni, Computer Science Press, 2ndEdition, 2008
2) *Data Structure and Program Design*. by R. L Kruse, Prentice Hall, 2nd Edition, 1996