2 / 4 B.Tech. THIRD SEMESTER

EM3T5 DATA STRUCTURES AND ALGORITHMS Credits: 4

Lecture: 4 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objectives

The objectives of the course are

- To allow to assess how the choice of data structures and algorithm design methods impacts the performance of programs
- To choose the appropriate data structure and algorithm design method for a specified application.
- To learn the systematic way of solving problems, various methods of organizing large amounts of data.
- To solve problems using data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs and writing programs for these solutions.
- To efficiently implement the different data structures and solutions for specific problems.

Learning Outcome

- To describe the usage of various data structures
- To explain the operations for maintaining common data structures
- To write programs using linked structures such as List, trees, and graphs
- To design and apply appropriate data structures for solving computing problems
- To implement different data structures.
- To choose the appropriate data structure to solve a programming problem
- To analyze algorithms and to determine algorithm correctness and time efficiency class
- To demonstrate various methods of organizing large amounts of data.
- To implement different sorting techniques.

UNIT I

Recursion and Linear Search: Preliminaries of algorithm, Algorithm analysis and complexity, Recursion: Definition, Design Methodology and Implementation of recursive algorithms, Linear and binary recursion, recursive algorithms for factorial function, GCD computation, Fibonacci sequence, Towers of Hanoi, Tail recursion List Searches using Linear Search, Binary Search,, *Analyzing search algorithms.*

UNIT II

Sorting Techniques: Basic concepts, Sorting by : insertion (Insertion sort), selection (heap sort), exchange (bubble sort, quick sort), distribution (radix sort) and merging (merge sort) *Algorithms.*

UNIT III

Stacks and Queues: Basic Stack Operations, Representation of a Stack using Arrays, Stack Applications: Reversing list,Factorial Calculation, In-fix- to postfix Transformation, Evaluating Arithmetic Expressions.

Queues: Basic Queues Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack, Applications of Queues-Round robin Algorithm, Enqueue, Dequeue, Circular Queues, Priority Queues.

UNIT IV

Linked Lists: Introduction, single linked list, representation of a linked list in memory, Operations on a single linked list, merging two single linked lists into one list**,** Reversing a single linked list, applications of single linked list to represent polynomial expressions and sparse matrix manipulation, Advantages and disadvantages of single linked list, Circular linked list, Double linked list

UNIT V

Trees: Basic tree concepts, Binary Trees: Properties, Representation of Binary Trees using arrays and linked lists, operations on a Binary tree , Binary Tree Traversals, Creation of binary tree from in-order and pre(post)order traversals, Tree Travels using stack.

UNIT VI

Advanced concepts of Trees: Binary search tree, Basic concepts, BST operations:insertion, deletion, balanced binary trees AVL Search Trees basic concepts , operations:insertion ,deletion. m-way search trees operations: insertion ,deletion, B Trees, operations: insertion , deletion.

UNIT VII

Graphs: Basic concepts, Representations of Graphs: using Linked list and adjacency matrix, Graph algorithms Graph Traversals (BFS & DFS), applications: Dijkstra's shortest path, Transitive closure, Minimum Spanning Tree using Prim's Algorithm, warshall's Algorithm.

Unit VIII

Sets: Definition, Representation of Sets using Linked list, operations of sets using linked lists, application of sets- Information storage using bit strings.

Abstract Data Type Introduction to abstraction, Model for an Abstract Data Type, ADT Operations, ADT Data Structure, ADT Implementation of array, Linked list and stack.

Learning resources

TEXT BOOKS:

1. Data Structures, 2/e, Richard F, Gilberg , Forouzan, Cengage
2. Data Structures and Algorithms, 2008, G.A.V.Pai, TMH

REFERENCE BOOKS:

1. Data Structure with C, Seymour Lipschutz, TMH
2. Classic Data Structures, 2/e, Debasis ,Samanta,PHI,2009
3. Fundamentals of Data Structure in C, 2/e, Horowitz,Sahni, Anderson Freed,University Prees