204184   Data Structures & Algorithms

Teaching Scheme:

Lectures: 4 Hrs/ Week

Practical : 2 Hrs/Week

Examination Scheme:

Theory Online :   50 Marks

Theory Paper   : 50 Marks

Oral: 50 Marks

Course Objectives & Outcomes:

This course provides an introduction to the theory, practice and methods of data structures and algorithm design. Students will learn elementary data structures such as stacks, queues, linked lists, trees and graphs in C language, and the algorithms designed for manipulating these data structures. The objective of this course is to introduce students to both data structures and algorithm design.

Having successfully completed this course, the student will be able to:
   a. Choose the data structures that effectively model the information in a problem.
   b. Judge efficiency trade-offs among alternative data structure implementations or combinations.
   c. Apply algorithm analysis techniques to evaluate the performance of an algorithm and to compare data structures.
   d. Implement and know when to apply standard algorithms for searching and sorting.
   e. Design, implement, test, and debug programs using a variety of data structures including lists, stacks, queues, hash tables, binary tree structures, search trees, heaps, graphs.

Unit I: Introduction to Algorithm & Program Design   8L

Basic Terminology; Elementary data organization, Data Structures, Data structure operations, Abstract Data Type.

Algorithm: Complexity, Time Space Tradeoff, Algorithmic Notations, Control Structures, Complexity of Algorithms, Sub-algorithms, Functions in C: Passing by value, recursive functions, Local & Global Variables, Arrays: Arrays in C and various operations. Searching Algorithms: Algorithms for Sequential Search, Indexed Sequential Search, Binary Search.

Unit II: Arrays, records and Pointers 8L

Sorting Algorithms: Selection sort, Bubble sort, Insertion Sort.

Multidimensional Arrays, Representation of polynomials using arrays.

Strings: Basic Terminology, Strings as ADT, and string operations.

Pointers: Basic concepts, Pointer declaration & initialization, Pointer to a pointer, Functions & Pointers, Array of pointers, Arrays & Pointers: Dynamic memory management.

Records: Structures in C, Comparison with arrays as a data structure. Array of structures, Pointers and structures, Polynomial representation using array of structures, Unions, Bitwise operators.

Unit III: Linked Lists 7L

Singly Linked Lists: Concept, Linked List as ADT, Representation of Linked list in Memory, Traversing a linked list, Searching a linked list, Memory Allocation; Garbage collection, Insertion into Linked list, Deletion from a linked list, Header Linked List, Representation of polynomial, Circularly Linked list, Doubly Linked List.

Unit IV: Stacks, Queues, Recursion 7L

Stacks: Concept, Array representation of stacks, Linked representation of stacks, Stack as ADT, Arithmetic expressions; Polish notation. Application of stacks: Recursion, Implementation of recursive procedures by stacks.

Queues: Concept, Array representation of queues, Linked representation of queues, Queue as ADT, Circular queues, Dequeues, Priority queues. Application of queues: Categorizing data, Simulation of queues.

Unit V: Trees 7L

Binary Trees: Concept & Terminologies, Representation of Binary Tree in memory, Traversing a binary tree, Traversal algorithms using stacks, Header Nodes; Threads, Binary Search Trees (BST), Searching and inserting in BST, Deleting in a BST, Balanced Binary Trees.

Application of Trees: Expression Tree, Game Trees.

Unit VI: Graphs 7L

Graphs: Graph theory terminology, Sequential representation of graphs; Adjacency matrix, Path matrix, Linked representation of a graph, Operations on graph, Traversing a graph, Topological sorting, Spanning trees; Minimum Spanning tree, Kruskal's Algorithm, Prim's Algorithm.

Text Books:

1. Seymour Lipschutz, Data Structure with C, Schaum's Outlines, Tata McGrawHill
2. Yashavant Kanetkar, Data Structures Through C, BPB Publication, 2nd Edition

Reference books:

1. E Balgurusamy - Programming in ANSI C, Tata McGraw-Hill (Third Edition)
2. Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum – Data structures using C and C++ - PHI Publications (2nd Edition).
3. Ellis Horowitz, Sartaj Sahni- Fundamentals of Data Structures – Galgotia Books source.
4. Data Structures using C , ISRD Group, Mc Graw Hill

List of Practical:

Write Programs in C to implement

1. Searching methods-Linear & Binary
2. Sorting Methods-Bubble, Selection & Insertion.
3. Data base Management using array of structure with operations Create, display, Modify, Append, Search and sort.
4. Polynomial addition using array of structure.
5. Singly linked list with operations Create, Insert, Delete, Search.
6. Stack using arrays & Linked Lists.
7. Queue using array & Linked Lists.
8. Evaluation of postfix expression (input will be postfix expression)
9. Binary search tree: Create, search, recursive traversals.
10. Graph using adjacency Matrix with BFS & DFS traversals.