A6-R3: DATA STRUCTURES THROUGH 'C' LANGUAGE

Objective of the Course

The objective of the course is to introduce the fundamentals of Data Structures, Abstract concepts and how these concepts are useful in problem solving. After completion of this course student will be able to

- Understand and use the process of abstraction using a programming language such as'C'.
- Analyze step by step and develop algorithms to solve real world problems. Implementing various data structures viz. Stacks, Queues, Linked Lists, Trees and Graphs.
- Understanding various searching & sorting techniques.

Outline of Course

S.No	Topic	Minimum No. of Hours
1	Basic concepts of data representation	03
2	Introduction to Algorithm Design and Data Structure	06
3	Arrays	05
4	Stacks and Queues	08
5	Linkes Lists	08
6	Trees	10
7	Searching, sorting and complexity	10
8	Graphs	10

Lectures = 60

Practicals / Tutorials = 60

Total=120

Detailed Syllabus

1. Basic concepts of data representation. 3 Hrs.

Abstract data types: Fundamental and derived data types. Representation, primitive data structures.

2. Introduction to Algorithm Design and Data Structures. 6 Hrs.

Design and analysis of algorithm: Algorithm definition, comparison of algorithms. Top-down and bottom up approaches to Algorithm design. Analysis of Algorithm; Frequency count, Complexity measures in terms of time and space. Structured approach to programming.

3. Arrays 5 Hrs.

Representation of arrays: single and multidimensional arrays. Address calculation using column and row major ordering. Various operations on Arrays. Vectors. Application of arrays: Matrix multiplication, Sparse polynomial representation and addition

4. Stacks and Queues 8 Hrs.

Representation of stacks and queues using arrays and linked-list. Circular queues, Priority Queue and D-Queue. Applications of stacks: Conversion from infix to postfix and prefix expressions, Evaluation of postfix expression using stacks.

5. Linked lists 8 Hrs.

Singly linked list; operations on list. Linked stacks and queues. Polynominal representation and manipulation using linked lists. Circular linked lists, Doubly linked lists. Generalized list structure. Sparse Matrix representation using generalized list structure

6. Trees 10 Hrs.

Binary tree traversal methods: Preorder, In-order, Post-ordered traversal. Recursive and non-recursive Algorithms for above mentioned Traversal methods. Representation of trees and its applications: Binary tree representation of a tree. Conversion of forest into tree. Threaded binary trees; Lexical binary trees. Decision and game trees.

Binary search tree.: Height balanced (AVL) tree, B-trees.

7. Searching, Sorting and complexity 10 Hrs.

Searching: Sequential and binary searches, Indexed search, Hashing Schemes. Sorting: Insertion, selection, bubble, Quick, merge, radix, Shell, Heap sort. Comparison of time complexity.

8. Graphs 10 Hrs.

Graph representation: Adjacency matrix, Adjacency lists, Adjacency Multicasts. Traversal schemes: Depth first search, Breadth first search.

Spanning tree: Definition, Minimal spanning tree algorithms.

Shortest Path algorithms (Prime's and Kruskal's).

RECOMMENDED BOOKS

MAIN READING

1. V.Langsam, M.J.Augenstein and A.M.Tanenbaum, "Data Structures Using C and C++", Second Edition, 2000, Prentice Hall of India.

2. R.Kruse, C.L Tondo and B.Leung, "Data Structures and Program Design in C", Second Edition, 1997, Pearson Education.

3. S.Chottopadhyay, D.Ghoshdastidar & M.Chottopadhyay, "Data Structures through 'C' Language", First Edition, 2001 , BPB Publication

SUPPLEMENTARY BOOKS

1. G. L Heileman, "Data Structutes, Algorithms and Object Oriented Programming", First Edition, 2002, Tata McGraw Hill.

2. E. Horowitz, Sahni and D. Mehta, " Fundamentals of Data Structures in C++," 2002 Galgotia Publiction 2002