

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>II Year B.E. (Electronics and Telecommunication Engg.)</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>3ETRC3 DATA STRUCTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>5</b>
<b>Duration of Theory Paper: 3 Hours</b>							

### Learning Objectives:

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 -

- Analyze step by step and develop algorithms to solve real world problems.
- Implementing various data structures like Stacks, Queues, Linked Lists, Trees and Graphs.
- Understanding various searching & sorting techniques.
- To develop skills to apply appropriate data structures in problem solving

### Prerequisites:

Computer Programming knowledge, C/C++ Language

## COURSE CONTENTS

### Unit –I

#### Data Structure and Arrays

Data structures & Programming, Types of data structures, Program Design, Complexities, Algorithm Specifications: Performance Analysis and Measurement (Time and space analysis of algorithms Average, best and worst case analysis, Asymptotic Notation.

**Array:** Definition, Representation, Address Calculation; Searching: Linear search, Binary search;

### Unit-II

#### Stack and Sorting:

**Stack:** Definition, Representations: static and dynamic, Implementation of stack, Applications of stack: Polish notation representation and conversion, Tower of Hanoi problem, Implementation of recursion,

**Sorting:** Bubble sort, Insertion sort, Selection sort, Radix sort, Shell sort, Quick sort and Merge sort.

### Unit-III

#### List and Queues:

**Linked List:** Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Applications of linked list.

**Queues:** Definition, Representations, Static and dynamic, Circular Queue, Double ended Queue, Priority Queue, Implementation of Priority Queue using Heap data structure, Heap Sort, applications of queues.

#### **Unit-IV**

##### **Hashing and Trees:**

**Hashing:** Hash Structures: Representation, Search and Implementation and other issues, The symbol table, Hashing Functions, Collision-Resolution Techniques, File Structure: Concepts of fields, records and files, hashing for direct files.

**Trees :** -Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Binary search trees, Conversion of General Trees To Binary Trees, B-tree & its variations ,Applications of Trees- Some balanced tree mechanism ,AVL trees, M- way search trees.

#### **Unit-V**

**Graphs:** Definition, Basic terminology, Graph Types, Representations: static, dynamic; Implementations, Searching in graphs, Shortest path in graphs, Graph Applications.

#### **Learning Outcomes:**

Upon completing the course, students will be able to:

- Be able to check the correctness of algorithms using inductive proofs and loop invariants.
- Be able to compare functions using asymptotic analysis and describe the relative merits of worst-, average-, and best-case analysis
- Learn the basic types for data structure, implementation and application
- Use the appropriate data structure in context of solution of given problem.
- Develop programming skills which require to solve given problem.
- Become familiar with a variety of sorting algorithms and their performance characteristics (eg, running time, stability, space usage) and be able to choose the best one under a variety of requirement.
- Become familiar with the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate

#### **BOOKS RECOMMENDED:**

- [1] E.Horowitz & Sahni,” *Fundamental Data Structure*”,GalgotiaBookSource,1983.
- [2] A.Tannenbaum,“*Data Structure Using C*”,PearsonEducation, 2003.
- [3] Kruse,“*Data Structure and Programming Design*”,PrenticeHall,1987.
- [4] N.Wirth,“*Algorithms+DataStructure=Program*”,Prentice Hall of India,1979.
- [5] Goodrich & Tamassia, “*Data Structures and Algorithms in C++*”,2<sup>nd</sup> Edition, John Wiley & Sons, 2011.

#### **List of Practical Assignments:**

During the learning of course, students need to carryout following assignments:

1. Implementation of searching and sorting techniques.
2. Implementation of list using array and linked list.
3. Implementation of push and pop operation on stack
4. Implementation of polish notation and its conversion
5. Write a program to solve the problems using iteration/recursion
6. Program for recursion removal using stack
7. Program for insertion/deletion operation on various queues & implementation of priority queue for process scheduling
8. Program for storing data as tree structure and implementation of various traversal techniques
9. Program for storing data as graph structure and implementation of various traversal techniques
10. Program for finding shortest path in graph.