| Program : **Diploma in Computer Engineering / Computer Hardware Engineering / Robotic Process Automation** | |
|---|---|
| Course Code : **4133** | Course Title: **Data Structures** |
| Semester : **4 / 5 /4** | Credits: **4** |
| Course Category: **Program Core** | |
| Periods per week: **4 (L:4 T:0 P:0)** | Periods per semester: **60** |

**Course Objectives:**

- Introduce the fundamental concept of data structures
- Emphasize the importance of data structures in designing and implementing efficient algorithms.

**Course Prerequisites:**

| Topic | Course code | Course name | Semester |
|---|---|---|---|
| Functions and Arrays | | Problem Solving and Programming | II |
| Recursion, Structures and Pointers | | Programming in C | III |

**Course Outcomes :**

On completion of the course,the student will be able to:

| COn | Description | Duration (Hours) | Cognitive Level |
|---|---|---|---|
| CO1 | Implement the primitive operations and applications of stacks & queues. | 18 | Applying |
| CO2 | Implement the different operations of linked lists | 12 | Applying |
| CO3 | Illustrate different types of binary trees and operations on it. | 16 | Applying |
| CO4 | Illustrate graph traversal algorithms. | 12 | Applying |

| | | | |
|---|---|---|---|
| | Series Test | 2 | |

**CO – PO Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | |
| CO2 | 3 | | | | | | |
| CO3 | 3 | | | | | | |
| CO4 | 3 | | | | | | |

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

**Course Outline**

| Module Outcomes | Description | Duration (Hours) | Cognitive Level |
|---|---|---|---|
| **CO1** | **Implement the primitive operations and applications of stacks & queues.** | | |
| M1.01 | Define data structure with its basic operations. | 2 | Remembering |
| M1.02 | Implement stack using array | 2 | Applying |
| M1.03 | Apply stack operations to solve simple problems | 2 | Applying |
| M1.03 | Convert infix expression to postfix expression and evaluate postfix expression. | 5 | Applying |
| M1.04 | Implement queue using array. | 3 | Applying |
| M1.05 | Explain circular queue, Deque and Priority queue | 4 | Understanding |
| **Contents:**<br>Introduction to Data Structures: Basic Terminology – Classification - Operations on Data Structures, Linear Data Structures, Stacks: Introduction to Stacks - Array Representation of Stacks - Operations on a Stack - Applications of Stacks - Infix-to-Postfix Conversion - Evaluating Postfix Expressions, Queues: Introduction to Queues - Array Representation of Queues - Operations on a Queue - Types of Queues: Circular Queue – Dequeue – Priority queue. | | | |
| **CO2** | **Implement the different operations of linked lists** | | |
| M2.01 | Outline the concept of Linked List and its representation in memory. | 2 | Understanding |

| | | | |
|---|---|---|---|
| M2.02 | Implement a Singly Linked List. | 6 | Applying |
| M2.03 | Explain different types of Linked List | 2 | Understanding |
| M2.04 | Construct stack and queue using Singly Linked List | 2 | Applying |
| | Series Test – I | 1 | |

**Contents:**

Linked Lists: Singly Linked List - Representation in Memory, Static, Dynamic - Operations on a Singly Linked List – Insertion, Deletion, Searching and Traversal- Types of Linked List- Circular Linked Lists, Doubly Linked Lists - Linked List Representation of Stack and Queue.

| **CO3** | **Illustrate different types of binary trees and operations on it.** | | |
|---|---|---|---|
| M3.01 | Explain the essential key terms related to Binary Trees and its classification. | 2 | Understanding |
| M3.02 | Illustrate the representation of a Binary Tree | 2 | Understanding |
| M3.03 | Implement a Binary Search Tree with different operations. | 8 | Applying |
| M3.04 | Explain different types of Binary Trees | 4 | Understanding |
| | | | |

**Contents:**

Non Linear Data Structures – Trees – Binary Tree - Definition - Basic Terminologies - Node, Parent, Child, Link, Root, Leaf, Level, Height of a tree and node, Depth of a tree and node, Degree of a tree and node, sibling, Ancestors, Path, Path Length - Types of Binary Trees: Full, Complete, Strict, Perfect, - Representations of a Binary Tree Linked Lists - Operations on a Binary Search Tree: Insertion –Traversal – Deletion – Searching - Sorting application – Count number of nodes – Height - Expression Tree – Threaded Binary Tree.

| **CO4** | **Illustrate graph traversal algorithms.** | | |
|---|---|---|---|
| M4.01 | Explain the essential key terms related to Graphs and its different classifications. | 2 | Understanding |
| M4.02 | Illustrate the different representations of a Graph. | 2 | Applying |
| M4.03 | Illustrate Graph Traversal algorithms. | 5 | Applying |
| M4.04 | Explain Warshall's algorithm to find the shortest path. | 3 | Understanding |
| | Series Test – II | 1 | |

**Contents:**

Non Linear Data Structures – Graphs: Graph Terminologies - Vertex, Edge, Adjacent vertices, Self-loop, Parallel edges, Isolated vertex, Degree of vertex, Pendant vertex, Subgraph, Paths and Cycles, - Types of Graphs - Directed, Undirected, Simple, Complete, Cyclic, Acyclic, Bipartite, Complete Bipartite, Connected, Disconnected and Regular, - Representation of Graphs - Set – Linked – Matrix - Graph Traversals - Warshall's Shortest path algorithm.

**Text / Reference**

| T/R | Author/Book Title |
|---|---|
| T1 | Samanta Debasis, **Classic Data Structures**, Prentice Hall of India, 2nd ed., 2009 |
| R1 | Reema Thareja, **Data Structures Using C**, Oxford University Press India. |
| R2 | Richard F. Gilberg, Behrouz A. Forouzan, Data Structures: **A Pseudo code approach with C**, 2nd ed., Cengage Learning, India, 2005 |
| R3 | Lipschutz S, **Theory and Problems of Data Structures with Applications**, Tata McGrawHill, 1995 |
| R4 | Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan, **Fundamentals of Data Structure in C**, University Press, India. |

**Online Resources**

| S.No | Website Link |
|---|---|
| 1 | https://nptel.ac.in/courses/106/103/106103069/ |
| 2 | https://www.programiz.com/dsa |
| 3 | https://www.tutorialspoint.com/data_structures_algorithms/index.htm |
| 4 | https://www.programmingsimplified.com/c/data-structures |
| 5 | https://www.sanfoundry.com |