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:

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