Course Code	050120303			
Category	Core Subject			
Course Title	Data Structures (DS)			
Scheme and Credits	Theory	Tutorial	Lab	Credits
	4	**0**	**4**	**6**
Pre-requisites (if any)	• Basic knowledge of writing and understanding algorithms for solving a problem. • Basic knowledge of C programming language.			

1. **Course Objectives:**

Sr.	Course Outcome (Learner will be able to)
1.	To understand how a problem is solved step by step to get the desired output
2.	To learn the right way to organize information in the digital space
3.	To understand the fundamental concept of elementary data structures and their implementation.
4.	To understand where and how the data structures are implemented in real world
5.	To learn how to write efficient and optimized computer programs.

2. **Course Contents:**

Module	Course Content	Weightag
Unit 1	**Introduction to Data Structures** Concept of Data structures, Impact of using data structures in algorithms, Introduction to calculation of Time Complexity and Space Complexity, Introduction to Linear and Non Linear Data structures.	10%
Unit II	**Linear Data Structures** Storage representation of Arrays – Single dimensional arrays and double dimensional arrays (Row major order and column major order), Concept of Sparse Matrices and its operations (Transpose addition and subtraction).	15%
Unit III	**Advanced Linear Data Structures: Linked lists, Stacks, Queues** **Linked List:** Basic concept, Storage representation, Types of Linked lists (Singly, Doubly, Circular), Operations on linked list (Insert, modify, delete, union, intersection, merge, sort, searching), Applications of Linked list (Polynomial operations – Addition and multiplication), Header linked lists. **Stack:** Basic concept, Storage representation (Array and linked	30%

	list), Basic Operations (PUSH, POP, PEEP AND CHANGE), Applications of Stacks (Polish and reverse polish expressions), Arithmetic Expression evaluation using stack. **Queues**: Basic concept, Storage representation (Array and Linked list), Basic Operations (INSERT AND DELETE). Types of Queues- Circular, Deque, Priority queues (Only concept). Application of Queues (Simulation, Scheduling algorithms).	
Unit IV	**Non Linear Data Structures – Trees and Graphs.** **Trees** – Basic concept, terms associated with trees(Node, parent, child, link, root, leaf, level, height, in degree, out degree, siblings), Storage representation – Linear and Linked , Types of tree (Binary Tree, BST, Expression tree, AVL Tree,2-3 tree, B tree, Threaded binary tree), Conversion of General tree to Binary tree, Complete Binary tree, full binary tree, BST operations, Tree traversals – In order, Pre-order, Post-order **Graphs**-Basic concepts, technical terms associated with Graphs – Digraph, Weighted graph, adjacent vertices, self-loop, parallel edges, simple graph, complete graph, isolated vertex, Degree of a vertex, connected graph-, Storage representation (Set representation, Adjacency matrix, Adjacency list), Graph Traversing algorithms- DFS and BFS. Overview of Concept of Minimum Spanning Tree – Prim's Algorithm, Kruskal's Algorithm, Shortest path algorithm – Dijikstra 's algorithm	**25%**
Unit V	**Sorting and Searching Algorithms** **Sorting Algorithms:** Bubble, Selection, Insertion, Shell, 2- Way Merge sort, Radix sort. Heap sort and Quick sort. **Searching Algorithms:** Linear Search and Binary Search, Introduction to Hashing and hashing methods, collision resolution techniques.	**20%**

3. Text Books:
1. Debasis Samanta, Classic Data Structures, PHI, Second Edition.
2. Jean-Paul Tremblay, Paul G. Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw-Hill, 2nd Edition, (2007).
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson, Second Edition,
4. Ashok N. Kamthane,"Introduction to Data Structures in C", Pearson Education (2004).
5. G. A.V.PAI,"Data Structures and Algorithms,Concepts, Techniques and Applications", TMH , 1st Edition (2008).
6. Reema Thareja, Data Structures using C, Oxford

4. Webilography:
1. https://www.tutorialspoint.com/data_structures_algorithms
2. https**://www.javatpoint.com/**
3. https://www.geekforgeeks.org/data-structure/

5. Accomplishment of the student after completing the course:

1. Ability to design and implement various abstract data types.
2. Understand the applications of various data structures in the basic computer system.
3. Understand and implement the various sorting and searching methods on the data sets (big and small).