Course Code	**40110201**			
Category	**Core Subject**			
Course Title	Data Structures (DS)			
Scheme and Credits	**Theory**	**Tutorial**	**Lab**	**Credits**
	3	**0**	**4**	**5**
Pre-requisites (if any)	• Basic knowledge of writing and understanding algorithms for solving a problem. • Knowledge of programming in C language			

1. Course Objectives:

- To understand how a problem is solved step by step to get the desired output.
- To learn the right way to organize information in the digital space.
- To understand the fundamental concept of elementary data structures and their implementation.
- To understand where and how the data structures are implemented in real world.
- To learn how to write efficient and optimized computer programs.

2. Course Contents

Unit	Course Content	Weightage
Unit 1	**Introduction to Data Structures** Data types – primitive and non-primitive, abstract data type, concept of data structures, what is algorithm?, introduction to linear and nonlinear data structures, introduction to calculation of time complexity (best case, worst case and average case) and space complexity.	**15%**
Unit II	**Linear Data Structures: Array, Linked lists, Stacks, Queues** **Array:** Operations (row major and column major address calculations) **Linked List: B**asic concept, difference between linked list and array, storage representation, types of linked lists (singly, doubly, circular), operations on linked list (insert, modify, delete, union, intersection, merge, sort, searching, reverse (by changing address not data)), applications of linked list (polynomial operations – addition and multiplication), sparse matrices implementation using linked list **stack:** Basic concept, storage representation (array and linked 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.	**40%**
Unit III	**Non Linear Data Structures – Trees and Graphs.**	**30%**

	Trees – Basic concept, terms associated with trees (Node, parent, child, link, root, leaf, level, height, indegree, outdegree, siblings), Storage representation – Linear and Linked, Conversion of General tree to Binary tree, Complete Binary tree, full binary tree, BST operations, Tree traversals – In-order, Pre-order, Post-order, Types of Binary tree : BST (Practical – recursive), Expression tree, AVL Tree (without practical),2-3 tree, B tree(without practical)), **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. Spanning Tree, Minimum spanning tree algorithm: Prim's Algorithm, Kruskal's Algorithm, Shortest path algorithm – Dijikstra 's algorithm	
Unit IV	**Sorting and Searching Algorithms and Hashing** **Sorting Algorithms:** Bubble, Selection, Insertion, Shell, 2- Way Merge sort, Radix sort, heap sort and Quick sort. **Searching Algorithms:** Binary Search, **Hashing :** Introduction to Hashing and hashing methods, collision resolution techniques.	**15%**

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, SecondEdition,
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/

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).