Paper code : ARD 209	L	T/P	Creditts
Subject : Data Structures	4	0	4

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : AS per University norms

➢ There should be 9 questions in the end term examination question paper
➢ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions.
➢ Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit.
➢ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
➢ The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes:
CO1: Describe the overview of data structures and their importance in solving computational problems **[K1]**.
CO2: Implement and perform operations on sparse matrices using both array and linked list representations. **[K3]**.
CO3: Analyze and compare different sorting algorithms, such as selection sort, insertion sort, exchange sort, and merge sort **[K4,K5]**.
CO4: Understand the representation of disjoint sets and apply the union-find algorithm **[K2]**.

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	3	3	3	1	-	-	-	-	-	1	2
CO2	2	3	3	3	1	-	-	-	-	-	1	2
CO3	2	3	3	3	1	-	-	-	-	-	2	3
CO4	3	3	3	3	5	-	-	-	-	-	2	3

Course Content	No. of Lectures
Unit I Overview of data structure, Basics of Algorithm Analysis including Running Time Calculations, Abstract Data Types, Arrays, Arrays and Pointers, Multidimensional Array, String processing, General Lists and List ADT, List manipulations, Single, double and circular lists. Stacks and Stack ADT, Stack Manipulation, Prefix, infix and postfix expressions, recursion. Queues and Queue ADT, Queue manipulation.	**[12]**
Unit II Sparse Matrix Representation (Array and Link List representation) and arithmetic (addition, subtraction and multiplication), polynomials and polynomial arithmetic. Trees, Properties of Trees, Binary trees, Binary Tree traversal, Tree manipulation algorithms, Expression trees and	**[12]**

their usage, binary search trees, AVL Trees, Heaps and their implementation, Priority Queues, BTrees, B* Tree, B+ Tree	
Unit III Sorting concept, order, stability, Selection sorts (straight, heap), insertion sort (Straight Insertion, Shell sort), Exchange Sort (Bubble, quicksort), Merge sort (External Sorting) (Natural merge, balanced merge and polyphase merge). Searching – List search, sequential search, binary search, hashing methods, collision resolution in hashing	**[12]**
Unit IV Disjoint sets representation, union find algorithm, Graphs, Graph representation, Graph Traversals and their implementations (BFS and DFS). Minimum Spanning Tree algorithms, Shortest Path Algorithms	**[12]**

Text Books:

[T1] Gilberg, R. F., & Forouzan, B. A. (2001). Data structures: A pseudocode approach with C++. Brooks/Cole Publishing Co.

[T2] .Aho Alfred, V., Hopcroft John, E., Ullman Jeffrey, D., Aho Alfred, V., Bracht Glenn, H., Hopkin

[T3] Kenneth, D., ... & Johnson, C. A. (1983). Data structures and algorithms. USA: Addison-Wesley.

Reference Books:

[R1] Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2022). Introduction to algorithms. MIT press.

[R2] E. Horowitz, S. Sahni, S. Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, Silicon Press (US), 2007.

[R3] Weiss M.A., "Data structures and algorithm analysis in C++", Pearson Education, 2014.