22DS1T1: DATA STRUCTURES

Course Name	Data Structures		L	T	P	C	CIA	SEE	TM
Course Code	22DS1T1		4	0	0	4	30	70	100
Year of Introduction: 2021	Year of Offering: 2022	Year of Revision: No Revision			Percentage of Revision: Nil				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose: Data Structure is a course that illustrates *Mathematical and Algorithmic Notations*, *Complexities of Algorithms*, *String Processing*, *Array Processing*, *Linked Lists*, *Stacks*, *Recursion*, *Trees*, *Graphs* and *Searching and Sorting*.

Course Objectives:
This course will help enable the students to understand and learn various *Mathematical and Algorithmic Notations*, *Time and Space Complexities*, *String Processing*, *Array Processing*, *Linked Lists*, Stacks and their *Applications*, *Tress*, *Graphs* and *Searching and Sorting*.

Specific objectives include:
- ✓ To understand *Overview* and *Preliminaries* of *Data Structure*.
- ✓ To understand the concepts of *String Processing*, *Arrays*, *Records and Pointers*.
- ✓ To understand and implement *Linked Lists*, *Stacks*, *Queues and Recursion*.
- ✓ To analyze and implement *Tree Concepts*.
- ✓ To understand and implement *Graphs*, *Sorting and Searching*.

Course Learning Outcomes:
Upon successful completion of the course, the student will be able to:
CO1: Learn overview and Preliminaries of Data Structure.
CO2: Understand the concepts of *String Processing*, *Arrays*, *and Records and Pointers*.
CO3: Understand and implement *Linked Lists*, *Stacks*, *and Queues and Recursion*.
CO4: Analyze and implement *Tree Concepts*.
CO5: Understand and implement *Graphs*, *Sorting and Searching*.

UNIT I (12 Hours)

Introduction and Overview: Elementary Data Organization - Data Structures - Data Structure Operations - Algorithms: Complexity - Time Space Tradeoff.
Preliminaries: Mathematical Notation and Functions - Algorithmic Notation - Control Structures - Complexity of Algorithms - Other Asymptotic Notations - Sub Algorithms - Variables - Data Types.

UNIT II (12 Hours)

String Processing: Storing Strings - Character Data Type - String Operations - Word Processing - Pattern Matching Algorithms.
Arrays, Records and Pointers: Linear Arrays - Representation and Traversing Linear Arrays - Inserting and Deleting - Bubble Sort - Linear Search - Binary Search - Multidimensional Arrays - Pointer Arrays - Record Structures - Representation of Records in Memory - Parallel Arrays -Matrices - Sparse Matrices.

UNIT III (12 Hours)

Linked Lists: Representation - Traversing - Searching - Memory Allocation: Garbage Collection, Insertion, Deletion, Header Linked Lists, Two Way Lists.
Stacks, Queues, Recursion: Stacks - Array Representation - Linked List Representation - Arithmetic Expressions: Polish Notation, Quick Sort, Recursion, Towers of Hanoi, Implementation of recursive procedures by stacks, Queues, Linked representation of Queues, DEqueues, Priority Queues.

UNIT IV (12 Hours)

Trees: Binary Trees - Representing and Traversing Binary Trees - Traversal Algorithms Using Stacks - Header Nodes - Binary Search Trees - Searching - Insertion and Deletion in Binary Search Trees - AVL Search Trees - Insertion and Deletion in AVL Trees - M Way Search Trees - Searching - Insertion and Deletion in M Way Search Tree - B Trees - Searching - Insertion and Deletion in B Tree - Heap: Heap Sort - Huffman's Algorithms - General Trees.

UNIT V (12 Hours)

Graphs: Terminology - Sequential representation of Graphs - Warshall's Algorithm - Linked Representation of Graphs - Operations on Graphs - Traversing a Graph - Topological Sorting.

Sorting and Searching: Insertion Sort - Selection Sort - Merging - Merge Sort - Radix Sort - Searching and Data Modification - Hashing.

Reference Text Books:

1. Seymour Lipschutz, Data Structures, The McGrawHill (Schaum's Outlines), February 2014.
2. Seymour Lipschutz, Theory and Problems of Data Structures, The McGrawHill, Schaum's Outlines, March 1986.
3. Aho, Hopcroft & Ullman, Data Structures & Algorithms, Addison-Wesley, 1982.
4. M.A.Weiss, Data Structures & Algorithms in C, Addison Wesley, 2000.

P.B.Siddhartha College of Arts & Science, Vijayawada - 520 010.
(An Autonomous College in the jurisdiction of Krishna University)
M.Sc. (Computational Data Science) Programme – I Semester
Course Code: 22DS1T1 Title: DATA STRUCTURES
(w.e.f admitted batch 2022-23)

SECTION-A

Answer ALL questions (5×4 = 20 Marks)

1. a) Define Data Structures. Explain different data types. (CO1,L2)
   (or)
   b) Explain how to analyse the complexity using various Asymptotic Notations with examples. (CO1,L2)

2. a) State different S*tring Operations* with examples. (CO2,L3)
   (or)
   b) Discuss *Priority Queues* with examples. (CO2,L3)

3. a) Discuss *Insertion and deletion* operations in a Linked List. (CO3,L2)
   (or)
   b) Explain *Towers of Hanoi problem* with a neat diagram. (CO3,L2)

4. a) Explain how *insertion and deletion* are performed in *AVL Trees.* (CO4,L2)
   (or)
   b) Write the algorithm for *Heap Sort*. (CO4,L2)

5. a) Explain a *Graph Traversal technique and apply it on example.* (CO5,L3)
   (or)
   b) How do we perform radix sort? Give an example. (CO5,L3)

SECTION-B

Answer Five Questions Choosing One Question from Each Unit.
All Questions Carry Equal Marks. (5×10 = 50 Marks)

6. a) Discuss *Elementary Data Organization* and *Data Structure Operations.* (CO1,L2)
   (or)
   b) Explain various *Control Structures*. (CO1,L2)
7. a) Explain *Binary Search* Algorithm and *Linear Search Algorithm* with an example. (CO2,L3)
   (OR)
   b) Discuss *The Second Pattern Matching Algorithm* with example. (CO2,L3)
8. a) Explain *Quick Sort Algorithm* with example. (CO3,L2)
   (or)
   b) Explain *Operations of Stack* and its representation using *Linked List* and *Array* with example. (CO3,L2)
9. a) Discuss *Binary Tree Traversal Techniques* using *Stack* in detail. (CO4,L2)
   (or)
   b) Briefly discuss about the insertion and deletion operations of *Binary Search Trees* with example. (CO4,L2)
10. a) Explain the process of *Topological Sorting*. (CO5,L3)
    (or)
    b) Discuss about *Merge Sort* with an example. (CO5,L3)