22CA2T2: DATA STRUCTURES

Course Name	Data Structures		L	T	P	C	CIA	SEE	TM
Course Code	22CA2T2		4	0	0	4	30	70	100
Year of Introduction: 1991	Year of Offering: 2023	Year of Revision: 2023			Percentage of Revision: 10				
L-Lecture, T-Tutorial, **P**-Practical, **C**-Credits, **CIA**-Internal Marks, **SEE**-External Marks, **TM**-Total Marks									

Course Description and Purpose:
Data Structures is a course that illustrates *Elementary Data Organization*, *Data Structure Operations*, and *Algorithms*, *Arrays*, *Matrices*, *String Processing*, *Stack*, *Queues*, *Linked List*, *Trees*, *Heap Sort*, *Multi-way Search Trees*, *B-Tree*, *B+-Trees*, *Graphs Algorithms*, *Elementary Graph Algorithms*, *Sorting* and *Searching Techniques*.

Course Objectives:
This course will help enable the students t o understand, learn and develop *Data Structure Operations and Algorithms*, *Arrays*, *Matrices*, *String Processing*, *Stack*, *Queues*, *Linked List*, *Trees*, *Heap Sort*, *Multi-way Search Trees*, *B-Tree*, *B+-Trees*, *Graphs Algorithms*, *Elementary Graph Algorithms*, *Sorting and Searching Techniques*.

Specific Objectives include:
- To understand *Data Structures*, *Data Structure Operations* and *Algorithms*, *Arrays*.
- To understand *String Processing, Stack, Queues and Linked List.*
- To learn the *Binary Tree, Binary Search Trees, AVL Trees, Heap*.
- To learn the *Multi-way Search Trees*, *B-Trees*, *B+-Trees*.
- To understand the *Graph Algorithms*, different *Sorting* and *Searching Techniques*.

Course Learning Outcomes:

At the end of this course the students should be able to:
CO1: Understand *Data Structures*, *Data Structure Operations and Algorithms*, *Arrays*.
CO2: Understand *String Processing, Stack, Queues and Linked List.*
CO3: Learn the Binary Tree, Binary Search Trees, AVL Trees, Heap.
CO4: Learn the *Multi-way Search Trees*, *B-Trees*, *B+-Trees*.
CO5: Understand the *Graph Algorithms*, different *Sorting* and *Searching Techniques*.

Course Content:

UNIT I (12 Hours)

Introduction and Overview: Elementary Data Organization, Data Structures, Data Structure Operations, and Algorithms: Complexity, Time and Space Tradeoff Asymptotic Notations. Linear Arrays, Representation and Traversing Linear Arrays, Inserting and Deleting, Linear Search, Binary Search, Multidimensional Arrays, Pointer Arrays, Record Structures, Representation of records in memory, Parallel Arrays, Matrices, Sparse Matrices.

UNIT II (12 Hours)

String Processing: Pattern Matching Algorithms.
Stacks: Stacks, Array representation, Linked List representation, Evaluation of Arithmetic

Expressions, Quick Sort, Recursion, Towers of Hanoi.
Queues: Linked representation of Queues, Deques, Priority Queues.
Linked Lists: Representation, Traversing, Searching, Memory Allocation: Garbage Collection, Insertion, Deletion, Header Linked Lists, Two Way Lists.

UNIT III (12 Hours)

Trees: Binary Trees, Representing and Traversing Binary Trees, Traversal Algorithms using Stacks, Binary Search Trees, Searching, Insertion and Deletion in Binary Search Trees, AVL Search Trees, Insertion and Deletion in AVL Trees.

Heap: Heap Sort, Huffman's Algorithms, General Trees

UNIT IV (12 Hours)

Multi-way Search Trees: M-Way Search Trees, Definition and Properties, Searching an M-Way Search Tree, B-Trees, Definition and Properties, Number of Elements in a B-Tree, Insertion into B-Tree, Deletion from a B-Tree, B+-Tree Definition, Searching a B+-Tree, Insertion into B+-Tree, Deletion from a B+-Tree.

UNIT V (12 Hours)

Graphs: Graphs Algorithms, Elementary Graph Algorithms: Topological Sort, Single Source Shortest PathAlgorithms:Dijkstra's, Bellman-Ford, All Pairs Shortest Paths : Floyd Warshall's Algorithm.
Sorting and Searching: Insertion Sort, Selection Sort, Merging, Merge Sort, Radix Sort, Searching and Data Modification, Hashing.

Reference Textbooks:

1. Seymour Lipschutz, Data Structures, Mc Graw Hill (Schaums Outlines), Revised First Edition, 2014.
2. Seymour Lipschutz, Theory and Problems of Data Structures, Mc Graw Hill (Schaums Outlines), Paperback, 2017.
3. John R Hubbard, Second Edition, Data Structures with Java, Mc Graw Hill (Schaums Outlines), 2009.
4. Robert Lafore, Data Structures & Algorithms in Java, Second Edition, Pearson Education, 2017.
5. Fundamentals of Data Structures in C, Second Edition, Horowitz, Sahani, Anderson-freed, Universities Press, 1993.
6. Data Structures: A Pseudocode Approach, Richard F Gilberg, Behrouz A Forouzan, Cengage, 2004

PARVATHANENI BRAHMAYYA SIDDHARTHA COLLEGE OF ARTS & SCIENCE

(An Autonomous College in the jurisdiction of Krishna University)

M.C.A., Second Semester

Course Name: Data Structures

Course Code: 22CA2T2

(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max Marks: 70 Marks**

SECTION-A

Answer ALL questions. All Questions Carry Equal Marks. (5×4 = 20 Marks)

1.(a) Explain different *Data Structure Operations*. (CO1, L2)

(or)

(b) Explain *Linear Array*.(CO1, L2)

2. (a) What is *Stack*? Explain its Operations. (CO2, L1)

(or)

(b) Define *Linked List* and its operations. (CO2, L1)

3. (a) Explain *Binary Search Trees*. (CO3, L2)

(or)

(b) Explain *General Trees*. (CO3, L2)

4. (a) Explain *M-Way Search Tree.* (CO4, L2)

(or)

(b) Explain *searching an element* from *B+-Tree*. (CO4, L2)

5. (a) Explain *Topological Sort Algorithm*. (CO5, L2)

(or)

(b) Explain *Bellman-Ford Algorithm*. (CO5, L2)

SECTION-B

Answer ALL questions. All Questions Carry Equal Marks. (5×10 = 50 Marks)

6. (a) Explain Binary Search and Linear Search Algorithms with example. (CO1, L2)

(or)

(b) Explain *Multidimensional Arrays in Java with example*. (CO1, L2)

7. (a) Explain *Towers of Hanoi Problem* implementation *with example*. (CO2, L5)

(or)

(b) Explain Operations of *Queue* using *Linked List with example*. (CO2, L5)

8. (a) Discuss *AVL Search Trees operations* in detail. (CO3, L6)

(or)

(b) Discuss about the insertion and deletion operations of Binary Search Trees with example. (CO3,L6)

9. (a) List *B-Tree operations* with examples. (CO4, L4)

(or)

(b) List insertion and deletion operations of B+-Tree with examples. (CO4, L4)

10. (a) Utilize Merge Sort Algorithm to sort the elements 10, 45, 15, 56, 48, 23, 8, 17. Explain step by step procedure. (CO5, L3)

(or)

(b) Make use of elements 23, 34, 12, 45, 14, 73, 21, 7 perform sort using Radix Sort. (CO5, L3)