DATA SCIENCE SYLLABUS
B.SC. I YEAR II SEMESTER (CBCS)
PAPER – II : DATA STRUCTURES (Theory)

UNIT – I

Fundamental Concepts: Introduction to Data Structures, Types of Data Structures, Introduction to Algorithm, Pseudo-code, Flow Chart, Analysis of Algorithms. Linear Data Structure Using Arrays: 1-D Arrays, 2-D Arrays, N-D Arrays, Memory Representation and Address Calculation of 1-D, 2-D, N-D Arrays, Concept of Ordered List, String Manipulation, Pros and Cons of Arrays. Stacks: Concept, Primitive Operations, Abstract Data Type, Representation Stacks Using Arrays, Prefix, Infix, Postfix Notations for Arithmetic Expression, Applications of Stacks– Converting Infix Expression to Postfix Expression, Evaluating the Postfix Expression, Checking Well-formed (Nested) Parenthesis, Processing of Function Calls, Reversing a String.

UNIT – II

Recursion: Introduction, Recurrence, Use of Stack in Recursion, Variants of Recursion, Execution of Recursive Calls, Recursive Functions, Iteration versus Recursion. Queues: Concept, Primitive Operations, Abstract Data Type, Representation Queues Using Arrays, Circular Queue, Double-Ended Queue, Applications of Queues. Linked Lists: Introduction, Concept, Terminology, Primitive Operations-creating, inserting, deleting, traversing, Representation of Linked Lists, Linked List Abstract Data Type, Linked List Variants - Singly Linked List, Doubly Linked List, Linear and Circular Linked List, Representation Stacks and Queues Using Linked Singly Lists, Application of Linked List–Garbage Collection.

UNIT – III

Trees: Introduction, Representation of a General Tree, Binary Tree Introduction, Binary Tree Abstract Data Type, Implementation of Binary Trees, Binary Tree Traversals – Preorder, Inorder, Postorder Traversals, Applications of Binary Trees Briefly. Graphs: Introduction, Graph Abstract Data Type, Representation of Graphs, Graph Traversal – Depth-First Search, Breadth-First Search, Spanning Tree – Prim's Algorithm, Kruskal's Algorithm. Hashing: Introduction, Hash Functions, Collision Resolution Strategies.

UNIT – IV

Searching and Sorting: Sequential (Linear) Search, Binary Search, Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Merge Sort, and Comparison of Sorting Techniques. Heaps: Concept, Implementation, Abstract Data Type, Heap Sort.

References

1. "Computer Algorithms" - Ellis Horowitz, Sartaj Sahni and S. Rajasekaran
2. "Data Structure and Algorithmic Thinking with Python" - Narasimha Karumanchi
3. "Data Structures and Algorithms in Python"- Roberto Tamassia, M. H. Goldwasser, M.T. Goodrich.
4. "Problem Solving in Data Structures & Algorithms Using Python"- Hemant Jain

Practical Paper-II: Data Structures Using Python (Lab)

[2 HPW :: 1 Credit :: 25 Marks]

1. Write programs to implement the following using an array: a) Stack ADT b) Queue ADT.
2. Write a program to convert the given infix expression to postfix expression using stack.
3. Write a program to evaluate a postfix expression using stack.
4. Write a program to ensure the parentheses are nested correctly in an arithmetic expression.
5. Write a program to find following using Recursion a) Factorial of +ve Integer b) n^{th} term of the Fibonacci Sequence (c) GCD of two positive integers
6. Write a program to create a single linked list and write functions to implement the following operations. a) Insert an element at a specified position b) Delete a specified element in the list c) Search for an element and find its position in the list d) Sort the elements in the list ascending order
7. Write a program to create a double linked list and write functions to implement the following operations. a) Insert an element at a specified position b) Delete a specified element in the list c) Search for an element and find its position in the list d) Sort the elements in the list ascending order
8. Write a program to create singular circular linked lists and function to implement the following operations. a) Insert an element at a specified position b) Delete a specified element in the list c) Search for an element and find its position in the list
9. Write programs to implement the following using a single linked list: a) Stack ADT b) Queue ADT. 10 Write a program to implement Binary search technique using Iterative method and Recursive methods.
10. Write a program for sorting the given list numbers in ascending order using the following technique: Bubble sort and Selection sort
11. Write a program for sorting the given list numbers in ascending order using the following technique: Insertion sort and Quicksort
12. Write a program for sorting the given list numbers in ascending order using the following technique: Merge sort and Heapsort
13. Write a program to traverse a binary tree in following way. a) Pre-order b) In-order c)Post-order 15 Write a program to the implementation graph traversals – BFS and DFS.
14. Write a program to find the minimum spanning tree for a weighted graph using a) Prim's Algorithm b) Kruskal's Algorithm.

Note: Write the Pseudo Code, flowcharts and Python program code for the above problems/methods/ algorithms with different possibilities like with and without oops, functions, etc. is mandatory.