Advanced Data Structures (OMC203)

Overview of the Course

Course Basics

- **Programme:** Master of Computer Applications
- **Semester:** 2
- **Course Title:** Advanced Data Structures
- **Course Code:** OMC203
- **Course Credits:** 3
- **Course Type:** Core Theory Course

Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

CO-1. Describe pointers, stack, and queue applications. [L-1]

CO-2. Classify linked lists, trees, and graphs and discuss searching and shortest path algorithms. [L-2]

CO-3. Perform analysis of algorithms to determine space and time complexity. [L-3]

CO-4. Use suitable sorting algorithms, advanced searching algorithms, and hashing techniques. [L-3]

CO-5. Illustrate indexed file structures, direct mapping techniques & M-way search, B Tree and B+ trees [L-4]

Unit 1

Title: Introduction

- Basic Terminology
- Pointer, and dynamic memory allocation
- Array Representation of stack
- Linked Representation of Stack
- Infix, Prefix, and Postfix Expressions

Unit 2

Title: Queue and Linked List

- Queues: Array and linked representation of queues

- Circular queue, D-queue, and Priority Queue.

- Linked list: Representation of Singly Linked Lists

- Two-way Header List

- Circular linked list

- Doubly linked list

Unit 3

Title: Non-linear Data Structures

- General Trees, Operations on Trees

- Trees traversals

- Binary Trees, Operations on binary trees

- Conversion of a general tree to binary

- Huffman's algorithm

- Applications of trees

Unit 4

Title: Graphs

- Graphs-Introduction
- BFS and DFS
- Spanning tree: Minimum Spanning tree, Kruskal's Algorithm, Prim's Algorithm,
- Floyd-Warshall algorithm
- Dijkstra's Algorithm

Unit 5

Title: Algorithm

- Growth of function
- Big-Oh, Theta, Omega notation
- Complexity of algorithm
- Notation of algorithm complexity

Unit 6

Title: : Sorting

- Introduction
- Bubble sort
- Insertion sort
- Selection sort
- Quick sort
- Merge sort

Unit 7

Title: Advanced Searching Algorithms

- Advanced searching techniques

- Search tree traversals

- Threaded binary search trees

- Inserting, and deleting nodes in a binary search tree

- Height balanced (AVL) tree, concept, and construction

- Heap: min heap and max heap

Unit 8

Title: Hashing

- Hashing Techniques, Hash function

- Common hash functions

- Collision resolution techniques: Linear probing, Double hashing

- Bucket addressing

- Rehashing

Unit 9

Title: File Structures

- Concept of record

- File Operations: Create, update, and delete

- File design considerations

- File systems organization: Sequential, Relative, Indexed, and Random-access Mode

- Direct mapping techniques: Absolute, relative, and indexed sequential files (ISAM)

Unit 10

Title: Indexed Structures

- Binary search trees as indexes

- M-way search tree: insertion, deletion

- B-Trees-searching, insertion, deletion

- B+ tree

Course Resources

a. Essential Reading

1. Gilberg, Riochard. Forouzan, Behrouz. (2018). Data Structure- A Pseudocode Approach with C, Thomson Learning Publications

2. RL Kruse, BP Leung and CL Tondo. (2006). Data Structure and Program Design in C. 2nd Ed., Pearson

3. Weiss, Mark Allen. (2002). Data Structures and Algorithm Analysis in C. 2nd Ed., Addison Wesley

b. Recommended Reading

1. R. Kennish Walter. (1986). Introduction to Data Management and File Design, Prentice Hall

2. Jean-Paul Trembley, Sorenson P.G. (1984). An Introduction to Data Structures with Applications, McGraw-Hall

3. Tanenbaum, Langasam, MJ Augenstein. (1991). Data Structures using C, Prentice-Hall, India