ICT 4303: FUNDAMENTALS OF DATA STRUCTURES AND ALGORITHMS [3 0 0 3]

Course Objectives:

- Design efficient algorithms for various problems
- Understand the basic concepts of linear and nonlinear data structures.
- Compare and contrast various searching and sorting techniques
- To apply data structure concepts for efficient representation of data

Abstract:

Introduction to algorithms, Arrays: Elementary operations, Applications, Performance Analysis, Sparse matrix representation, Transpose of sparse matrix, Stacks operations, Arithmetic expression conversion and evaluation using stack, Queue Operations, Singly linked Lists, Circular lists, Doubly linked lists, Trees, Binary Tree traversals and different operations, Binary search Tree, Heaps, Graph Abstract type: Representations and elementary operations, Sorting and searching techniques, Analysis of algorithm.

Syllabus:

Introduction:
Performance Analysis and Measurements – Asymptotic notations, introduction to data structure, classification of data structure, Abstract data types **[4 Hours]**

Arrays:
The Array as Abstract Data type, Sparse Matrix Representation, Transpose of a sparse matrix, Representation of multidimensional arrays, The String abstract data type, Pattern matching. **[3 Hours]**

Stacks:
Definition, operations on stacks, Evaluation of Arithmetic Expressions, Conversion of arithmetic expressions, Recursion, Multiple Stacks **[3 Hours]**

Queues:
Definition, operations, application of circular queues. **[2 Hours]**

Linked Lists:
Introduction to pointers and Dynamic memory allocation, Singly linked lists, Circular lists, Dynamically Linked Stacks and Queues, Polynomial representation and polynomial operations using singly linked list, Singly circular linked list, Doubly linked lists, Analysis of linked list operations. **[8 Hours]**

Trees:
Tree terminology, Binary trees, Properties, Binary tree representations, Binary Tree Traversal algorithms, Expression tree, Heaps, Binary Search Trees. Complexity associated with various algorithms. [**8 Hours]**

Graphs:
Definitions and Representations, Depth First Search, Breadth First Search, Connected components, Spanning trees, Complexities associated with each of the searching techniques.
[4 Hours]

Sorting and Searching:
Insertion Sort, Quick Sort, Merge sort, Heap sort, Shell sort, Linear search, Binary search, analysis of algorithms with respect to time complexity **[4 Hours]**

Course Outcomes:

By the end of this course, the students should be able to:

- Summarize asymptotic notations to represent the complexities of the algorithms.
- Apply the appropriate data structure for the given problem.
- Compare the performance of sorting and searching techniques.
- Develop an efficient algorithm for the given problem

.

References:

1. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, *Fundamentals of Data Structures in C++ (2e),* Galgotia Publications, 2008.
2. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C++ (3e),* Pearson Education, 2009.
3. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, *Fundamentals of Data structures in C (2e),* Silicon Press, 2008