CS2143 - Data Structures

Course Title:	Data Structures (CS2143)
Pre-requisite(s):	Object Oriented Programming (CS1143) Introduction to Programming (CS1133)
Credit Hours:	3
Instructor(s):	
Text Book(s):	Data structures and algorithm in C++ By Adam Drozdek (second edition).
Reference Book(s):	• Data structures using C++ by D. S. Malik. • Data structures and algorithm analysis in C++ By Mark Allen Weiss Benjamin/Cummings Publishing Company, Inc
Web Reference:	• https://www.tutorialspoint.com/data_structures_algorithms/index.htm

Course Introduction:

Typically, a program is a set of instructions that processes some data. In order to develop a good (efficient) program we need to organize data in computer memory in a proper way. Organized data is called a data structure. Study of computer science includes the study of how data (information) is organized in computer and, how it can be manipulated and utilized by programs. It is extremely important for a student of computing related discipline to understand the concepts of data (information) organization and manipulation. This course will focus on data structures and basic algorithms for manipulating them. Data structures for storing information in lists, stacks, queues, trees, graphs and tables will be covered.

Course Objectives:

The main objective of this course is to enable students to understand, design, and implement common data structures and algorithms to manipulate those data structures using C++

techniques. Emphasis will be on a lot of understanding, practice on paper and in writing codes to implement all the major data structures.

Course Learning Outcomes (CLOs):

At the end of this course, the students should be able to

CLO 1: Understand the fundamental of data structures along with its operations. **(C2-Understanding)**

CLO 2: Implement various data structures using programming language. **(C3-Applying)**

CLO 3: Solve real life problems using various data structures. **(C3-Applying)**

CLOs – PLOs Mapping:

	CLO:1	**CLO:2**	**CLO:3**
PLO:1 (Academic Education)			
PLO:2 (Knowledge for Solving Computing Problems)	√		
PLO:3 (Problem Analysis)		√	√
PLO:4 (Design/Development of Solutions)			
PLO:5 (Modern Tool Usage)			

Course Contents:

Week	**Contents**
1	Course overview, Need of Data Structures, Single dimensional Static and Dynamic arrays, Multi-Dimensional Static and Dynamic Arrays
2	Array-based Dynamic List implementation, Array-based Dynamic List implementation and resize on runtime
3	Stack ADT and Advantages of Stack ADT, Implementation of Stack using a dynamic array
4	Application of stack: postfix calculator and infix to postfix convertor, postfix expression evaluation, FIFO Queue Concepts, Array-based Queue implementation

5	Priority Queue, Sorting array to make priority queue, Circular Queue, Stack & Queue Revision
6	Linked Lists Introduction, performing insert and traversal of nodes of list, Linked Lists Search and Delete node operations
7	Implementation of Stack using linked lists, Implementation of Queue using linked list
8	Circular and Doubly Linked Lists and their operations, Implementation of double-ended queue using doubly linked lists
Mid-Term Exam	
9	Recursion: Introduction and Applications, Basic concepts about Trees, Difference between Simple, Binary, and Binary Search Trees, complete and Full BT
10	Implementation of Binary Tree (Linked-list based): Traversal (recursive) and Search operations, Operations on BST: search, getting height, leaves and nodes count
11	Implementation of Linked-list based Binary Search Tree: Search, Insert, delete operation on Linked-list based Binary Search Tree
12	Linked-list based Binary Search Tree Iterative Traversal, Time and Space Complexity of Binary Search Tree, Unbalanced BST problem.
13	AVL Trees Basic Concept and types of rotations, Constructing an AVL Tree: understanding concept and code
14	Deleting nodes from AVL Tree, Concept of Heap Trees, Minimum and Maximum Heap Trees
15	Use of Heaps for Implementation of Priority Queues, Basic concepts about Graph and storage of Graph in memory using Adjacency Matrix and Adjacency Lists
16	Hash Table

Grading Policy:

S. No	Grading	% of Total Marks
1	Assignments	20
2	Quizzes	20
3	Mid-term Exam	20
4	Final Exam	40
	Total	**100**