LAB DESCRIPTION

NAME OF INSTITUTION   Lahore Garrison University

PROGRAM (S) TO BE EVALUATED   **BS Computer Science**

Course Code	CC-6313
Course Title	Data Structures
Credit Hours	3 + 1
Prerequisites by Course(s) and Topics	Students should have taken the following course in prior semesters. • Object Oriented Programming
Grading Schema (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Project: 20% Lab Performance: 15% Lab Report: 15% Open Ended Lab: 10% Final Term: 40%
Course Coordinator/ Instructor(s)	Mr. Humayun Majeed/ Ms. Farwa Javed, Ms. Khola Farooq, Ms. Syeda Urwa Warsi
Course Coordinator/ Instructor's Profile	Qualifications: MSCS (Scholar) Areas of Interest: Programming Languages, HDL, Mobile Development
Counselling Hours	Monday: 12:00 pm – 02:00 pm Tuesday: 12:00 pm – 02:00 pm Venue: Robotics Lab, 1st floor (Old Building)
Course Content	Abstract data types, complexity analysis, Big O notation, Stacks (linked lists and array implementations), Recursion and analyzing recursive algorithms, divide and conquer algorithms, Sorting algorithms (selection, insertion, merge, quick, bubble, heap, shell, radix, bucket), queue, dequeue, priority queues (linked and array implementations of queues), linked list & its various types, sorted linked list, searching an unsorted array, binary search for sorted arrays, hashing and indexing, open addressing and chaining, trees and tree traversals, binary search trees, heaps, balanced trees, graphs, breadth-first and depth-first traversal, topological order, shortest path, adjacency matrix and adjacency list implementations, memory management and garbage collection
Text Book	• Data Structures and Algorithms in C++ by Adam Drozdek, 4th ed. 2016, ISBN: 978-1-133-60842-4.

Reference Material	• Data Structures and Algorithm Analysis in C++ by Mark Allen Weiss,2013,4th edition, ISBN-13: 9780132847377 • "Data Structures and Algorithms Made Easy" by Narasimha Karumanchi, 5th ed. 2023, ISBN: 9788193245286.			
Course Learning Outcomes (CLOs)	**CLO**	**At the end of the course the students will be able to:**	**Domain**	**PLO**
	CLO1	**Apply** appropriate data structures and algorithms to explain, demonstrate their working, and determine their complexities in order to interpret problems and design solutions	C3	PLO4
	CLO2	**Practice** and apply appropriate data structures and algorithms to design solutions	P3	PLO5
	*BT = Bloom's Taxonomy, C = Cognitive domain, P = Psychomotor domain, A = Affective domain *PLO4 = Design/ Development of solutions *PLO5 = Modern Tool Usage			

Weeks	Topics Covered	CLOs	Assessments	Teaching Methodology
Week-1	**Array Operations** – Traversal, Insertion, and Deletion	1	Lab Task – 1	Hands-on Lab Task
Week-2	**Searching Algorithms** – Linear Search (Concept and Implementation), Binary Search (Working and Requirement of Sorted Arrays)	1	Lab Task – 2	Hands-on Lab Task
Week-3	**Linked List** - Singly Linked List (Insertion, Deletion, and Traversal)	1	Lab Task – 3	Hands-on Lab Task
Week-4	**Linked List -** Doubly Linked List and Circular Linked List (Insertion, Deletion, and Traversal)	1	Lab Task – 4	Hands-on Lab Task
Week-5	**Stack** – Operations, Implementation (Array and Linked List), Applications (Infix to Postfix Conversion, Expression Evaluation)	1	Lab Task – 5	Hands-on Lab Task
Week-6	**Queue Structures** – Linear, Circular, and Priority Queues (Array and Linked List Implementations)	1	Lab Task – 6, Class Participation - 1	Hands-on Lab Task + Class Discussions & Debates
Week-7	**Basic Sorting Techniques** – Bubble Sort, Selection Sort, and Insertion Sort	1	Lab Task – 7, Project Proposal Submission	Hands-on Lab Task + Collaborative Group Work
Week-8	**Recursive Sorting Techniques** – Merge Sort and Quick Sort	2	Lab Task – 8	Hands-on Lab Task
Week-9	**Advanced Sorting Techniques** – Heap Sort, Max Heap, and Min Heap	2	Lab Task – 9, Class Participation - 2	Hands-on Lab Task + Class Discussions & Debates
Week-10	**Binary Search Tree (BST)** – Properties, Insertion, Deletion, and Traversal	2	Lab Task – 10	Hands-on Lab Task
Week-11	**AVL Trees** – Balancing, Rotations, and Height Property	2	Lab Task – 11	Hands-on Lab Task
Week-12	**Graph Representations** – Adjacency List, Adjacency Matrix, Depth-First Search (DFS), and Breadth-First Search (BFS)	2	Lab Task – 12, OEL	Hands-on Lab Task + Open Ended Lab
Week-13	**Graph Algorithms** – Minimum Spanning Tree (Prim's and Kruskal's Algorithms)	2	Lab Task – 13	Hands-on Lab Task
Week-14	**Graph Shortest Path Algorithms** – Dijkstra's Algorithm and Applications	2	Lab Task – 14, Project & Documentation Submission	Hands-on Lab Task
Week-15	**Project Presentations -** evaluation of lab projects.	2	Project Evaluation	Project-Based Learning + Peer Feedback
Week-16	**Lab Final Exam**	**1,2**	**Exam**	Outcome-Based Assessment

Laboratory Projects/Experiments Done in the Course	The lab is associated with this course. Assignments and class tasks have been taken from the students.		
Class Time Spent on (in contact hours)	**Theory**	**Problem Analysis**	**Solution Design**
	30 mins	1 hr	1.5 hrs
Oral and Written Communications	Physical presence in the classroom and online social interaction. Modes for communication: ● Google Classroom ● WhatsApp Group		

Coordinator / Instructor(s) Name: Mr. Humayun Majeed

Instructor Signature: Humayun Majeed.

Date: 08th/September/2025