COMSATS University Islamabad
Department of Computer Science
Course Syllabus

Course Information

Course Code: **CSC211** | Course Title: **Data Structures**
Credit Hours: **4(3,1)** | Lecture Hours/Week: **3**
Lab Hours/Week: **3** | Pre-Requisites: **CSC103-Programming Fundamentals**

Catalogue Description:

This course provides fundamental knowledge of data organization. The topics include Overview of Data Structures; Static & Dynamic List; Stack; Queue; Tree & its Algorithms; Graph & its Algorithms; Sorting; Searching; Hashing.

Text and Reference Books

Textbook:

1. A Common-Sense Guide to Data Structures and Algorithms, Jay Wengrow, Pragmatic Bookshelf, 2020.

Reference Book:

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, Addison-Wesley, 2014.

Week wise Plan:

Lecture #	CDF Unit #	Topics Covered	Reference Material
1.	1	Data Structure: Overview, Importance, Classification, Operations, and Abstract Data Types.	Wengrow: Ch1 Weiss: Ch3
2.	2	Array List & its Operations.	Weiss: Ch3
3.	2	Dynamic VS. Static Data Structures, Pointers, and Structures.	Wengrow: Ch14
4.	2	Introduction to Linked List & its operations: Insert at Start, Insert after a Specific location(node), Insert at End of Linked List, Display of Linked List.	Wengrow: Ch14
5.	2	More Operations of Singly Linked List: Insert Before Specific Value, Delete from Start, Delete from End, Delete After a Specific Value, and Delete Before a Specific Value.	Wengrow: Ch14
6.	2	Doubly Linked List Operations.	Wengrow: Ch14
7.	2	Circular Linked List.	Wengrow: Ch14
8.	3	Introduction to Stack, Static and Dynamic Implementation of Stack, Its Operations and Usage with Examples.	Wengrow: Ch9
9.	3	Infix to Postfix Conversion using Stack.	Weiss: Ch3
10.	4	Introduction to Queue, Static and Dynamic Implementation, Its Operations and Example of Different Applications.	Wengrow: Ch9 Weiss: Ch3
11.	4	Circular Queue: Insertion & Deletion (Static and Dynamic Implementation); Priority Queue: Insertion & Deletion (Static & Dynamic Implementation); Applications.	Wengrow: Ch9 Weiss: Ch3
12.	4	Double Ended Queue: Input restricted Queue, Output restricted Queue; Applications	Wengrow: Ch9 Weiss: Ch3
13.	5	Non-Linear Data Structures (Trees), Concept & Terminology, and Traversal Algorithms.	Wengrow: Ch15
14.	5	Binary Search Tree (BST), Insertion, Traversal and Search	Wengrow: Ch15

		in BST.	
15.	5	Deletion from BST.	Wengrow: Ch15
16.	5	Tree Balancing Technique (AVL).	Weiss: Ch4
17.	**Mid Term Exam**		
18.			
19.	5	Left to Left and Right to Right Rotation in AVL to Balance the Tree.	Weiss: Ch4
20.			
21.	5	Heap: Max Heap, Min Heap, Insertion and Deletion in Heap, Heap Tree as Priority Queue.	Wengrow: Ch16
22.	6	Introduction to Graph, Terminology and Representation.	Wengrow: Ch18
23.	6	Graph Traversal Techniques: Breadth First Search, and Depth First Search.	Wengrow: Ch18
24.	6	Shortest Path Problem: Dijkstra's Algorithm.	Wengrow: Ch18
25.	6	Minimum Spanning Trees (MST): Kruskal Algorithm.	Weiss: Ch9
26.	6	Prims Algorithm.	Weiss: Ch9
27.	7	Sorting Algorithms: Bubble Sort, Insertion Sort, and Selection Sort.	Wengrow: Ch4-6
28.	7	Merge Sort	Weiss: Ch7
29.	7	Searching Algorithms: Linear Search and Binary Search.	Wengrow: Ch2
30.	8	Time Complexity of Searching and Sorting Algorithms	Wengrow: Ch 4-6
31.	8	Hashing: Hash Functions, choosing a Hash function, Types of Hash function: Division method, Mid square method, Digit folding method, and Collision	Wengrow: Ch8 Weiss: Ch5
32.	8	Strategies for Avoiding & Resolving Collisions: Closed Hashing: Linear Probing, Quadratic Probing, Double Hashing; Open Hashing: Separate chaining	Wengrow: Ch8 Weiss: Ch5
33.	Revision		
		Final Term Exam	

Graduate Attributes (GAs)

S.#	Description
2	Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
3	Identify, formulate, research literature, and solve *complex* computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
4	Design and evaluate solutions for *complex* computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
5	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to *complex* computing activities, with an understanding of the limitations.

6	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.

Course Learning Outcomes (CLO)

Sr.#	Unit #	Course Learning Outcomes	Blooms Taxonomy Learning Level	GA
CLO's for Theory				
CLO-1	1-4	Employ linear data structures to solve computing problems.	*Applying*	2-4
CLO-2	5-6	Use non-linear data structures to solve computing problems.	*Applying*	2-4
CLO-3	7,8	Apply fundamental sorting, searching, and hashing techniques on different data structures.	*Applying*	2-4
CLO's for Lab				
CLO-4	2-7	Implement various data structures, searching, sorting, and hashing in a programming language.	*Applying*	2-4
CLO-5	1-8	Develop a project using appropriate data structures in a team environment.	*Creating*	2-6

CLO Assessment Mechanism

Assessment Tools	CLO-1	CLO-1	CLO-2	CLO-3	CLO-4	CLO-5
Quizzes	Quiz 1	Quiz 2	Quiz 3	Quiz 4	-	-
Assignments	Assignment 1	Assignment 2	Assignment 3	Assignment 4	Lab Assignments	-
Mid Term Exam	Mid Term Exam	Mid Term Exam	-	-	Lab Mid Term Exam	-
Final Term Exam	Final Term Exam				-	Lab Project/ Final Term Lab Exam

Policy & Procedures

- **Attendance Policy:** Every student must attend 80% of the lectures delivered in this course and 80% of the practical/laboratory work prescribed for the respective courses. The students falling short of required percentage of attendance of lectures/seminars/practical/laboratory work, etc., shall not be allowed to appear in the terminal examination of this course and shall be treated as having failed this course.

- **Course Assessment:**

	Quizzes	Assignments	Mid Term Exam	Terminal Exam	Total
Theory(T)	15	10	25	50	100
Lab(L)	-	25	25	50	100
Final Marks (T+L)	**(T/100)*75 + (L/100)*25**				

- **Grading Policy:** The minimum pass marks for each course shall be 50%. Students obtaining less than 50% marks in any course shall be deemed to have failed in that course. The correspondence between letter grades, credit points, and percentage marks at CUI shall be as follows:

Grade	**A**	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D**	**F**
Marks	90 - 100	85 - 89	80 - 84	75 - 79	70 - 74	65 - 69	60 - 64	55 - 59	50 - 54	<50
Cr. Point	4.0	3.7	3.3	3.0	2.7	2.3	2.0	1.7	1.3	0.0

- **Missing Exam:** No makeup exam will be given for final exam under any circumstance. When a student misses the mid-term exam for a legitimate reason (such as medical emergencies), his grade for this exam will be determined based on the Department policy. Further, the student must provide an official excuse within one week of the missed exam.

- **Academic Integrity:** All CUI policies regarding ethics apply to this course. The students are advised to discuss their grievances/problems with their counsellors or course instructor in a respectful manner.

- **Plagiarism Policy:** Plagiarism, copying and other anti-intellectual behaviour are prohibited by the university regulations. Violators must face serious consequences.