Form: FET – 1

UIT University

Faculty of Engineering and Technology
Session: Fall – 2024

Course Information

Course Title: Data Structures and Algorithms			**Code:** SET213
Department: Engineering Technology			
Program: SET213	**Semester:** III	**Batch:** 23B	**Credit Hours: 2+1** **Lecture: 32** **Practical:** 16
Knowledge Area (as per HEC curriculum template)	Foundation		

1. **Course description and objectives:**
   This course will focus on data structures and algorithms for manipulating them. Data structures for storing information in tables, lists, stacks, queues, trees and graphs will be covered. Basic algorithms for creating, manipulating and using these structures will also be discussed. Different types of searching and sorting techniques will also be introduced and will be compared. Students will carry out a number of programming assignments, which will emphasize various aspects of data organization and manipulation process.

2. **Course Learning Outcomes (CLOs):**

CLO No.	CLO Description	Domain and Taxonomy level	PLO mapped (i to xii)	Level of emphasis of the PLO (1=High; 2=Medium; 3=Low)
1.	**Analyze** algorithms and data structures for performance comparison in terms of time and space complexity using Asymptotic Analysis. algorithm complexity and time-space trade-off.	C3	ii	1
2.	**Use** linear data structures, and implement algorithms for them: (e.g. Arrays, stacks, queues, linked lists, etc.).	C4	i	1
3.	**Use** non-linear data structures, and implement algorithms for them: (e.g. trees, graphs, heaps etc.).	C4	i	1
4.	**Implement** various linear and non-linear data structures and algorithms in C++.	P4	iii	1

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Teaching Plan

1. Weekly Lecture Breakdown

Week #	Topic(s) to be covered	Remarks (if any)
1	Introduction to data structures, Introduction to algorithm writing, Basic Operations.	CLO – 1
2	Complexity of Algorithms, time-space tradeoffs	CLO – 1
3	Arrays, Operations in Arrays	CLO – 2
4	Queues and Stacks	CLO – 2
5	String Processing and Pattern Matching	CLO – 2
6	Searching Algorithms, Introduction to Sorting Algorithms	CLO – 2
7	Sorting Algorithms (Cont.)	CLO – 2
8	Linked Lists, Operations on linked lists	CLO – 2
	Midterm Examination	
9	Linked Lists, Operations on linked lists	CLO – 2
10	Recursion	CLO – 3
11	Recursion Applications	CLO – 3
12	Trees, binary trees, basic operations on binary trees	CLO – 3
13	Binary search tree and tree traversal, expression tree	CLO – 3
14	Heaps	CLO – 3
15	Graphs	CLO – 3
16	Graphs	CLO – 3

Lab-work Plan (if applicable)

2. Experiment/Practical Breakdown

Experiment #	Experiment Title	CLO Mapped	Remarks
1	**Getting familiar with Data Structure & Algorithms**	CLO – 4	
2	**Complexity of algorithms and time-space tradeoffs**	CLO – 4	
3	**Operations on Arrays**	CLO – 4	
4	**Queue Operations**	CLO – 4	
5	**Stack Operations**	CLO – 4	
6	**String Processing and Pattern Matching**	CLO – 4	
7	**Searching Algorithms**	CLO – 4	
8	**Sorting Algorithms**	CLO – 4	**Includes Open-ended Activity**
Midterm Examination			
9	**Linked Lists**	CLO – 4	
10	**Linked Lists**	CLO – 4	**Includes Open-ended Activity**
11	**Recursion**	CLO – 4	
12	**Binary Tree – Basic operations on Binary Tree**	CLO – 4	

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13	**Binary Tree Traversal**	**CLO – 4**	**Includes Open-ended Activity**
14	**Heaps**	**CLO – 4**	
15	**Graphs**	**CLO – 4**	
16	**Project Submission and viva**		**Open-ended Activity**

3. Syllabus and Books:

Pointers and Dynamic Memory Allocation, Dynamically Allocated Arrays, Structures and Unions, Stacks, Queues, Recursion.
Lists - Singly-linked lists, doubly linked lists and circular linked lists. Operations on linked list (Traversal, Deletion, Insertion).
Searching and Sorting Algorithms. Complexity Analysis.
Hash table, Trees - binary trees, binary tree basic algorithms and traversals (In-order, Pre-order, -Order).
Graphs - Binary Search Trees (BSTs) representation and traversal (insertion, deletion). Heaps and heap sort, spanning trees, topological sort, shortest path algorithm.

Books:

1. *Lipshutz, "Data Structures", Schaum Outline Series, (Latest Edition).*
2. *Weiss, "Data structures and algorithm analysis in C++". (Latest Edition).*
3. *Horowitz Sahni, "Fundamentals of Data Structures in C++", (Latest Edition)*

4. Percentage of theoretical background, problems analysis and solution design

Elements covered in the course	Percentage of full course coverage
Theoretical background	40
Problem analysis	30
Solution design	30

5. Teaching and learning methods:

a. Lecture
b. Class discussion/ Videos
c. Presentation
d. Activities
e. Homework

6. Student assessment methods:

a. Quiz
b. Assignment
c. Exams (Theory)
d. Project
e. Activities etc.

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7. Assessment schedule:

a. Quiz throughout the semester
b. Assignment throughout the semester
c. Exams
   Midterm exam Week 9
   Final theory exam Week 18
d. Activities throughout the semester

8. Weighting of assessments:

Theory:

a.	Quizzes/Activities	15 Marks
b.	Assignment, Project	15 Marks
c.	Midterm examination	20 Marks
d.	Final term examination	50 Marks
	Theory Total	100 Marks

Lab:

a.	Lab Performance/Activities	20 Marks
b.	Final term examination	30 Marks
	Lab Total	50 Marks

9. Facilities required for teaching and learning

a. Computer Usage
b. Software (C++)

Course group leader name: Engr. Dr. M. Ghazanfar Ullah

Signature:

S. No.	Course group member (if any)	Theory/Lab	Signature
1	Engr. Asad Hussain	Lab	