National University of Sciences & Technology (NUST)
School of Electrical Engineering and Computer Science (SEECS)
Department of Electrical Engineering

Data Structures and Algorithms			
Course Code:	CS-250	**Semester:**	8th
Credit Hours:	3+1	**Prerequisite Codes:**	CS110 Fundamentals of Computer Programming
Instructor:	Bostan Khan	**Class:**	BEE-12ABCD
Office:	MachVIS Lab	**Telephone:**	--
Lecture Days:	Tuesday, Thursday, Fridays	**E-mail:**	bostankhan6@gmail.com
Class Room:	CR-05 Group-01 CR-04 Group-02	**Consulting Hours:**	Mondays – 1415h-1700h via email appointment
Lab Engineer:	Ms. Anum Asif	**Lab Engineer Email:**	anum.asif@seecs.edu.pk
Knowledge Group:	Programming	**Updates on LMS:**	Every day, after the class.

Course Description:
An overview of data structure concepts, arrays, stack, queues, linked lists, trees, and graphs. Discussion of various implementations of these data objects, programming styles, and run-time representations. Course also examines algorithms for sorting, searching and some graph algorithms.

Course Objectives:
Learn about basic abstract data structures and implement them efficiently. Understand the importance of data structures in developing and implementing efficient algorithms. Introduce commonly used sorting algorithms and compare them based on computational efficiency and memory requirements

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**PLO**	**BT Level***
1. **Describe** the fundamentals of data structures and algorithms	1	C-2
2. **Analyze** and solve a given real time problem by applying the appropriate data structure and algorithm.	2	C-4
3. **Practice** programs using the latest IDEs ensuring testing, documentation and packaging of programs as per standards practices applicable to the software industry.	5	P-3
4. **Demonstrate** commitment to professional ethics by following engineering norms applicable to the software industry.	8	A-3
* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain Knowledge(C-1), Comprehension(C-2), Application(C-3), Analysis(C-4), Synthesis(C-5), Evaluation(C-6)		

	Perception(P-1), Set(P-2), Guided Response(P-3), Mechanism(P-4), Complete Overt Response(P-5), Adaption(P-6), Organization(P-7), Receiving(A-1), Responding(A-2), Valuing(A-3), Organization(A-4), Internalizing(A-5)

Mapping of CLOs to Program Learning Outcomes

PLOs/CLOs	CLO1	CLO2	CLO3	CLO4
PLO 1 (Engineering Knowledge)	√			
PLO 2 (Problem Analysis)		√		
PLO 3 (Design/Development of Solutions)				
PLO 4 (Investigation)				
PLO 5 (Modern tool usage)			√	
PLO 6 (The Engineer and Society)				
PLO 7 (Environment and Sustainability)				
PLO 8 (Ethics)				√
PLO 9 (Individual and Team Work)				
PLO 10 (Communication)				
PLO 11 (Project Management)				
PLO 12 (Lifelong Learning)				

Grading Criteria:

Assessments	Details
Theory: 75%	Assignments: 10%, Quiz exams: 15 %
	Midterm: 30%
	End Semester Exam: 45 %
Labs: 25 %	Lab Tasks: 70%
	Project: 30%
Total : 100 %	

Books:	
Text Book:	**1. Data Structures & Algorithms Using C++, Fourth or latest Edition, Nell Dale**
Reference Books:	1. Adam Drozdek. Data Structures and Algorithms in C++, sixth Edition (2016) 2. T. H. Cormen, Charles E. Leiserson, R. L. Rivest, Clifford S. Introduction to Algorithms, Third Edition (2009) 3. Mark A. Weiss, Data Structures and Algorithm Analysis in C++, Fourth Edition (2013) 4. Data Structures & Algorithms Using C++, Fourth or latest Edition, John Bullinaria (2019)

Topics to be covered:	

1. Lists	**2.** Sorting algorithms
3. Stack and Queue	**4.** Trees
5. Running time complexity	**6.** Introduction to graph theory
7. Recurrence	**8.** Introduction to greedy algorithms

Lessons Plan:–

Week No.	Topics	Assessment
1	Introduction to Data Structures and Algorithms	
2	Array, Linked List, Singly Linked List	Assignment # 1
3	Doubly Linked List, Circular Linked List	Quiz # 1
4	Stacks, Queue, Priority Queue	
5	Introduction to Trees, Binary Search Trees	Assignment # 2
6	Binary Search Tree Operations and Traversal	Quiz # 2
7	AVL Trees	
8	Binary Heaps	
9	**Mid Term**	
10	Sorting Algorithms I	Assignment # 3
11	Sorting Algorithms II	Quiz # 3
12	Introduction to Graphs	
13	Search Operations	Quiz # 4
14	Hash Tables	
15	Recursion	Quiz # 5
16	Spanning Trees, Shortest Paths	
17	Concept in Running Time Complexity, Function Growth	
18	**End Semester Exam**	

Lab Experiments:

Lab 01:	Understand pointers and dynamic memory
Lab 02:	Implement singly-linked lists using pointers
Lab 03:	Solve a practical problem using linked lists
Lab04:	Implement doubly linked lists
Lab 05:	Implement stacks and queues
Lab 06:	Computational time of algorithms
Lab 07:	Implement more sorting algorithms
Lab 08:	Use recursion to solve a problem
Lab 09:	Implement trees
Lab 10:	Implement binary search tree

Lab 11:	Implement binary heap
Lab 12:	Implement graphs
Lab 13:	Spanning trees, shortest path trees
Lab 14:	Project Evaluation
Lab 15:	Project Evaluation

Tools / Software Requirement:
● VC++ using MS Visual Studio, Eclipse C++ or any other appropriate IDE.

Grading Policy:	
Assignment Policy:	In order to develop a comprehensive understanding of the subject, assignments will be given. Late assignments will not be accepted / graded. All assignments will count towards the total (No 'best-of' policy). The students are advised to do the assignment themselves. Copying of assignments is highly discouraged and violations will be dealt with severely by referring any occurrences to the disciplinary committee. The questions in the assignment are meant to be challenging to give students confidence and extensive knowledge about the subject matter and enable them to prepare for the exams.
Lab Conduct:	The labs will be conducted for three hours every week. A lab handout will be given in advance for study and analysis. The lab handouts will also be placed on LMS. The students are to submit their results by giving a lab report at the end of the lab for evaluation. One lab report per group will be required. However, oral exams shall also be conducted during lab sessions.
Plagiarism:	SEECS maintains a zero-tolerance policy towards plagiarism. While collaboration in this course is highly encouraged, you must ensure that you do not claim other people's work/ ideas as your own. Plagiarism occurs when the words, ideas, assertions, theories, figures, images, programming codes of others are presented as your own work. You must cite and acknowledge all sources of information in your assignments. Failing to comply with the SEECS plagiarism policy will lead to strict penalties including zero marks in assignments and referral to the academic coordination office for disciplinary action.