UNITED INTERNATIONAL UNIVERSITY
Department of Computer Science and Engineering (CSE)
Course Syllabus

1	**Course Title**	Data Structure and Algorithms-I
2	**Course Code**	CSE 2215
3	**Trimester and Year**	Fall 2024
4	**Pre-requisites**	CSE 1115
5	**Credit Hours**	3.00
6	**Section**	I
7	**Class Hours**	Saturday: 1:51—3:10; Tuesday: 1:51—3:10
8	**Classroom**	309
9	**Instructor's Name**	Dr. Ohidujjaman Tuhin
10	**Email**	ohidujjaman@cse.uiu.ac.bd
11	**Office**	335(C)
12	**Counseling Hours**	
13	**Text Book**	1. Data Structures - E M Reingold
14	**Reference**	1. Data Structure and Algorithms in C++: Goodrich Tamassia 2. Introduction to Algorithms: Cormen, Leiserson, Rivest, Stein
15	**Course Contents (approved by UGC)**	Internal data representation; Abstract data types; Introduction to algorithms; Asymptotic analysis: growth of functions, O, Ω and Θ notations; Correctness proof and techniques for analysis of algorithms; Master Theorem; Elementary data structures: arrays, linked lists, stacks, queues, trees and tree traversals, graphs and graph representations, heaps, binary search trees; Graph Traversals: DFS, BFS, Applications of DFS and BFS; Sorting: heap sort, merge sort, quick sort, linear-time sorting; Data structures for set operations.
16	**Course Outcomes (COs) and Mapping**	

CO	Statement	Bloom's Domain	Program Outcome	Knowledge Profile	Complex Problem	Engineering Activities
CO1	Able to choose appropriate data structure as applied to specified problem definition.	C	PO1: Engineering Knowledge	Engineering fundamentals (K3)	Depth of Knowledge (P1)	-
CO2	Able to handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.	C	PO1: Engineering Knowledge			
CO3	Able to use linear and non-linear	C	PO1:			

	data structures like stacks, queues , linked list etc.		Engineering Knowledge			
CO4	Able to perform complexity analysis of algorithms.	C	PO2: Problem Analysis			

17	**Teaching Methods**	Lecture, Case Studies.
18	**CO with Assessment Methods**	
19	**Lecture Outline**	

CO	Assessment Method	(%)
-	Attendance	5
-	Assignments	5
-	Class Tests	20
CO1, CO2, CO4	Midterm exam	30
CO1, CO2, CO3	Final exam	40

Class	Topics/Assignments	CO Mapping
1.	Introduction to Data Structure	
2.	Internal Data Representation and Abstract Data Types	CO1
3.	Introduction to Algorithms; Asymptotic Analysis, Big Oh, Big Omega, Lower and Upper Limit, Best and Worst Cases	CO4
4.	Correctness proof and techniques analysis of algorithms	CO4
5.	Solving recurrences and Master theorem	CO4
6.	Arrays: Memory Mapping, Vector Implementation **[CT-1]**	CO2, CO3
7.	Arrays: Merge Sort, Quick Sort	CO1
8.	Arrays: Sorting, Linear Time Sort	CO1
9.	Linked Lists: Single Linked List	CO2, CO3
10.	Linked Lists: Double Linked List, Circular Linked List	CO2, CO3
11.	Linked Lists: Application **[CT-2]**	CO1
12.	Stack: Implementation using Array and Linked Lists	CO2, CO3
MID TERM EXAM		
13.	Stack: Application, Tower of Hannoi, Recursion	CO1
14.	Stack: Application, Introduction to Queue, Implementation of Queue using Arrays and Linked lists	CO1, CO2, CO3
15.	Queue Continued, Applications	CO1, CO2, CO3
16.	General Tree, Binary Tree **[CT-3]**	CO2, CO3
17.	Tree Traversal Algorithms	CO2, CO3
18.	Binary Search Trees, Insertion, Deletion, Properties, Tree Applications	CO1, CO2, CO3

19.	Heap and Priority Queue, Heap Sort	CO1, CO2, CO3
20.	Graphs: Implementation using adjacency matrix and Adjacency lists **[CT-4]**	CO2, CO3
21.	Graphs: BFS and DFS using adjacency matrix and Adjacency lists	CO2, CO3
22.	Graphs: Application of Graphs, Search Algorithms	CO1, CO2, CO3
23.	Set Operations **[CT-5]**	CO1, CO2
24.	Review	
	FINAL EXAM	

Appendix 1: Grading Policy

Letter Grade	Marks %	Grade Point	Letter Grade	Marks%	Grade Point
A (Plain)	90-100	4.00	C+ (Plus)	70-73	2.33
A- (Minus)	86-89	3.67	C (Plain)	66-69	2.00
B+ (Plus)	82-85	3.33	C- (Minus)	62-65	1.67
B (Plain)	78-81	3.00	D+ (Plus)	58-61	1.33
B- (Minus)	74-77	2.67	D (Plain)	55-57	1.00
			F (Fail)	<55	0.00

Appendix-2: Program outcomes

	Program Outcomes
1	**Engineering knowledge:** Apply knowledge of mathematics, natural science, engineering fundamentals and Computer Science and Engineering to the solution of complex engineering problems.
2	**Problem analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3	**Design/development of solutions:** Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
4	**Investigation:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions
5	**Modern tool usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations.
6	**The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems.
7	**Environment and sustainability:** Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts.
8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9	**Individual work and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**Project management and finance:** Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's 13 own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent

	and life-long learning in the broadest context of technological change.

Appendix-3: Knowledge Profile

Knowledge Profile
K1 – natural sciences
K2 – mathematics
K3 – engineering fundamentals
K4 – specialist knowledge
K5 – engineering design
K6 – engineering practice
K7 – comprehension
K8 – research literature

Appendix-4: Complex Engineering Problem

Attribute	Complex Engineering Problems have characteristic P1 and some or all of P2 to P7:
Depth of knowledge required	**P1:** Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach
Range of conflicting requirements	**P2:** Involve wide-ranging or conflicting technical, engineering and other issues
Depth of analysis required	**P3:** Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
Familiarity of issues	**P4:** Involve infrequently encountered issues
Extent of applicable codes	**P5:** Are outside problems encompassed by standards and codes of practice for professional engineering
Extent of stake-holder involvement and conflicting requirements	**P6:** Involve diverse groups of stakeholders with widely varying needs
Interdependence	**P7:** Are high level problems including many component parts or sub-problems