UNITED INTERNATIONAL UNIVERSITY

Department of Computer Science and Engineering (CSE)

Course Syllabus

Part A: Introduction		
1	**Course Title**	Data Structure and Algorithms - I
2	**Course Code**	CSE 2215
3	**Pre-requisites**	CSE 1111, CSE 1115
4	**Course Type**	Core Course
5	**Credit Hours**	3.00
6	**Contact Hours**	3 Hours/Week
7	**Semester**	4th
8	**Total Marks**	100
9	**Course Instructor's Information**	Md. Mohiminul Islam(MoI) Email: mohaiminul@cse.uiu.ac.bd Cell Phone Number: 01843707534 Office: 636
10	**Course Rationale**	This course has been designed to provide a solid foundation about the data structure and algorithms used in computer science. This course will give insights about the pros and cons of different data structures and algorithms.
11	**Course Objectives**	The objectives of this course are: ● To familiarize the basic data structures (array, linked list). ● To familiarize complex data structures (queue, stack, priority queue) using basic data structures ● To use suitable data structures for different algorithms ● To introduce the algorithms and their complexity and use cases
Part B: Content of the Course		
12	**Course Contents (approved by UGC)**	Complexity Analysis: Big Oh, Big Omega, Lower and Upper Limit, Best and Worst Cases, Arrays: Memory Mapping, Vector Implementation, Sorting, Linear Time Sort, Merge Sort, Quick Sort, Linked Lists: Single Linked List, Double Linked List, Circular Linked List, Stack: Implementation using Array and Linked Lists, Application, Tower of Hanoi, Postfix Expression, Queue: Introduction to Queue, Implementation of Queue using Arrays and Linked Lists, Applications, General Tree: Introduction, Definition, Binary Tree: Introduction, Implementation using Array and Pointers, Tree Traversal Algorithms, Binary Search Tree: Operations, Insertion, Deletion, Properties, Tree Applications, Heap and Priority Queue: Introduction, Heap Sort and Application of Priority Queue, Graph Representation: Implementation using Adjacency Matrix and Adjacency List, Graphs: BFS and DFS using Adjacency Matrix and Adjacency Lists, Application of Graphs, Search Algorithms, Set Operations: Make set, Find, Union.
13	**Course**	

Outcomes (COs)

COs	Description
CO1	**Able** to choose appropriate data structure as applied to specified problem definition.
CO2	**Able** to handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
CO3	**Able** to use linear and non-linear data structures like stacks, queues, linked list etc.

14 Mapping of COs and Program outcomes

COs	Program Outcomes(POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1			C									
CO2			C									
CO3				C								

15 Mapping COs with Teaching-Learning and Assessment Strategy

Class/ Week	Topics/Assignments	Course Outcomes (COs)	Reading Reference	Teaching-Learning Strategies	Assessment Strategies
1	Introduction, Course Overview		Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
2	Complexity Analysis, Big Oh, Big Omega, Lower and Upper Limit, Best and Worst Cases	CO1	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
3	Arrays: Memory Mapping, Vector Implementation	CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
4	Arrays: Sorting, Linear Time Sort	CO1	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
5	Arrays: Sorting, Merge Sort, Quick Sort	CO1	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
6	Linked Lists: Single Linked List	CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
7	Linked Lists: Double Linked List, Circular	CO2, CO3	Lecture Slides and	Lecture/Group Discussion/	Class Tests/Assignments

	Linked List		Text/ Ref. Book	Exercise	/Quizzes/Exam
8	Stack: Implementation using Array and Linked Lists	CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
9	Stack: Application, Tower of Hanoi, Postfix Expression	CO1	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
10	Queue: Introduction to Queue, Implementation of Queue using Arrays and Linked lists	CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
11	Queue: Applications	CO1	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
12	Review	CO1, CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture	Class Tests/Assignments /Quizzes/Exam
13	General Tree: Introduction, Definition	CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
14	Binary Tree: Introduction, Implementation using Array and Pointers	CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
15	Tree Traversal Algorithms	CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
16	Binary Search Tree: Operations, Insertion, Deletion	CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
17	Binary Search Tree: Operations, Insertion, Deletion	CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
18	Binary Search Tree: Properties, Tree Applications	CO1	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
19	Heap and Priority Queue: Introduction	CO1	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
20	Heap Sort and Application of Priority Queue	CO1	Lecture Slides and	Lecture/Group Discussion/	Class Tests/Assignments

			Text/ Ref. Book	Exercise	/Quizzes/Exam
21	Graph Representation: Implementation using Adjacency Matrix and Adjacency List	CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
22	Graphs: BFS using Adjacency Matrix and Adjacency Lists	CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
23	Graphs: DFS using Adjacency Matrix and Adjacency lists	CO2, CO3	Lecture Slides and Text/ Ref. Book/ Online Materials	Lecture/Group Discussion/ Exercise	Class Tests/Assignments /Quizzes/Exam
24	Graphs: Application of Graphs, Search Algorithms	CO1, CO3	Lecture Slides and Text/ Ref. Book/ Online Materials	Lecture/Group Discussion/ Exercise	Class Tests/Assignments/ Quizzes/Exam
25 -26	Set Operations (Make set, Find, Union)	CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture/Group Discussion/ Exercise	Class Tests/Assignments/ Quizzes/Exam
27	Review	CO1, CO2, CO3	Lecture Slides and Text/ Ref. Book	Lecture	Class Tests/Assignments /Quizzes/Exam
28	**FINAL EXAM**				

Part C: Assessment and Evaluation Methods

Assessment Strategy	**Assessment Types**	**Marks**
Formative Assessment	Attendance	5%
	Assignments	5%
	Class Tests	20%
Summative Assessment	Mid Term	30%
	Final Exam	40%

Grading System

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

Part D: Learning Resources

Text Book	1. Introduction to Algorithms – Thomas H. Cormen (4th edition, MIT Press & McGraw Hill, 2022) 2. Data Structures – E. M. Reingold (Addison Wesley Publication, 1998)
Reference	1. Data Structure and Algorithms in C++ - Goodrich, Tamassia (2nd edition, John Wiley and Sons Inc., 2003)
LMS URL	http://lms.uiu.ac.bd/course/view.php?id=3143

Appendix-1: Program outcomes

POs	Program Outcomes
PO1	An ability to apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.
PO3	An ability to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and of cultural, societal and environmental concerns.
PO4	An ability to conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.
PO5	An ability to create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of their limitations
PO6	An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO7	An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO8	An ability to apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice.
PO9	An ability to function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings.
PO10	An ability to communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.
PO11	An ability to demonstrate knowledge and understanding of engineering and management principles and apply these to one's work as a team member or a leader to manage projects in multidisciplinary environments.
PO12	An ability to recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.