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

1	**Course Title**	Data Structure and Algorithms-II
2	**Course Code**	CSE 2217
3	**Trimester and Year**	Spring 2024
4	**Pre-requisites**	CSE 2215: Data Structures and Algorithms-I
5	**Credit Hours**	3.00
6	**Section**	B
7	**Class Hours**	Sat/Tue 8:30 – 9:50
8	**Class Room**	631
9	**Instructor's Name**	Professor Mohammad Shahriar Rahman, PhD
10	**Email**	mshahriar@cse.uiu.ac.bd
11	**Office**	518 (CITS)
12	**Counselling Hours**	Day: Saturday — Time: 1:30PM-3:00PM; Day: Wednesday — Time: 12:30PM-2:00PM
13	**Text Book**	Introduction to Algorithms (3rd edition) by Cormen, Leiserson, Rivest and Stein
14	**Reference**	
15	**Course Contents (approved by UGC)**	Techniques for analysis of algorithms, Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic programming, back tracking, branch and bound, Basic search and traversal techniques, graph algorithms, Algebraic simplification and transformations, lower bound theory, NP-hard and NP-complete problems.
16	**Course Outcomes (COs)**	

Cos	Description
CO1	Analyze worst-case running times of algorithms using asymptotic analysis. Explain what complexity classes are. Be familiar with the complexity classes and conversion, relation, and reduction between them.
CO2	Describe different algorithm paradigms and explain when algorithmic design situations call for them. Recite algorithms that employ these paradigms. Synthesize such algorithms.
CO3	Apply appropriate data structures to design algorithms for solving various problems.

CO	Statement	Bloom's Domain	Program Outcome	Knowledge Profile	Complex Problem	Engineering Activities
CO1	Analyze worst-case running times of	C	a Engineering	Engineering fundamentals	Depth of Knowledge	-

	algorithms using asymptotic analysis. Explain what complexity classes are. Be familiar with the complexity classes and conversion, relation, and reduction between them.		Knowledge	(K3)	(P1)	
CO2	Describe different algorithm paradigms and explain when algorithmic design situations call for them. Recite algorithms that employ these paradigms. Synthesize such algorithms.	C	b Problem Analysis	Engineering fundamentals (K3) Specialist knowledge (K4)	Depth of Knowledge (P1) Range of conflicting requirements (P2)	
CO3	Apply appropriate data structures to design algorithms for solving various problems.	C				

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

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

19 Lecture Outline

Class	Topics/Assignments	COs	Reading Reference	Lecture Outcomes/Activities
1	Analyzing Algorithms: Worst-Case and Best-Case Analysis	1, 2	Lecture Slides and Text/ Ref.	Lecture, Assignment
2	Analyzing Algorithms: Worst-Case and Best-Case Analysis	1, 2	Lecture Slides and Text/ Ref.	Lecture, Assignment
3	Asymptotic Notation	2	Lecture Slides and Text/ Ref.	Lecture, Assignment

4	Class Test; The Divide-and-Conquer Approach; Analyzing Divide-and-Conquer Algorithms	1, 2	Lecture Slides and Text/ Ref.	Lecture, Test
5	The Maximum-Subarray Problem; The Recursion-Tree Method for Solving Recurrences	1, 2	Lecture Slides and Text/ Ref.	Lecture, Assignment
6	The Recursion-Tree Method for Solving Recurrences	1, 2	Lecture Slides and Text/ Ref.	Lecture, Assignment
7	An Activity-Selection Problem; Elements of the Greedy Strategy	1, 2	Lecture Slides and Text/ Ref.	Lecture, Assignment
8	Class Test; Some Legacy Greedy Problems	1, 2	Lecture Slides and Text/ Ref.	Lecture, Test
9	Fractional Knapsack Problem, Coin Change Problem	1, 2	Lecture Slides and Text/ Ref.	Lecture, Assignment
10	Dynamic Programming Basics, The Rod Cutting Problem	1, 2	Lecture Slides and Text/ Ref.	Lecture, Assignment
11	Coin Change Problem, Elements of Dynamic Programming	1, 2	Lecture Slides and Text/ Ref.	Lecture, Assignment
12	0/1 Knapsack Problem, Review	1, 2	Lecture Slides and Text/ Ref.	Lecture, Assignment
	MIDTERM EXAM			
13	Applications of BFS, DFS	2, 3	Lecture Slides and Text/ Ref.	Lecture, Assignment
14	Disjoint-Set Operations; Disjoint-Set Forests	3	Lecture Slides and Text/ Ref.	Lecture, Assignment
15	Growing a Minimum Spanning Tree	3	Lecture Slides and Text/ Ref.	Lecture, Assignment
16	Class Test; Kruskal's Algorithm	2, 3	Lecture Slides and Text/ Ref.	Lecture, Test
17	Single-Source Shortest Path Variants, Optimal Substructure of a Shortest Path, Negative-weight Edges, Cycles, Relaxation	2, 3	Lecture Slides and Text/ Ref.	Lecture, Assignment

18	The Bellman-Ford Algorithm	2, 3	Lecture Slides and Text/ Ref.	Lecture, Assignment
19	Dijkstra's Algorithm	2, 3	Lecture Slides and Text/ Ref.	Lecture, Assignment
20	Class Test; Direct-Address Tables, Hash Tables	3	Lecture Slides and Text/ Ref.	Lecture, Test
21	Hash Functions; Open Addressing	3	Lecture Slides and Text/ Ref.	Lecture, Assignment
22	The Nave String-Matching Algorithm; The Rabin-Karp Algorithm	2, 3	Lecture Slides and Text/ Ref.	Lecture, Assignment
23	Class Test; Polynomial Time; Polynomial-Time Verification; NP-Completeness	1	Lecture Slides and Text/ Ref.	Lecture, Test
24	NP-Hard, Reducibility, Review	1	Lecture Slides and Text/ Ref.	Lecture

Appendix 1: Assessment Methods

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

Appendix 2: 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-3: 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.