BANGLADESH ARMY INTERNATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY (BAIUST)

Department of Computer Science and Engineering

Undergraduate Program

COURSE OUTLINE — SPRING 2024 SEMESTER

I. Basic Information:

Faculty	**Mamun Ahmed, Associate Professor, Dept. of CSE**			
Office Hours	**Day**	**Time**	**Room No.**	**Section**
	Monday	11.35 AM – 01:30 PM	311	A
	Tuesday	12.35 PM – 01.30 PM	311	B
	Wednesday	10.30 AM- 11.25 AM	311	A
	Thursday	9.30 AM - 11.25 AM	312	B
Counselling Hours	**Day**	**Time**	**Room No.**	
	Tuesday	09.00 AM – 12.30 PM	CSE Faculty Room	
	Wednesday	12.00 PM- 03.00 PM	CSE Faculty Room	
	Thursday	12.00 PM- 03.00 PM	CSE Faculty Room	
Contact Details	Office:	Faculty Office		
	Mobile:	01790356681(9 am-5pm), Email: mamun.cse@baiust.ac.bd (24/7)		
Course Pre-requisites	CSE 121 : Structured Programming Language			
Department Offering the Course	CSE			
Course Title	Data Structures			
Course Code	CSE-211	**Credit** 03	**Contact Minutes** 2310	
Number of Lectures	36	**Class Tests** 04	**Assignment** 2	**Total** 42

II. Course Description:

1. Internal data representation, Abstract data types.
2. Algorithm performance and elementary asymptotic analysis (Introduction to Big-O notation).
3. Elementary data structures: array, linked list, stack, queue, tree and tree traversal, graphs and graph representation, heap, binary search tree.
4. Sorting algorithms, Searching: linear search and binary search;
5. Advanced data Structures: balanced binary search trees, skip list, advanced heaps; hashing.

OBJECTIVE:

1. To develop a general understanding of basic data structures and algorithms.
2. To develop Programming skills for advanced data structures and algorithms.

III. Course Learning Outcomes and Generic Skills:

At the end of the course, the students should be able to:

Course Learning Outcome (Upon completion of the course, the students will be able to)		Bloom's Taxonomy	CP	CA	KP	PO
CO 1	Express the fundamentals of static and dynamic data structures and relevant standard algorithms.	C1- C3	1		1	PLO1
CO 2	Demonstrate advantages and disadvantages of specific algorithms and data structures.	C4	1		1	PLO1
CO 3	Select basic data structures and algorithms for autonomous realization of simple programs or program parts.	C1-C5	1,2		1	PLO2
CO 4	Develop the communication skill by presenting topics on data Structures and algorithms.	A2		1		PLO10

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, C: Cognitive; P: Psychomotor; A: Affective)

IV. Mapping of CO and Program Outcomes: SKILL MAPPING

COs	Program Outcomes (POs) (Appendix 1) S = Strong, M = Medium and W = Weak											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S											
CO3		M										
CO4										W		

V. Justification for CO-PO Mapping

Mapping	Level	Justifications
CO1-PO1	Strong	Increase breadth and depth of knowledge by expressing the fundamentals of static and dynamic data structures and relevant standard algorithm.
CO2-PO1	Strong	Increase breadth and depth of knowledge by demonstrating advantages and disadvantages of specific algorithms and data structures.
CO3-PO2	Medium	Analyse and formulate different methods of analysis to select basic data structures and algorithms for autonomous realization of simple programs or program parts.
CO4-P010	Weak	Develop communication skills through participating in presentation and viva.

VI. Lecturer Outline: Teaching Learning and Assessment Strategy Mapped with CLOs

Week	**Intended Learning Outcomes (ILOs)**	**Teaching/ Learning Strategy**	**Assessment Strategy**	**CLO**
1-2	Introduced to Data Structure. Basic terminology and operations. Understanding algorithm, complexity and time-space tradeoff.	Lecture, Q/A,	Assignment,	1
3-5	Linear data Structure-Array. Understanding the concept and use of array. Memory organization of array. Array manipulation.	Lecture, Q/A, Multimedia Slides	Problem solving using Array. Write programs to store and manipulate data using Array	1
6-7	Applying searching and sorting algorithms	Lecture, Q/A, Multimedia	Assignment/ Quiz, Problem	2

	using array. Understanding the performance, limitation and improvement of these algorithms.	Slides	solving	
Midterm	Week 1-7			
8-9	Understanding the concept of Linked List, representation of Linked List in memory. Importance of Linked List over array. Inserting, deleting, traversing and searching in Linked List.	Lecture, Q/A, Multimedia Slides	Assignment/ Quiz	3
10-12	Understanding Stacks and Queue. Applying Stack and Queue to solve problems.	Lecture, Multimedia Slides, Q/A	Assignment, Problem solving using Stack and Queues.	4
13-14	Understanding non-linear data structure-Tree, terminologies, memory representation of tree. Searching and sorting using tree structure.	Lecture, Multimedia Slides, Q/A	Assignment, Quiz	3

Class	Topics/Assignment	COs	Reading Reference	Lecture Outcomes/ Activities
1	Abstract data types	1	1	Name basic Data representation
2	Algorithm performance and elementary	1	2	Explain Asymptotic notations

	asymptotic analysis			
3	Searching: linear search and binary search	2,3	1	Explain and Differentiate linear search and binary search
4	Searching: linear search and binary search	2,3	1	Explain and Differentiate linear search and binary search
5	Sorting algorithms	2,3	1	Explain Selection sort and Bubble sort
6	Sorting algorithms	2,3	1	Explain Insertion sort
7	Sorting algorithms	2,3	1	Explain Merge sort
8	Sorting algorithms	2, 3	1	Explain Quick sort
9	Sorting algorithms	2, 3	1	Explain Bucket sort
10	Problem Solving			Lecture 1– 9
11	Class Test 1			Lecture 1-7
12	Elementary data structures: array	1	1	Explain Array
13	Elementary data structures: stack	1	1	Explain push and pop operation of Stack
14	Elementary data structures: stack	1	1	Explain polish notations and evaluate postfix notation
15	Elementary data structures: stack	1	1	Convert Infix notation into postfix notation
16	Elementary data structures: Recursion	1,4	1	Solve problem using recursion
17	Elementary data structures: queue	1	1	Explain insert and delete operations of Queue
18	Elementary data structures: queue	1	1	Explain deque operations
19	Problem Solving			Lecture 12– 18
20	Class Test 2			Lecture 8 – 15
21	Elementary data structures: linked list	1,3	1	Explain and Differentiate Array and Lined List
22	Elementary data structures: linked list	1	1	Insertion in Linked list
23	Elementary data structures: linked list	1	1	Deletion in Linked list
24	Elementary data structures: Queue	1	1	Explain priority queue operations
25	Review			Lecture 1 – 24
26	Assignment			Based on Lecture 1 – 24
27	Assignment			Based on Lecture 1 – 24
28	Graphs and graph representation	1	1	Explain DFS and BFS
29	Graphs and graph representation	1	1	Explain shortest path algorithms
30	Graphs and graph representation	1	1	Differentiate shortest path algorithms
31	Tree and tree traversal	1	1	Explain Huffman Coding

32	Class Test 3			Lecture 16– 24
33	Heap	3,4	1	Construct heaps and explain Heapsort
34	Sorting algorithms	2,3	1	Explain topolpgical sort
35	balanced binary search trees	2,4	1	Explain balanced binary search trees
36	balanced binary search trees	2,4	1	Analyze balanced binary search trees
37	Class Test 4			Lecture 32– 36
38	Hashing	3,4	1	Explain Hashing
39	Advanced heaps	3,4	1	Explain Advanced heaps
40	Review Class and Problem Solutions			Lecture 28 – 30 and Lecturer 32 – 33
41	Review Class and Problem Solutions			Lecture 34 – 39
42	Suggestion			Lecture 1 – 41

VII. Reading Reference:

1. Theory and Problems of Data Structures - Seymour Lipschutz
2. Introduction to algorithms- Thomas H. Corman, Ronald L. Rivest, Clifford Stein and Charles E. Leiserson

VIII. Assessment Methods:

CIE: Continuous Internal Evaluation (20 Marks)

Bloom's Category Marks (Out of 20)	**Test (10)**	**Assignment (05)**	**Quizzes (05)**	**External Participation in Curricular/Co-Curricular Activities**
Remember			2	
Understand	2			
Apply	3	2	1	
Analyze	3	3	1	
Evaluate	2		1	

Midterm and Semester End Examination (30+50 Marks)

Bloom's Category	Test
Remember	5
Understand	20
Apply	15
Analyze	20
Evaluate	15
Create	5

IX. Grading System

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.5
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

X. Course Requirements

Class attendance: Minimum 60% of total class attendance is required to attend the final examination. Below 60% attendance will be counted as 0. All students are expected to attend all scheduled classes, and to read all assigned chapters / materials before coming to class

Late submission of work: If there is any assignment given to the students, they have to submit it before the deadline decided by the course teacher. Late submission will be followed by penalty,

please maintain deadlines. Late submission of homework/assignment will have negative impact on marks.

Unfair means /plagiarism: Plagiarism is going to be handled by severe punishment. Original work submission is motivated because it carries marks of value. Students are strongly encouraged to interact and discuss ideas and materials for courses among themselves.

XI. Students' Responsibilities

Regular participation in class, Discussion with teacher, Regular go through text books and recommended books or online resources. Class Attendance less than 70% will be considered as 0% attendance in the final assessment.

XII. Teaching Method

1. Formal lectures will provide the theoretical basis and cover the practical implementation of the topic. A collection of lecture notes, tutorial examples, followed by debate and explanation, along with suggested reading, will support and guide the learners in their own private research.
2. Maximum topics from the textbook will be covered. Reference books will be followed for the remaining subjects. Some notes of the class will be uploaded to the internet. Most of the moment, white board will be used. Multimedia projector will be used for the students ' convenience in some cases.
3. Before entering the class, students must study until the last lesson and it is recommended that they go through the appropriate section before entering the class. It's not enough just to be present in the class. Students must be involved in debates in the classroom. In order to test their class efficiency, few tasks will be provided to the learners based on that class.

XIII. Teaching Aid

White Board, Reference Books

XIV. Additional Reading Material

Google web & Google Scholar, Wikipedia, online tutorial links, online course materials etc. will be provided time to time in lectures.

Appendix-1: Program Outcome (POs)

(Source: https://www.baetebangladesh.org/poa.php)

Program Outcomes (POs) are narrower statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills and attitudes that students acquire while progressing through the program. The program must demonstrate that by the time of graduation, students have achieved an acceptable minimum level of certain knowledge, skills and behavioral traits. The BAETE specifically requires that students acquire the following graduate attributes:

(a) Engineering knowledge (PO 1): Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

(b) Problem analysis (PO 2): Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.

(c) Design/development of solutions (PO 3): 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.

(d) Investigation (PO 4): Conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.

(e) Modern tool usage (PO 5): 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.

(f) The engineer and society (PO 6): Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

(g) Environment and sustainability (PO 7): Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

(h) Ethics (PO 8): Apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice.

(i) Individual work and teamwork (PO 9): Function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings.

(j) Communication (PO 10): 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.

(k) Project management and finance (PO 11): 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.

(l) Life-long learning (PO 12): Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

XV. Verification

Prepared by, --- Mamun Ahmed Course Teacher Date:	Checked and Certified by: --- Head of Department Date:	Approved by: --- Dean / Chair of Academic Council Date:
	Moderated by: --- Date:	Moderated by: --- Date: