



AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)

Faculty of Science and Information (FST)

Department of Computer Science (CS)

Undergraduate Program

PART-A

Course Outline	
I. Course No./ Course Code	CSC 2107
II. Course Title	Data Structure Lab
III. Course Type (General Education / Core Course / Electives)	Core Course for CS, CSE, CSSE, SE and CIS.
IV. Semester	Third Semester
V. Academic Session	Fall 2022-23
VI. Course Teacher/Instructor	<ul style="list-style-type: none"> • DR. ASHRAF UDDIN • MD. AL AMIN • MD. FARUK ABDULLAH AL SOHAN • MIR MD KAWSUR • NAZMUL HOSSAIN • NYME AHMED • RASHIDUL HASAN NABIL • RIFATH MAHMUD • SUPTA RICHARD PHILIP • SYEDA NISHAT TASNIM • SYMA KAMAL CHAITY • TANVIR AHMED • ZAHIDUDDIN AHMED
VII. Pre-requisite (If any)	CSC 1204: Discrete Mathematics CSC 1205: Object Oriented Programming 1
VIII. Credit Value:	1 credit
IX. Contact Hours:	3 hours per week
X. Total Marks:	100
XI. Rationale of the Course:	This course offers students a theoretical and experiential understanding of different types of data structure and algorithms.
XII. Course Objectives:	<ul style="list-style-type: none"> • Discuss class policy, course content, different data types, introduction to data structure. • Explain Arrays, linear searching, insertion, and deletion operations on array. • Parallel and Multidimensional array Iteration • ADT Data type and recursion



- Stack operation [initialization, push, pop, Isempty]
- Implementation with array
- Arithmetic Expression conversion (Infix, Postfix, Prefix) and Expression evaluation
- Linear & Circular queue operation [initialization, enqueue, dequeue, Isempty]
- Bubble sort, Insertion sort and Selection sort algorithms and Binary search algorithms.
- Complexity Analysis (Space and Time)
- Time Complexity with respect to Array, Pointer, and Structure and for all the next topics and make comparison if possible.
- Understand Dynamic storage management
- Singly Linked List
- Insertion, Deletion and Search Operation of Singly Linked List
- Binary, complete, full, and balanced tree,
- Tree traversal-inorder, preorder, postorder
- Construction of binary search tree, Searching, Insertion and Deletion operation with simulations.
- Representation: adjacency matrix & List, spanning tree, Traversing method (BFS and DFS)

XIII. Course Learning Outcomes (CLOs) and Mapping of CLOs with Program Learning Outcomes (PLOs)

CLOs	CLO Descriptions	PLO Assessed
CLO1	Distinguish between the unique properties/features of different data structures	PLO-b-2
CLO2	Justify the selection of an appropriate data structure to find the optimized solution for a given problem.	PLO-b-2
CLO3	Apply appropriate data structures for open ended problems based on realistic scenario.	PLO-e-1
CLO4	Develop an efficient solution considering the impact on the system environment.	PLO-e-1

PART-B

XIV. Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching-Learning Strategy	Assessment strategy	Corresponding CLOs
1	Implementation of basic programming problems with loop, arrays, and function	Discuss– Class policy, course content, To know basic relationship between the usage of Loops and Arrays. To know basic structure of a function and its usage.	Discussion, Group study, Justifying	CLO1
2	Implementation of array operations and its applications	To know how to solve basic, moderate, and complex programming problems using 1-Dimensional Array. To master array operations such as traversal, searching, insertion, and deletion.	Discussion, Group study, Justifying	CLO1
3	Implementation of 2D array, string, pointer, structure, and their applications	To know how to solve basic, moderate, and complex programming problems using 2-Dimensional Array, String, Pointer, and Structure. To master 2-D Array, String manipulation, usage of Pointer, and Structure.	Discussion, Group study, Justifying, Perform exercises, Quiz	CLO1, CLO2, CLO3, CLO4
4	Implementation of Sorting and Searching (Linear and Binary searching) algorithm implementation using array	To implement how to sort data elements stored in an array using different algorithms. To implement how to search a data element in an array using Binary Search	Group study, Justifying, Perform exercises	CLO1, CLO2, CLO3

		To compare different sorting and searching algorithms		
		To solve more complex problems related to sorting and searching		
5	Implementation of Stack, Stack application	<p>To learn in detail about the structure of stack by implementing them in various ways.</p> <p>To prepare for applying stack to solve different problems by knowing their implementation in detail.</p> <p>To recognize the need of LIFO (Last in First Out) mechanism in a problem.</p>	Discussion, Group study, Justifying, Perform exercises	CLO1, CLO3, CLO4
6	Lab Exam			
7	Midterm Week			
8	Implementation of Queue and Circular Queue and its applications	<p>To learn in detail about the structure queue by implementing them in various ways.</p> <p>To prepare for applying queue to solve different problems by knowing their implementation in detail.</p> <p>To recognize the need of FIFO (First In First Out) mechanism in a problem.</p>	Lecture, Student reporting, question- answer session.	CLO1, CLO2, CLO3, CLO4
9	Linked list	To implement how to implement different linked list operations.	Lecture, Board work, question- answer session.	CLO1
10	Implementation of Linked List (Doubly, Circular)	To solve more complex problems such as Doubly Linked List	Lecture, Student reporting	CLO1, CLO2, CLO3, CLO4
11	Implement Binary search tree, Tree traversal	To implement Binary Search Tree with its operations such as	Lecture, Student reporting, question- answer	CLO1, CLO2

		insertion, searching, traversal and deletion	session.	
12	Implementation of Heap (Priority QUEUE)	To know how to implement a priority queue by using the heap data structure. To master heap operations such as heapify, insertion, deletion, and heap sort.	Lecture, Student reporting, question- answer session.	CLO1, CLO2, CLO3
13	Lab Exam			
14	Final term Week			



Part-C

XV. Assessments and Evaluation

1) Assessment strategy:

• Attendance
• Lab Performance
• Assignment
• Lab exam

2) Grading Policy:

Marking System for Mid Term		Marking System for Final Term	
Attendance	10	Attendance	10
Continuous Lab performance	30	Lab performance	30
Assignment	20	Assignment	20
Lab exam	40	Lab exam	40
Total	100	Total	100
Grand Total: Mid Term 40% + Final Term 60%			

Letter	Grade Point	Numerical %
A+	4.00	90-100
A	3.75	85<90
B+	3.50	80<85
B	3.25	75<80
C+	3.00	70<75
C	2.75	65<70
D+	2.50	60<65
D	2.25	50<60
F	0.00	<50(Failed)

PART-D

XVI. Learning materials

1) Recommended Textbook/ Readings:

- **INTRODUCTION TO ALGORITHMS (SECOND EDITION)**, THOMAS H. CHARLES E. LEISERSON, RONALD L. RIVEST, AND CLIFF STEIN, PUBLISHED BY MIT PRESS AND MCGRAW-HILL.
- **FUNDAMENTALS OF COMPUTER ALGORITHMS**, ELLIS HOROWITZ, SARTAZ SAHNI, AND RAJASEKARAN, PUBLISHED BY W.H. FREEMAN AND COMPANY, 1998. INDIAN EDITION PUBLISHED BY GALGOTIA PUBLICATIONS, 2000.

- **ALGORITHMS IN C, PARTS 1-4: FUNDAMENTALS, DATA STRUCTURES, SORTING, SEARCHING**, 3RD EDITION, ROBERT SEDGEWICK, PUBLISHED BY ADDISON WESLEY PROFESSIONAL.
- **DATA STRUCTURES AND PROGRAM DESIGN IN C (2ND EDITION)**, ROBERT L. KRUSE, BRUCE P. LEUNG, CLOVIS L. TONDO.

Appendix

Mapping of PLOs to CS courses:

PLO-a: Engineering Knowledge

Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization.

PLO Indicator ID	PLO Indicators Definition
PLO-a-1	Apply information and concepts in natural science with the familiarity of issues.
PLO-a-2	Apply information and concepts of mathematics with the familiarity of issues.
PLO-a-3	Apply information and concepts in engineering fundamentals to solve complex engineering problems with a range of conflicting requirements.
PLO-a-4	Apply information and concepts in specialized engineering sciences with the in-depth of analysis of a complex engineering problem.

PLO-b: Problem Analysis

Identify, formulate, research literature and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PLO Indicator ID	PLO Indicators Definition
PLO-b-1	Identify first principles of natural sciences and engineering sciences in practical applications.
PLO-b-2	Formulate solutions, procedures, and methods using first principles of mathematics for engineering sciences.
PLO-b-3	Analyze solutions for complex engineering problem reaching substantiated conclusion.
PLO-b-4	Research literature of engineering science and analyze the validity and accuracy of existing solution for complex engineering problems.

PLO-c: 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.

PO Indicator ID	PO Indicators Definition
PLO-c-1	Design solutions for a complex engineering problem considering public health and safety.
PLO-c-2	Develop system or components that meets specific needs considering health, safety and environment.

PLO-d: 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.

PO Indicator ID	PO Indicators Definition
PLO-d-1	Conduct investigations of complex problems using research-based knowledge
PLO-d-2	Use appropriate research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

PLO-e: 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.

PO Indicator ID	PO Indicators Definition
PLO-e-1	Select and apply appropriate techniques, tools and resources (e.g., prediction & modeling) to solve complex engineering problems considering their limitations.
PLO-e-2	Create appropriate techniques, tools or resources (e.g., prediction & modeling) to solve complex engineering problems considering their limitations.

PLO-f: 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.

PLO Indicator ID	PLO Indicators Definition
PLO-f-1	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues in relation to professional engineering practice and solution.
PLO-f-2	Assess the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems.

PLO-g: 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.

PLO Indicator ID	PLO Indicators Definition
PLO-g-1	Understand the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts.
PLO-g-2	Evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts.

PLO-h: Ethics

Apply ethical principles and commit to professional ethics and responsibilities and norms of

engineering practice.

PLO Indicator ID	PLO Indicators Definition
PLO-h-1	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PLO-i: Individual and Teamwork

Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

PLO Indicator ID	PLO Indicators Definition
PLO-i-1	Function effectively as an individual in diverse teams and in multi-disciplinary settings.
PLO-i-2	Function effectively as a member or leader in diverse teams and in multi-disciplinary settings.

PLO-j: 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

PLO Indicator ID	PLO Indicators Definition
PLO-j-1	Comprehend and write effective reports and design documentation for effective communication on complex engineering activities.
PLO-j-2	Make effective presentations to exchange clear instructions with engineering community and the society at large.

PLO-k: Project Management and Finance

Demonstrate knowledge and understanding of engineering management principles and economic decision making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PLO Indicator ID	PLO Indicators Definition
PLO-k-1	Apply engineering management principles and economic decision to manage project as a team member / team leader.
PLO-k-2	Apply engineering management principles and economic decision to manage project in multidisciplinary environments.


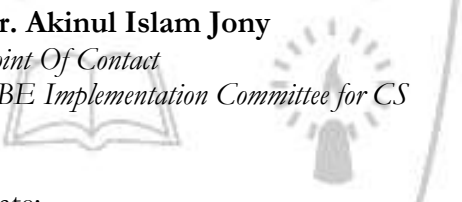

PLO-l: Lifelong learning

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.

PLO Indicator ID	PLO Indicators Definition
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PLO-1-1	Identify the need and prepare accordingly for independent learning in solving complex engineering problems and change of technologies.
PLO-1-2	Demonstrate the ability to engage in independent and life-long learning in the broadest context of technological change.

Verification:

Prepared by:  <hr/> Zahiduddin Ahmed <i>Course Convener</i> Date: 18/09/2022		Moderated by: <hr/> Dr. Akinul Islam Jony <i>Point Of Contact</i> <i>OBE Implementation Committee for CS</i>  Date:.....	
Checked by: <hr/> Dr. Md. Abdullah-Al-Jubair <i>Head,</i> <i>Department of Computer Science</i> Date:.....	Certified by:  <hr/> Dr. Dip Nandi <i>Director,</i> <i>Faculty of Science & Technology</i> Date:.....	Approved by: <hr/> Mr. Mashiour Rahman <i>Associate Dean,</i> <i>Faculty of Science & Technology</i> Date:.....	