**Course Description and Outcome Form** Department of Computer Science and Engineering School of Engineering and Computer Science

Brac University



# Course General Information:

| **Course Code:** | CSE 220  CSE 220L |
| --- | --- |
| **Course Title:** | Data Structures  Data Structures Laboratory |
| **Credit Hours** (Theory+Lab): | 3 + 0 |
| **Contact Hours** (Theory+Lab): | 3 + 3 |
| **Category:** | Program Core |
| **Type:** | Required, Engineering , Lecture + laboratory |
| **Prerequisites:** | CSE 111 Programming Language II + CSE 230 Discrete Mathematics |
| **Co-requisites:** | NO |

1. **Course Catalog Description (Content):**

This course is an introduction to data structures, where the students will study the elementary data structures such as arrays, lists, stacks, queues, trees, etc. These data structures will be used to study and implement different algorithms such as sorting, searching, tree traversal, etc. The course includes a 3 hour mandatory laboratory per week as CSE220L. In the laboratory, the students will use a standard programming language, usually Java, to implement the various data structures and algorithms learned in the theory component of the course.

# Course Objective:

* 1. Teach students the basics of circular array and advantage(s) of it over a linear array
  2. Demonstrate the construction and manipulation of different types of linked lists
  3. Introduce the students to stack and queue data structures and explain how they are implemented
  4. Discuss the fundamental concept of recursion so that they can build recursive models for simple problems.
  5. Discuss trees and explain related algorithms

1. **Course Outcomes (COs):**

Upon successful completion of this course, students will be able to

| **Sl.** | **CO Description** | **Weightage (%)** |
| --- | --- | --- |
| CO1 | **Show** different operations such as insertion, removal, rotation, shifting, etc. on linear arrays, circular arrays, linked lists, Stack, Queue and Tree data structures. | 25% |
| CO2 | **Demonstrate** basic algorithms related to searching and tree traversal using various data structures. | 25% |
| CO3 | **Compare** the suitability and merits of various data structures and basic algorithms when given certain requirements or constraints. | 10% |
| CO4 | **Apply** concepts of recursion to solve programming problems. | 15% |
| CO5 | **Construct** general-purpose data structures and basic algorithms for solving programming problems. | 25% |

1. **Mapping of CO-PO-Taxonomy Domain & Level- Delivery-Assessment Tool:**

| **Sl.** | **CO Description** | **POs** | **Bloom’s**  **taxonomy domain/level** | **Delivery methods and activities** | **Assessment tools** |
| --- | --- | --- | --- | --- | --- |
| CO1 | **Show** different operations such as insertion, removal,  rotation, shifting, etc. on arrays, linked lists, Stack, Queue and Tree data structures. | **a** | Cognitive/ Apply | Lecture + Lab | Assignment,  Quiz, Exam, Lab Work |
| CO2 | **Demonstrate** basic algorithms related to searching, tree traversal using various data structures. | **a** | Cognitive/ Apply | Lecture + Lab | Assignment,  Quiz, Exam, Lab Work |
| CO3 | **Compare** the suitability and merits of various data structures and basic algorithms when given certain requirements or constraints. | **a** | Cognitive/Evaluate | Lecture | Exam |
| CO4 | **Apply** concepts of recursion to solve programming problems. | **a** | Cognitive/ Apply | Lecture + Lab | Assignment,  Quiz, Exam, Lab Work |
| CO5 | **Construct** general-purpose data structures and basic algorithms for solving programming problems. | **c** | Cognitive/ Create | Lab | Lab work |

1. **Course Materials:**

**i. Text and Reference Books:**

| **Sl.** | **Title** | **Author(s)** | **Publication**  **Year** | **Edition** | **Publisher** | **ISBN** |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | Algorithms in Java | Robert Sedgewick and Kevin Wayne | 2011 | 4th Edition | Addison- Wesley | ISBN-10: 032157351X ISBN-13: 9780321573513 |
| 2 | Introduction to Algorithms | Thomas H. Cormen, Charles E. Leiserson, Ronald  L. Rivest and Clifford Stein | 2009 | 3rd Edition | MIT Press | ISBN-10: 0262033844 ISBN-13: 9780262033848 |

1. **Lesson Plan (Theory):**

| No | Topic | Week/Lecture# | Related CO (if  any) |
| --- | --- | --- | --- |
| 1 | Introduction of Big O and Multi-Dimensional Array | Lecture 1, 2 | CO1, CO3, CO5 |
| 2 | Linked List | Lecture 3, 4, 5, 6 | CO1 CO3, CO5 |
| 3 | Hash table and Hashing | Lecture 7 |  |
| 4 | Stacks (using arrays and linked lists) | Lecture 8 | CO1 CO3, CO5 |
| 5 | Queues (using arrays and linked lists) | Lecture 9 | CO1 CO3, CO5 |
| Review and Midterm Exam | | | |
| 6 | Introduction to Trees and Binary Tree | Lecture 10,11 | CO4, CO5 |
| 7 | Binary Search Tree | Lecture 12, 13 | CO2 CO3, CO5 |
| 8 | Heap | Lecture 14, 15 | CO1, CO2, CO5 |
| 9 | Graph Representation and Traversal | Lecture 16, 17, 18 | CO1, CO2, CO5 |
| Review and Final Exam | | | |

**Lesson Plan (Laboratory):**

| No | Topic | Week/Lecture# |
| --- | --- | --- |
| 1 | Complexity and 2D array | Week 1 |
| 2 | Singly Linked List (basic) | Week 2 |
| 3 | Doubly Linked List (basic) | Week 3 |
| 4 | Hashtable and Stack | Week 4 |
| 5 | Tree basics and Binary Tree | Week 5 |

| 6 | Binary Search Tree | Week 6 |
| --- | --- | --- |
| 7 | Heap | Week 7 |
| 8 | Graph Representation and Traversal | Week 8 |

1. **Assessment Tools:**

| **Assessment Tools** | **Weightage (%)** |
| --- | --- |
| Quizzes | 15% |
| Midterm Exam | 25% |
| Lab | 25% |
| Final Exam | 35% |

1. **CO Assessment Plan:**

| **Assessment Tools** | **Course Outcomes** | | | | |
| --- | --- | --- | --- | --- | --- |
| **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| Midterm Exam | √ | √ | √ |  | √ |
| Lab | √ | √ | √ | √ | √ |
| Final Exam | √ | √ | √ | √ |  |

1. **CO Attainment Policy:**

As per BRAC University Policy.

1. **Grading policy:**

As per BRAC University Policy

1. **Course Coordinator: Md. Abu Ibrahim**