# UNITED INTERNATIONAL UNIVERSITY

Department of Computer Science and Engineering (CSE)

## Course Syllabus

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|---|---|---|
| 1. | **Course Title** | Data Structure and Algorithms I |
| 2. | **Course Code** | CSE 2215 |
| 3. | **Trimester and Year** | Fall 2025 |
| 4. | **Pre-requisites** | CSE 1111 Structured Programming Language |
| 5. | **Credit Hours** | 3.00 |
| 6. | **Class Hours** | |
| 7. | **Counselling Hours** | |
| 8. | **Course Teacher** | Charles Aunkan Gomes<br>Lecturer, Department of CSE<br>United International University |
| 9. | **Email** | charles@cse.uiu.ac.bd |
| 10. | **Office** | 419 |
| 11. | **Text Book** | • Introduction to Algorithms-Thomas H Cormen |
| 12. | **Reference** | • Data Structures and Algorithms in C++ Goodrich, Tamassia, and Mount |
| 13. | **Course Contents** | Internal data representation; Abstract data types; Introduction to algorithms; Asymptotic analysis: growth of functions, O, Ω and Θ notations; Correctness proof and techniques for analysis of algorithms; Master Theorem; Elementary data structures: arrays, linked lists, stacks, queues, trees and tree traversals, graphs and graph representations, heaps, binary search trees; Graph Traversals: DFS, BFS, Applications of DFS and BFS; Sorting: heap sort, merge sort, quick sort, linear-time sorting; Data structures for set operations. |
| 14. | **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. |

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| 15. | **Teaching Methods** | Lecture, Case Studies, Project Developments. |
| 16. | **CO with Assessment Methods** | |

| CO | Assessment Method | (%) |
|---|---|---|
| - | Attendance | 5 |
| - | Assignment | 5 |
| - | Class Tests | 20 |
| CO1, CO2, CO3, CO4 | Midterm Exam | 30 |
| CO1, CO2, CO3 | Final Exam | 40 |

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|---|---|---|
| 17. | **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 | | | | | | | | |

**18. Lecture Outline**

| Class | Topics/Assignments | CO Mapping |
|---|---|---|
| 1. | Introduction to Data Structure: linear data structure<br>Complexity Analysis, Big Oh, Big Omega | |
| 2. | Lower and Upper Limit, Best and Worst Cases | |
| 3. | Arrays: Memory Mapping, Linear and Binary Search, Linear Time Sorting (Counting Sort) | CO2, CO3 |
| 4. | Arrays: Sorting, Merge Sort | CO1 |
| 5. | Arrays: Sorting, Quick Sort | CO1 |
| 6. | Linked Lists: Single Linked List | CO2, CO3 |
| 7. | Linked Lists: Double Linked List, Circular Linked List | CO2, CO3 |
| 8. | Linked Lists: Application | CO1 |
| 9. | Stack: Implementation using Array and Linked Lists | CO2, CO3 |
| 10. | Stack: Application, Tower of Hanoi, Recursion | CO1 |
| 11. | Infix to Postfix and Postfix evaluation, Introduction to Queue | CO1, CO2, CO3 |
| 12. | Implementation of Queue using Arrays and Linked lists | CO1, CO2, CO3 |
| **MID TERM EXAMINATION WEEK** | | |
| 13. | General Tree, Binary Tree Implementation using Array and left-right pointers | CO2, CO3 |
| 14. | Tree Traversal Algorithms, Tree Applications | CO2, CO3 |
| 15. | Binary Search Trees, Insertion, Deletion | CO2, CO3 |
| 16. | Binary Search Tree Properties | CO1, CO2, CO3 |
| 17. | Heap and Priority Queue | CO1 |
| 18. | Heap Sort and Application of Priority Queue | CO1, CO2, CO3 |
| 19. | Graphs: Implementation using adjacency matrix and Adjacency lists<br>Sparse and Dense graph, Space requirements | CO2, CO3 |
| 20. | Graphs: BFS using adjacency matrix and Adjacency lists | CO2, CO3 |
| 21 | Graphs: DFS using adjacency matrix and Adjacency lists | CO2, CO3 |
| 22 | Graphs: Application of Graphs, Directed Acyclic Graph, Topological Sort | CO1, CO2, CO3 |
| 23 | Set Operations: Disjoint Set Union | CO1, CO2 |
| 24 | Set Operations Continued | CO1, CO2 |
| **FINAL EXAMINATION** | | |

## Appendix 1: Assessment Methods

| CO | Assessment Method | (%) |
|---|---|---|
| - | Attendance | 5 |
| - | Assignment | 5 |
| - | Class Tests | 20 |
| CO1, CO2, CO3, CO4 | Midterm Exam | 30 |
| CO1, CO2, CO3 | 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

| POs | Program Outcomes |
|---|---|
| **a** | Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in K1 to K4 respectively to the solution of complex engineering problems. |
| **b** | Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (K1 to K4) |
| **c** | 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. (K5) |
| **d** | Conduct investigations of complex problems using research-based knowledge (K8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions. |
| **e** | 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. (K6) |
| **f** | 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. (K7) |
| **g** | Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (K7) |
| **h** | Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (K7) |
| **i** | Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings. |
| **j** | 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. |
| **k** | 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. |
| **l** | 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. |