| UNITED INTERNATIONAL UNIVERSITY Department of Computer Science and Engineering (CSE) Course Syllabus | | |
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| **Part A: Introduction** | | |
| **1** | **Course Title** | Data Structure and Algorithms - I |
| **2** | **Course Code** | CSE 2215 |
| **3** | **Pre-requisites** | CSE 1111, CSE 1115 |
| **4** | **Course Type** | Core Course |
| **5** | **Credit Hours** | 3.00 |
| **6** | **Contact Hours** | 3 Hours/Week |
| **7** | **Semester** | 4th |
| **8** | **Total Marks** | 100 |
| **9** | **Course Instructor’s Information** | Shekh. Md. Saifur Rahman(SMSR)  Email: [saifur@cse.uiu.ac.bd](mailto:saifur@cse.uiu.ac.bd)  Cell Phone Number: 01303529289  Office: 837 D |
| **10** | **Course Rationale** | This course has been designed to provide a solid foundation about the data structure and algorithms used in computer science. This course will give insights about the pros and cons of different data structures and algorithms. |
| **11** | **Course Objectives** | The objectives of this course are:   * To familiarize the basic data structures (array, linked list). * To familiarize complex data structures (queue, stack, priority queue) using basic data structures * To use suitable data structures for different algorithms * To introduce the algorithms and their complexity and use cases |
| **Part B: Content of the Course** | | |
| **12** | **Course Contents (approved by UGC)** | Complexity Analysis: Big Oh, Big Omega, Lower and Upper Limit, Best and Worst Cases, Arrays: Memory Mapping, Vector Implementation, Sorting, Linear Time Sort, Merge Sort, Quick Sort, Linked Lists: Single Linked List, Double Linked List, Circular Linked List, Stack: Implementation using Array and Linked Lists, Application, Tower of Hanoi, Postfix Expression, Queue: Introduction to Queue, Implementation of Queue using Arrays and Linked Lists, Applications, General Tree: Introduction, Definition, Binary Tree: Introduction, Implementation using Array and Pointers, Tree Traversal Algorithms, Binary Search Tree: Operations, Insertion, Deletion, Properties, Tree Applications, Heap and Priority Queue: Introduction, Heap Sort and Application of Priority Queue, Graph Representation: Implementation using Adjacency Matrix and Adjacency List, Graphs: BFS and DFS using Adjacency Matrix and Adjacency Lists, Application of Graphs, Search Algorithms, Set Operations: Make set, Find, Union. |
| **13** | **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. | |
| **14** | **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 |  |  |  |  |  |  |  |  | | |
| **15** | **Mapping COs with Teaching-Learning and Assessment Strategy** | |
|  | | **Class/Week** | **Topics/Assignments** | **Course Outcomes**  **(COs)** | **Reading Reference** | **Teaching-Learning Strategies** | **Assessment Strategies** | | --- | --- | --- | --- | --- | --- | | 1 | Introduction, Course Overview |  | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 2 | Complexity Analysis, Big Oh, Big Omega, Lower and Upper Limit, Best and Worst Cases | CO1 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 3 | Arrays: Memory Mapping, Vector Implementation | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 4 | Arrays: Sorting, Linear Time Sort | CO1 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 5 | Arrays: Sorting, Merge Sort, Quick Sort | CO1 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 6 | Linked Lists: Single Linked List | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 7 | Linked Lists: Double Linked List, Circular Linked List | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 8 | Stack: Implementation using Array and Linked Lists | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 9 | Stack: Application, Tower of Hanoi, Postfix Expression | CO1 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 10 | Queue: Introduction to Queue, Implementation of Queue using Arrays and Linked lists | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 11 | Queue: Applications | CO1 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 12 | Review | CO1, CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture | Class Tests/Assignments/Quizzes/Exam | |  |  | | | |  | | 13 | General Tree: Introduction, Definition | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 14 | Binary Tree: Introduction, Implementation using Array and Pointers | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 15 | Tree Traversal Algorithms | CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 16 | Binary Search Tree: Operations, Insertion, Deletion | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 17 | Binary Search Tree: Operations, Insertion, Deletion | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 18 | Binary Search Tree: Properties, Tree Applications | CO1 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 19 | Heap and Priority Queue: Introduction | CO1 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 20 | Heap Sort and Application of Priority Queue | CO1 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 21 | Graph Representation: Implementation using Adjacency Matrix and Adjacency List | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 22 | Graphs: BFS using Adjacency Matrix and Adjacency Lists | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 23 | Graphs: DFS using Adjacency Matrix and Adjacency lists | CO2, CO3 | Lecture Slides and Text/ Ref. Book/ Online Materials | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 24 | Graphs: Application of Graphs, Search Algorithms | CO1, CO3 | Lecture Slides and Text/ Ref. Book/ Online Materials | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 25 -26 | Set Operations (Make set, Find, Union) | CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture/Group Discussion/  Exercise | Class Tests/Assignments/Quizzes/Exam | | 27 | Review | CO1, CO2, CO3 | Lecture Slides and Text/ Ref. Book | Lecture | Class Tests/Assignments/Quizzes/Exam | | 28 | **FINAL EXAM** | | | |  | | |

**Part C: Assessment and Evaluation Methods**

| **Assessment Strategy** | **Assessment Types** | **Marks** |
| --- | --- | --- |
| Formative Assessment | Attendance | 5% |
| Assignments | 5% |
| Class Tests | 20% |
| Summative Assessment | Mid Term | 30% |
| Final Exam | 40% |

**Grading System**

| **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 |

**Part D: Learning Resources**

| **Text Book** | 1. Introduction to Algorithms – Thomas H. Cormen (4th edition, MIT Press & McGraw Hill, 2022) 2. Data Structures – E. M. Reingold (Addison Wesley Publication, 1998)   ([link](https://drive.google.com/drive/folders/1AoM68HLXMH-pDDVQWVuPzatFfjzrvdye?usp=sharing)) |
| --- | --- |
| **Reference** | 1. Data Structure and Algorithms in C++ - Goodrich, Tamassia (2nd edition, John Wiley and Sons Inc., 2003) |

**Appendix-1: Program outcomes**

| **POs** | **Program Outcomes** |
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| **PO1** | An ability to apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. |
| **PO2** | Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences. |
| **PO3** | An ability to 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. |
| **PO4** | An ability to conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions. |
| **PO5** | An ability to 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 |
| **PO6** | An ability toapply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice. |
| **PO7** | An ability tounderstand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. |
| **PO8** | An ability toapply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice. |
| **PO9** | An ability tofunction effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings. |
| **PO10** | An ability tocommunicate 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. |
| **PO11** | An ability todemonstrate 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. |
| **PO12** | An ability torecognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change. |