**COURSE BASICS**

Course Title**: Data Structure and Algorithms**

Course Code**: CSC-221**

Credit Hours**: 3+1**

Prerequisite**: CSC-113 Object Oriented Programming**

Class**:** **BSE-3**

Section**: A & B**

Instructor**:** Engr. Laraib Siddiqui

Email**:** laraibsiddique.bukc@bahria.edu.pk

**Course Objectives and Description:**

The objective of this course is to introduce the analysis and designing of data structures using various standard algorithms. A portion of this course comprises on C#/C++ programming to understand the basic concepts behind various data structures. This course also introduces students to the analysis and design of computer algorithms. Assess how the choice of data structures and algorithms impacts the performance of programs. Also to choose appropriate data structures and algorithms to use for a specified problem or application.

**Course Learning Outcomes (CLO):**

Upon successful completion of this course, students should be able to:

|  |  |  |  |
| --- | --- | --- | --- |
| CLO | Statement | Bloom’s Taxonomy | Associated PLO |
| CLO 1 | Describe basic data structures and relevant standard algorithms | C1 | PLO1 |
| CLO 2 | Demonstrate working of different algorithms and processes of data structures | C3 | PLO2 |
| CLO 3 | Design different algorithms for data structures operations | C5 | PLO3 |
| CLO 4 | Analyze and compare algorithms for efficiency. | C4 | PLO2 |

**Weekly Breakdown:**

|  |  |  |
| --- | --- | --- |
| **Week** | **Week Days** | **Tentative Course Plan** |
| 1 | 18th Sept – 22nd Sept | Introduction of Data Structures  Basic Data Structures Operations  Abstract data type  Analysis of algorithms: Term, Definition, Types, Incentives  Design of algorithms: Design issues, Effects of design on algorithms  Time complexity: Concept. Best, average and worst cases |
| 2 | 25th Sept – 29th Sept  (29th Sept -  Eid Milad Un Nabi) | Big O Notation  Operations on Array  Complexity  Applications  Brute Force Algorithms  Sorting Techniques: Why Sort data - Bubble Sort, Selection Sort & Insertion Sort  Linear and Binary Search |
| 3 | 2nd Oct – 6th Oct | Linked List creation  Operations on Linked List  Applications  Complexity  Doubly Linked List |
| 4 | 9th Oct – 13th Oct | Circular Linked List  Introduction to stacks  Stack ADT  Implementations  Basic Operations  Applications |
| 5 | 16th Oct – 20th Oct | Complexity  Polish Notations  Introduction  Precedence  Associativity  Infix, Prefix and Postfix notations and conversions |
| 6 | 23rd Oct – 27th Oct | Recursion  Direct and Indirect recursion  Types: Linear, Binary , Multiple  Applications  Tower of Hanoi problem |
| 7 | 30th Oct – 3rd Nov | Divide and conquer Algorithms  Merge Sort  Merge Function  Complexity  Quick Sort  Problem of unbalance dividing  Choice of pivot  Complexity |
| 8 | 6th Nov – 9th Nov  (9th Nov - Iqbal Day) | Introduction to Queues  Queues as ADT  Implementation  Basic Operations  Complexity  Circular Queue  Double ended queue |
| 9 | 10th – 19th Nov | **MID TERM EXAM** |
| 10 | 20th – 24th Nov | Priority Queues  Introduction to Trees  Key terminologies  Binary Tree  Tree Traversals  Expression Trees |
| 11 | 27th Nov – 1st Dec | Binary Search Tree (BST)  Implementation  Traversing  Breadth first traversal  Depth first traversal  Balances Binary Trees |
| 12 | 4th Dec – 8th Dec | AVL  Balancing and rotations  M ways trees  B Trees |
| 13 | 11th Dec – 15th Dec | Heap  Max/min heap implementation  Insertion/ deletion  Heap Sort  Huffman Encoding |
| 14 | 18th Dec – 22nd Dec | Bucket Arrays, Hash Functions  Hash Codes, compression methods  Collision Resolution  Open addressing  Separate Chaining  Bucket Sort |
| 15 | 25th Dec – 29th Dec  (25th Dec -  Quaid Birth Anniversary) | Graph Types  Representation  Adjacency matrix  Linked list  Traversals  Depth First Search  Breadth First Search |
| 16 | 1st Jan – 5th Jan | Spanning trees  Minimum spanning trees algorithms  Kruskal’s Algorithm  The Prim’s Algorithm  Shortest path Problem |
| 17 | 8th Jan – 11th Jan | Shortest path algorithms  The Greedy Method  Dijkstra’s Algorithm  Floyd Warshalll’s algorithm |
| 18 | 12th Jan – 24th Jan | **FINAL TERM EXAM** |

***NOTE:***

**a.** This schedule is subject to revisions as conditions may warrant.

**b.** Topics will be covered in sequence no matter if city observes any planned or unplanned holidays.

**c.** The information in this course outline is subject to revision as conditions may warrant.

**COURSE ASSESSMENT METHOD**

**Method of Evaluation and Structure:**

A student’s grade will be based on multiple measures of performance as mentioned below:

|  |  |
| --- | --- |
| **Evaluation Instruments (EI)** | **Marks** |
| Quizzes (4 Quizzes of 10 Marks) | 10 |
| Assignments (3 Assignments) | 20 |
| Mid Term Examination | 20 |
| Final Examination | 50 |
| **Total** | **100** |

*NOTE: Any change in this scheme/format will be communicated well in time.*

**Grading System:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Letter Grade** | **Grade Point** | **Percentage** | |
| **A** | 4.0 | ≥ 85 | - |
| **A-** | 3.67 | ≥ 80 | < 85 |
| **B+** | 3.33 | ≥ 75 | < 80 |
| **B** | 3.00 | ≥ 71 | < 75 |
| **B-** | 2.67 | ≥ 68 | < 71 |
| **C+** | 2.33 | ≥ 64 | < 68 |
| **C** | 2.00 | ≥ 60 | < 64 |
| **C-** | 1.67 | ≥ 57 | < 60 |
| **D+** | 1.33 | ≥ 54 | < 57 |
| **D** | 1.00 | ≥ 50 | < 53 |
| **F** | 0.00 | - | < 50 |

**Mapping of CLOs to PLOs (Program Learning Outcomes)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PLO’s | CLO’s | | | |
| CLO 1 | CLO 2 | CLO 3 | CLO 4 |
| PLO:1 (Engineering Knowledge) | 🗸 |  |  |  |
| PLO:2 (Engineering Problem Analysis) |  | 🗸 |  | 🗸 |
| PLO:3 (Designing and Development) |  |  | 🗸 |  |
| PLO:4 (Investigation) |  |  |  |  |
| PLO:5 (Modern tool usage) |  |  |  |  |
| PLO:6 (Engineer and Society) |  |  |  |  |
| PLO:7 (Environment and sustainability) |  |  |  |  |
| PLO:8 (Professionalism and Ethics) |  |  |  |  |
| PLO:9 (Communication) |  |  |  |  |
| PLO:10 (Individual and Team Work) |  |  |  |  |
| PLO:11 (Lifelong learning) |  |  |  |  |
| PLO:12 (Project Management) |  |  |  |  |

**Mapping of CLOs to Course Evaluation Instruments (EI)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| EI | CLO’s | | | |
| CLO 1 | CLO 2 | CLO 3 | CLO 4 |
| Assignment 1 |  | 🗸 |  |  |
| Assignment 2 |  |  | 🗸 |  |
| Assignment 3 |  |  |  | 🗸 |
| Quiz 1 | 🗸 |  |  |  |
| Quiz 2 |  | 🗸 |  |  |
| Quiz 3 |  |  | 🗸 |  |
| Quiz 4 |  |  |  | 🗸 |
| Midterm Exam | 🗸 | 🗸 | 🗸 | 🗸 |
| Final Exam | 🗸 | 🗸 | 🗸 | 🗸 |

**COURSE RESOURCES**

**Instructor:** Engr. LARAIB SIDDIQUI

**Designation:** SENIOR LECTURER

**Office:** ENGINEERING BLOCK 1st FLOOR

**Email:** laraibsiddique.bukc@bahria.edu.pk

**Counseling Hours:** Monday & Friday (9:30 – 12:00)

**Text Book:**

1. Data Structures and algorithm analysis in C, Fourth Edition, by Mark Allen Weiss.

**Reference Books:**

1. C++ Plus Data Structures, Fifth Edition, Nell Dale.
2. Foundations of Algorithms Using C++ Pseudocode, Third Edition, by Richard Neapolitan & Kumarss Naimipour.

**Online References:**

To be provided with lectures as required.

**Appendix - I**

Blooms Taxonomy Levels Codes

|  |  |
| --- | --- |
| **C**ognitive | Knowledge (C1) |
| Comprehension (C2) |
| Application (C3) |
| Analysis (C4) |
| Synthesis (C5) |
| Evaluation (C6) |
| **A**ffective | Receiving (A1) |
| Responding (A2) |
| Valuing (A3) |
| Organization (A4) |
| Characterization (A5) |
| **P**sychomotor | Perception (P1) |
| Set (P2) |
| Guided Response (P3) |
| Mechanism (P4) |
| Complete Overt Response (P5) |
| Adaption (P6) |
| Organization (P7) |