COMSATS University Islamabad
Department of Computer Science
Course Description Form (CDF)

Course Information

Course Code: **CSC102** | Course Title: **Discrete Structures**
Credit Hours: **3 (3, 0)** | Lecture Hours/Week: **3**
Lab Hours/Week: **0** | Pre-Requisites: **None**

Course Objectives

- To introduce a formal system (propositional and predicate logic) on which mathematical reasoning is based;
- To teach important discrete data structures such as sets, relations, functions, graph and trees;
- To exercise common mathematical arguments and proof strategies;
- To develop the ability to see a problem from a mathematical perspective.

Course Content

This course introduces mathematical structures necessary for the development of program logic. It covers the following topics: Propositional & Predicate Logic; Arguments and Proof; Sets, Relations, Functions; Recursion; Combinatorics; Graphs & Tree Structures.

Unit wise Major Topics

Unit	Topic	No of teaching hours
1.	Propositional Logic: Overview, Simple & Compound Statements, Truth Tables, Translation of English Sentences into Logical Expressions & vice versa, Laws of Logic and, Logical Equivalence.	6
2.	Predicate Logic: Quantifiers, The Logic of Quantified Statements: Negations of Quantified Statements; Negations of Universal & Existential Conditional Statements; The Relation among ∀, ∃, ∧, and ∨; Vacuous Truth of Universal Statements; Variants of Universal Conditional Statements; Statements with Multiple Quantifiers.	4.5
3.	Arguments and Proof: Arguments & Rule of Inference, Arguments with Quantified Statements, Direct and Indirect Proofs, and Mathematical Induction.	6
4.	Sets & Relations: Concept, Operations with Sets, Computer operations with set, Problem solving with Venn Diagram, Proving Arguments with Sets; Relations: Representation of relations using Boolean Matrices & Digraphs, Properties of Relations, Operations on Relations, Connectivity Relations, Transitive Closure, Equivalence Relations, Partial & Total Orderings; Elementary Number Theory	6

5.	Functions and Matrices: Concept of Function, Special Function, Properties of Functions, Pigeonhole Principle, Composition of Functions, Sequence & the Summation Notations, and Matrices.	6
6.	Recursion: Recursively defined Functions and Series, Solving Recurrence Relation, Generating Functions.	4.5
7.	Combinatorics: Fundamental Counting Principles, Permutations, Derangements, Combinations, Permutations & Combinations with Repetitions, and Procedures for generating Permutations & Combinations.	3
8.	Graphs and Tress: Concepts, Computer Representation of Graphs, Types of Graphs, Isomorphic Graphs, Paths, Cycles, & Circuits, Eulerian & Hamiltonian Graphs, Planner Graphs, Graph Coloring. Digraphs & Weighted Digraphs, Directed Acyclic Graph, and Applications of Graph; Rooted Trees, Terminologies and Characterizations of Trees, Isomorphisms of Trees.	9
Total Contact Hours		**45**

Mapping of CLOs and GAs

Sr.#	Unit #	Course Learning Outcomes	Blooms Taxonomy Learning Level	GA
CLO-1	1,2	Apply symbolic propositional and predicate logic to determine the most effective solutions of a given problem.	*Applying*	2,3
CLO-2	3	Apply formal logic proofs and reasoning to construct a sound argument.	*Applying*	2,3
CLO-3	4,5	Solve a computing problem using a specific set, function, or relation model.	*Applying*	2,3
CLO-4	6,7	Use recurrence relation and counting formalisms to solve real-world problems.	*Applying*	2,3
CLO-5	8	Solve real-world problems in computer science using appropriate forms of graphs and trees.	*Applying*	2,3

CLO Assessment Mechanism

Assessment Tools	CLO-1	CLO-2	CLO-3	CLO-4	CLO-5
Quizzes	Quiz 1	Quiz 2	Quiz 3	Quiz 4	-
Assignments	Assignment 1	Assignment 2	Assignment 3	Assignment 3	Assignment 4
Midterm Exam	Mid Term Exam	Mid Term Exam	Mid Term Exam	-	-

Final Term Exam	Final Term Exam

Text and Reference Books

Textbook:

1. Discrete Mathematics and Its Applications, Rosen, K. H., McGraw Hill, 2019.

Reference Books:

1. Discrete Mathematics with Applications, Susanna S.E., Cengage Learning, 2019.
2. Discrete Mathematics, Richard Johnsonbaugh, Pearson, 2018.