**NATIONAL UNIVERSITY**
**of Computer & Emerging Sciences, Lahore**

# Department of Computer Science

## CS 1005– Discrete Structures

## Fall 2024

**Program:** BSCS / BDS/SR **Credit Hours:** 3 **Type:** Core

### Course Description/Objectives/Goals:

The goal of this course is to introduce the students to "Discrete Structures", which is an important area of mathematics and theoretical computer science. It deals with structures that are not continuous and do not vary smoothly, but are distinct with separate values. The course covers the basics of logic, set theory, proof techniques, counting, number theory and graph theory.

**Course Learning Outcomes (CLOs):**

| At the end of the course students will be able to: | **Domain** | **BT* Level** |
|---|---|---|
| 1. **Express** statements in terms of predicates, quantifiers and logical connectives. | C | 2 |
| 2. **Apply** formal logic proofs, logical reasoning to practical problems related to offered program. | C | 3 |
| 3. **Apply** mathematical induction to prove properties of sequences, recursive relations. | C | 3 |
| 4. **Apply** graph theory concepts to compute network related metrics and develope solutions for computing applications related to the program. | C | 3 |

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain.

**Bloom's taxonomy Levels:**1. Knowledge, 2. Comprehension, 3. Application, 4. Analysis, 5. Synthesis, 6. Evaluation

### Course Textbook

1. Kenneth H. Rosen, Discrete Mathematics and Its Applications, eight Edition., McGraw-Hill.

### Additional references and books related to the course:

1. Ralph P. Grimaldi, *Discrete and Combinatorial Mathematics: An Applied Introduction*, Fourth edition or later, Addison-Wesley.
2. Winifred K. Grassman, Jean P. Tremblay, *Logic and Discrete Mathematics: A Computer Science Perspective,* International Edition (or edition 1 or later), Prentice Hall.
3. Stuart Russell and Peter Norvig, *Artificial Intelligence, A Modern Approach*, Second edition or later, Pearson.

## Tentative Weekly Schedule

| Week | Topics to be covered | Section/chapter |
|---|---|---|
| 1 | Introduction to the course<br>Propositional Logic<br>Applications of Propositional Logic | 1.1 and 1.2 |
| 2 | Propositional Equivalences<br>Predicates and Quantifiers | 1.3 and 1.4 |
| 3 | Nested Quantifiers<br>Rules of Inference | 1.5 and 1.6 |
| 4 | Introduction to Proofs<br>Proof Methods and Strategy | 1.7 and 1.8 |
| 5 | Cardinality of sets. countable and uncountable sets | 2.5 |
| 6 | Midterm Exam 1 | |
| 6 | Divisibility and Modular Arithmetic<br>Primes and Greatest Common Divisors | 4.1<br>4.3 |
| 7 | Solving Congruences<br>Mathematical Induction | 4.4<br>5.1 |
| 8 | Strong Induction<br>The Basics of Counting | 5.2<br>6.1 |
| 9 | The Pigeonhole Principle<br>Permutations and Combinations<br>Binomial Coefficients and Identities | 6.2 , 6.3 and 6.4 |
| 10 | Generalized Permutations and Combinations<br>Applications of Recurrence Relations | 6.5 and 8.1 |
| 11 | Solving Linear Recurrence<br>Relations and Their Properties | 8.2 and 9.1 |
| 11 | Mid term 2 | |
| 12 | Representing Relations<br>Closures of Relations | 9.3, 9.4 |
| 13 | Equivalence Relations<br>Graphs and Graph Models | 9.5 and 10.1 |
| 14 | Graph Terminology and Special Types of Graphs<br>Representing Graphs and Graph Isomorphism | 10.2<br>and 10.3 |

## Evaluations

1. Assignments: 10%
2. Quizzes: 10%
3. Midterm Exams:30%
4. Final Exam: 50%

## Course Policies

1. No makeup for missed quizzes or assignments.
2. 80% attendance is essential

## Grading Scheme Absolute