

## MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

### 1. Introduction

**Objective:** The purpose of this course is to understand basic concepts of mathematics (definitions, proofs, sets, functions, and relations) and use (abstract) discrete structures(integers, bits, strings, trees, and graphs) that are backbones of computer science.

**Credits: 3 -0-0**

### 2. Course Outline

#### UNIT - I: Logic

Propositional logic, logical equivalence, predicates & quantifiers, and logical reasoning. Boolean Algebra

#### UNIT - II: Sets, Relations & Functions

Basics, set operations, Properties, Combining relations, Closures, Equivalence, partial ordering, One-to-one, onto, inverse, composition, graphs

#### UNIT - III: Algorithms on Integers

Greatest common divisor, Euclidean algorithm.

#### UNIT - IV: Mathematical reasoning

Proof strategies, Mathematical Induction, Recursive definitions, Structural Induction

#### UNIT - V: Counting

Basic rules, Pigeonhole principle, Permutations and combinations, Binomial coefficients and Pascal triangle

#### UNIT - VI: Probability

Discrete probability. Expected values and variance

#### UNIT - VII: Graph Theory

Paths, degree sequences, trees, minimum spanning trees, shortest path, bipartite matching, Tutte's theorem, connectivity, flows, graph coloring

### 3. Reading Material

#### Text Books

1. Discrete mathematics and its application: K H Rosen

#### References

1. Discrete and Combinatorial mathematics : Grimaldi
2. Concrete mathematics: Donald Knuth
3. Discrete mathematics with applications: Sussana Epp