

**Course Title:** Discrete Mathematics

**Course Code:** MATH-104

**Course Type:** Major Math

**Prerequisites:** N/A

**Credit Hours:** 3 (3 + 0)

**Course Objectives:** After the completion of course, the students will be able to:

- Master the principles of computational logic and methods of proof.
- Develop proficiency in counting techniques and solving recurrence relations.
- Gain foundational knowledge in probability for data analysis.

**Course Contents:**

**Computational Logic:** Propositional logic, Applications of propositional logic, Propositional equivalences, First-order logic or predicate logic, Quantifiers in first-order logic, Free and bound variables, Proof methods: Direct proof, Proof by contradiction, Proof by contrapositive.

**Relations:** Sets, Functions, Sequences, Relations and their properties, n-ary relations, Representing relations, Equivalence relations, Partial orderings, Hasse diagram, Lattice.

**Counting Techniques:** Basics of counting, Pigeonhole principle, Permutations, Combinations, Recursive definitions, Recurrence relations, Solving linear recurrence relations, Generating functions, Inclusion-exclusion principle.

**Probability:** Axioms of probability, Addition and multiplication rules of probability, Conditional Probability, Bayes Theorem.

**Recommended Books:**

1. Grimaldi, R.P., *Discrete and Combinatorial Mathematics*, Pearson, 5th edition, 2003.
2. Richard, J., *Discrete Mathematics*, Pearson, 7th edition, 2007.
3. Rosen, K. *Discrete Mathematics and Its Applications*, McGraw-Hill Education; 7th edition, 2011.
4. Susanna S. Epp, *Discrete Mathematics with Applications*, Cengage Learning, 4th edition, 2010.
5. Walpole, R. E., *Introduction to Statistics*, Macmillan Publishing Company, 3rd edition, 1982.

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