

## BCSC1010: DISCRETE MATHEMATICS

**Objective:** The objective is to introduce students to language and methods of the area of Discrete Mathematics. The focus of the module is on basic mathematical concepts in discrete mathematics and on applications of discrete mathematics in computer science.

Credits: 4

L–T–P–J: 3–1–0–0

Module No.	Content	Teaching Hours
I	<p><b>Sets, Relations and Functions:</b> Introduction to Set Theory, Venn diagrams, algebra of Sets, Inclusion-Exclusion Principle, Partitions, Relations, Properties and their types, Function and their types.</p> <p>Recurrence Relations and Generating Functions</p> <p><b>Introduction to Counting Principle:</b> Permutation, Combination, Permutation with Repetition, Combination with Repetition, Pigeonhole Principle.</p> <p><b>Posets &amp; Lattices:</b> Definition, Properties of lattices – Bounded, Complemented, Modular and Complete lattice.</p> <p><b>Natural Numbers:</b> Introduction, Mathematical Induction, Variants of Induction, Induction with Nonzero Base cases. Proof Methods, Proof by counter – example, Proof by contradiction.</p>	20
II	<p><b>Propositional Logic</b> - Logical Connectives, Truth Tables, Normal Forms (Conjunctive and Disjunctive), Validity;</p> <p><b>Predicate Logic</b> - Quantifiers, Inference Theory</p> <p><b>Algebra:</b> Motivation of Algebraic Structures, Finite Groups, Subgroups and Group Homomorphism; Lagrange's Theorem; Commutative Rings and Elementary Properties;</p> <p><b>Graph Theory:</b> Trees: Definition, Binary tree, Binary tree traversal, Binary search tree. Introduction to Graphs, , Operations on Graphs, Representation of graphs, Types: Planner, Directed, Complete, Bipartite Graph, Isomorphism, Euler Graph, Hamiltonian Graph, Connectivity.</p>	20

### Text Book:

- Kenneth H Rosen , “Discrete Mathematics and Its Applications”, 7th edition, TMH,2012.

### Reference Books:

- J.P. Tremblay , “Discrete Mathematical Structures with Applications to Computer Science”, TMH, New Delhi,1997.
- V. Krishnamurthy , “Combinatorics: Theory and Applications”, East-West Press, New Delhi,1986.
- Ralph P. Grimaldi, “Discrete and Combinatorial Mathematics- An Applied Introduction”, 5th Edition, Pearson Education,2004.
- C.L. Liu, “Elements of Discrete Mathematics”, 2nd Edition, TMH,2000.

**Outcome:** After the completion of the course, the student will be able to:

- C01: Understand the notion of mathematical thinking and proofs to solve the problem.
- C02: Apply the basics of discrete probability and number theory to solve the real world problem.
- C03: Analyze basic discrete structures and algorithms using effectively algebraic techniques.
- C04: Analyze mathematical concepts like sets, reasoning, relational algebra and graph theory to solve optimization problems.
- C05. Analyze the validity of an argument using logical notation.
- C06. Demonstrate the basic structures of proof techniques to write and evaluate the validity of arguments.
- C07. Understand the basic principles of sets, set equalities and operations in sets.
- C08. Apply counting principles to determine probabilities.