DISCRETE MATHEMATICS AND GRAPH THEORY SYLLABUS

Module 1: Mathematical Logic

- Statements and Notation
- Connectives
- Tautologies
- Equivalence
- Implications
- Normal Forms
- Theory of Inference for the Statement Calculus
- Predicate Calculus
- Inference Theory of Predicate Calculus

Module 2: Algebraic Structures

- Semigroups and Monoids
- Groups
    - Subgroups
    - Lagrange's Theorem
    - Homomorphism Properties
    - Group Codes

Module 3: Counting Techniques

- Basics of Counting
- Exclusion Principle
- Pigeonhole Principle
- Permutations and Combinations
- Inclusion-Exclusion Principle
- Recurrence Relations

- Solving Recurrence Relations
- Generating Functions
- Solution to Recurrence Relations

Module 4: Lattices and Boolean Algebra

- Partially Ordered Relations
- Lattices as Posets
- Hasse Diagram
- Properties of Lattices
- Boolean Algebra
    - Properties of Boolean Algebra
    - Boolean Functions

Module 5: Fundamentals of Graphs

- Basic Concepts of Graph Theory
- Planar and Complete Graphs
- Matrix Representation of Graphs
- Graph Isomorphism
- Connectivity
- Cut Sets
- Euler and Hamilton Paths
- Shortest Path Algorithms

Module 6: Trees, Fundamental Circuits, Cut Sets

- Trees
    - Properties of Trees
    - Distance and Centers in Trees
    - Spanning Trees
    - Spanning Tree Algorithms
    - Tree Traversals

- Fundamental Circuits and Cut-Sets

Module 7: Graph Coloring, Covering, Partitioning

- Bipartite Graphs
- Chromatic Number
- Chromatic Partitioning
- Chromatic Polynomial
- Matching
- Covering
- Four Color Problem