SYLLABUS
DISCRETE STRUCTURE & GRAPH THEORY

Unit I: The Foundations: Logic and Proofs: Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, De Morgan's Laws, Satisfiability: Applications and Solving Problems; Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic, Use to Build Arguments.

Unit II: Sets, Functions and Relation: Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations ,Functions, Inverse Functions, Compositions and Graphs of Functions, Partial Functions; Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Properties of Relations, Combining Relations; Representing Relations Using Matrices; Representing Relations, Closures of Relations, Equivalence Relations.

Unit III: Algebraic Structures: Algebraic Systems: Examples and General Properties; Semigroups and Monoids: Homomorphism of Semigroups and Monoids, Subsemigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, algebraic Systems with Two Binary Operations; Group Codes: The Communication Model and Basic Notions of Error Correction, Hamming Distance.

Unit IV: Boolean Algebra: Lattices, Boolean Algebra: Boolean Functions, Representing Boolean Functions, sum of product expansions, Functional Completeness, Logic Gates, Combinations of Gate, Minimization of Circuits, Karnaugh Maps.

Unit V: Tree: Introduction, Rooted Tree, ordered rooted tree, tree as model, Properties of Trees, Applications of tree, Binary Search Trees, Decision Trees, Prefix Codes, Huffman Coding, Game Trees, Tree traversal, Preorder Traversing, Inorder Traversing, Post order Traversing, Spanning Tree, Minimum spanning tree.

Unit VI: Graph: Graph Models; Basic Terminology, Special Simple Graphs, Bipartite Graphs, Matchings, Applications of Special Types of Graphs, New Graphs from Old; Graph Representation, Adjacency and Incidence Matrices, Isomorphism of Graphs, Determining Isomorphism; Paths, Connectedness in Undirected Graphs and Directed Graphs, Paths and Isomorphism, Counting Paths Between Vertices; Euler Paths and Circuits, Hamilton Paths and Circuits, Applications of Hamilton Circuits; Planar Graphs: Euler's Formula, Kuratowski's Theorem; Graph Coloring: Introduction, Applications of Graph Colorings;