IMA-102: DISCRETE STRUCTURES **L T P**

(MCA, I Semester) **3 1 0**

UNIT I: Fundamentals of Logic:

Propositional Logic: Propositions, Basic logic operations and truth tables, Tautologies, Contradictions, Contigency, Algebra of propositions, Logical equivalence: the laws of logic, Logical implication: Rules of inference, Logical analysis of arguments, Some computing applications (Normal forms), Functionally complete set of operations, Formal proofs.

First Order Logic:Predicates & quantifiers, Nested quantifiers, Use of quantifiers, Rules of inference, Validity of arguments.

Notion of Proofs: Proof by counter example, the contraposition, proof by contradiction, inductive proofs.

UNIT II: Set Theory, Relations and Functions

Set Theory: sets & subsets, Venn diagrams, Set operations and laws, countable and uncountable sets, Cartesian product, Cardinality, Principle of inclusion- exclusion.

Relations: Relation, Representation & properties, n-ray relations and applications, Composition of relations, Closures of relations, Equivalence relation & partitions, partial orders, compatibility relation.

Functions: Functions and its types, Inverse function, Composition of functions, Special functions, Recursively defined functions, Computational Complexity, Analysis of algorithms.

Theorem Proving Techniques: Mathematical induction, strong induction, and well ordering, structural induction, Pigeonhole principle.

UNIT III: Algebraic Structures and Coding Theory

Algebraic Structures: Definition, Properties, Semi group, Monoid, Group, Properties of groups, Subgroup, Cyclic group, Cosets and Lagrange's theorem, Permutation groups, Normal subgroup, Homomorphism and isomorphism of groups, Congruence relation, Rings and Fields. Example and standard results.

Coding Theory: Elements of coding theory, Hamming matric, Parity-check and generator matrices, Coding and error detection, Group codes: decoding with coset leaders and error correction, Hamming matrices.

UNIT IV: Partially Ordered Structures

Posets,: Definitions, ordered set, Hasse diagram, isomorphic ordered set, well ordered set, Minimal and Maximal elements, LUB & GLB etc.

Lattices: Definition & Properties, Product Lattices, Isomorphic Lattices, Applications, Types of Lattices

Boolean Algebras: Definitions & Properties, SOP & POS forms, Logic gates and minimization of circuits, Karnaugh maps, Quine-McClusky method.

Trees: Definition & Examples and Properties , Rooted tree, Binary tree, Tree traversal, application in computer science and engineering .

UNIT V: Combinatorics and Graph Theory:

Combinatorics: Basic counting techniques**,**Discrete numeric functions and properties, Recurrence relations and their applications (modelling), various methods of solutions, system of recurrence relations, OGF & EGF, properties, applications: solution of recurrence relations and combinatorial problems. Polya's enumeration theorem and applications.

Graphs: Graphs and graph models, terminology, matrices associated with graphs, Isomorphism, Special types of graphs, connectedness, Euler and Hamilton graphs with their applications, trees with properties, MST, planer graphs and applications, criteria of planarity, Graph coloring and coloring models, directed graphs.

Books Recommended:

1. Trembley, J.P. & R. Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, McGraw Hill.
2. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, McGraw Hill.
3. Ralph, P. Garimaldi, “Discrete & Combinatorial Mathematics” Pearson Publication, Asia.
4. Deo, Narsingh,”Graph Theory with applications to Engineering & Computer Science”, PHI.
5. Krishnamurthy, V., “Combinatorics Theory & Application”, East-West Press Pvt. Ltd., New Delhi.