Discreet Mathematics
MCS-501

Block-I

Unit I

Set Theory, Definition of SetsNotations; Types of Sets, Relation between Sets, Operations on Sets,Venn Diagrams: Definition, Complements, Cartesian Product, Power SetsCounting Principles: Product Rule, Sum Rule, Subtraction Rule, Division Rule; Cardinality Countability: Countable sets, Uncountable Sets, Basic Set Identities & proofs,Pigeonhole Principle

Unit II

Relation, Definition of Relation: Notations; Types of Relations: Inverse relation, Combined relation, Composition of Relation, Domain & Range, Pictorial Representation: Matrix, Arrow Diagram Directed Graph; Properties of Relation: Reflexive , Symmetric , Transitive , Irreflexive, Antisymmetric, Partial Ordering.

Unit III

Function, Definition, Classification, Types of Function: Into, Onto , One-one , many-one , One-one into, One-one onto, Many one into, Many one onto, Identity, Constant, Composition of Function, Recursively Defined Function

Unit IV

Propositional Logic, Propositions: Elements of Propositions, Propositional Variable; Basic Logic: Logical Connectives, Truth Tables; Tautologies, Contradiction, Normal Forms: Elementary Product, Elementary Sum, Conjunctive, Disjunctive, Principal Disjunctive Normal Form, Principal Conjunctive Normal Form.

Block-2

Unit-I

Inference, Rules of Inference, Modus Ponens, Modus Tollens: Formal Notation, Relation with modus tollens; Validity: Validity of an argument, Validity of a statement; Predicate Logic, Quantification: Universal Quantification, Existential Quantification.

Unit-II

Notion of proof, Proof by implication, Converse, Inverse, Contrapositive, Negation, Contradiction Direct proof, Proof by truth table: Proof of tautology, Proof by counter example.

Unit-III

Combinatorics, Mathematical induction: Principle of strong mathematical induction, Recursive Mathematical definitions: Recursively defined Functions, Recursively defined Sets; Basics of counting: Sum Rule, Product Rule, Counting ways of forming numbers from a set of digits, Inclusion – Exclusion principle, Permutations and Combinations

Unit-IV

Recurrence Relation, Definition, Modeling with Recurrence Relations, Order and degree of Recurrence Relations, Linear homogenous Recurrence Relations: Solving linear homogeneous recurrence relations with constant coefficients, Solving linear non-homogeneous recurrence relations with constant coefficients.

Block-3

Unit-I

Generating function, Closed form expression: Definition of Generating Function, Some special generating function; Properties of Generating Function, Solution of Recurrence Relation using Generating Function, Solution of combinatorial problem using Generating Function.

Unit-II

Algebraic Structure, Introduction, Binary Composition & its properties: Closure Law, Associative Law, Existence of identity element, Existence of Inverse element, Commutative Law; Definition of algebraic structure.
Group, Overview: Definition, Abelian Group, Properties of Group, Groyas Semi group; Monoid Groups.

Unit-III

Generating function, Sub Groups: Cosets, Index of subgroup, Centralizer and Normalizer, Order of a group Lagrange's Theorem; Cyclic Group, Permutation Group: Equality of two permutations, Identity permutation, Product of permutation, Inverse permutation, Cyclic Permutation; Rings: Commutative ring, Ring & unity, Zero divisor of a ring, Subrings, Ring Homomorphism, Integral Domain , Division Ring (Skew Field);Fields.

Block-4

Unit-I

Graph Theory, Basic Terminology, Types of Graph: Simple Graph, Multi-graph, Trivial Graph and Null Graph, Pseudo-graph, Complete Graph, Regular Graph, Bipartite Graph, Platonic Graph, Weighted Graph Connected Graphs; Connected Graph & its Components, Euler graph, Hamiltonian path and circuits, Graph coloring & Chromatic number.

Unit-II

Trees, Definition, Types of tree: Rooted, Binary; Properties of trees, binary search tree, Tree traversing.

Unit-III

Finite Automata, Basic Concept of Automation theory: Alphabet & Words, Language, Grammars: Types of Grammars, Chomsky Hierarchy; Deterministic Finite Automation (DFA): Transition Function, Transition Table; Non Deterministic Finite Automata, Minimization of finite Automation, Mealy ,Moore Machine.

Suggested Reading:

Kenneth H. Rosen, "Discrete Mathematics and its Applications", Mc.Graw Hill, 2002.
J.P.Tremblay& R. Manohar, "Discrete Mathematical Structure with Applications toComputer Science" Mc.Graw Hill, 1975.
V. Krishnamurthy, "Combinatories:Theory and Applications", East-West Press.
Seymour Lipschutz, M.Lipson, "Discrete Mathemataics" Tata McGraw Hill, 2005.
Kolman, Busby Ross, "Discrete Matheamatical Structures", Prentice Hall International.\