MCA 101 - Mathematical Foundations of Computer Science

Module 1:- Sets: Basic Concepts
Relations: Binary relations, Equivalence relations and partition.
Functions: Different types of functions, Composition and Inverse, Recursive and hashing functions. Mathematical Induction.

Module 2:- Partial Ordering Relations
Partially ordered set: Representation of Poset - Hasse Diagram, LUB, GLB, well ordered set, meet and join of elements.
Lattices as partially ordered sets: Definition and basic properties, Lattices as algebraic systems, sub lattices.
Basic Concepts of Automata Theory: Alphabets, Strings, Languages, DFA, NFA and their representations.

Module 3:- Logic
Mathematical logic, Logical operators – Conjunction, Disjunction, Negation, Conditional and biconditional. Truth tables. Equivalence formula, Tautology, methods of proof-direct, indirect, contradiction, equivalence and induction. Inference Theory, Validity by truth table, Rules of Inference. .

 Predicate calculus :   Predicates , statement functions, variables and quantifiers, predicate formulas, free and bound variables, the universe of discourse.

Module 4:- Graph Theory
Basic terminology: Different types of graphs – Directed and undirected, Simple, Pseudo, Complete, Regular, Bipartite. Incidence and degree, Pendant and Isolated vertex and Null graph. Isomorphism, Sub graphs, Walk, Path and Circuit, Connected and disconnected graphs and components, operations on graphs. Euler Graphs, Fleury's Algorithm, Hamiltonian circuits and paths. Traveling salesman problem. Matrix representation of graphs – Incidence and Adjacency matrices.

Module 5:- Trees & Planar Graph
Trees: Basic properties, Rooted and binary trees, Binary search trees, Tree traversals – Pre order, , In order and Post order , Spanning Trees, Prims and Kruskals algorithm.
Planar graphs: Kuratowski's two graphs and Euler's formula . Detection of planarity.

References

- Discrete Mathematical Structures with Applications to Computer Science by J. P. Tremblay and R Manohar, Tata McGraw-Hill Publications, 1997.
- Graph Theory by Narsingh Deo, Prentice-Hall of India publications, 2004.

- Theory of computer science (Automata, Languages and Computation), 2nd ed. Mishra K.L.P , N Chandrasekharan, Prentice-Hall of India publications.

- Discrete Mathematical Structures, Theory and Applications . D.S. Malik, Thomson Learning , I Edn.
- Discrete Mathematics for Computer Science, Haggard, Thomson Learning , I Edn.
- Discrete Mathematics and Its Applications by Kenneth H Rosen. Tata McGraw-Hill Publications.
- Introduction to Automata Theory, Languages and Computation by Hopcroft and J. D .Ullman. Narosa Publications.
- Mathematical foundation of Computer Science by Y. N Sings. New Age international Publishers.
- Bernard Kolman, Robert.C.Busby & sharon Ross, "Discrete Mathematical structures" Prentice Hall of India,2001.