GUJARAT TECHNOLOGICAL UNIVERSITY

MASTERS IN COMPUTER APPLICATION (Integrated MCA)

Year – I (Semester – II) (W.E.F. JAN 2014)

Subject Name: Discrete Mathematics for Computer Science

Subject Code: (4420601)

Objectives: The objective of this course is to present the foundations of many basic computer related concepts and provide a coherent development to the students for the courses like Fundamentals of Computer Organization, RDBMS, Data Structures, Analysis of Algorithms, Theory of Computation ,Cryptography, Artificial Intelligence and others. This course will enhance the student's ability to think logically and mathematically.

Prerequisites: Basic Mathematics

Course Contents:

Sr. No.	Course Content	No. of Sessions
1	**Lattices and Boolean Algebra**: Partial ordering; Totally (Simply) ordered set or Chain; Frequently used partially ordered relations; Partially ordered sets; Hasse diagram; Least, Greatest, Maximal, Minimal Members; Upper bound, lower bounds, least upper bound or supremum, greatest lower bound or infimum; Well-ordered sets Relation and ordering, partially ordered sets, Lattices as poset, properties of lattices, Lattices as algebraic systems, sublattices, direct product and homomorphism, complete lattices, bounds of lattices, distributive lattice, complemented lattices. **Boolean Algebra**: Introduction, definition and important properties, Sub Boolean algebra, direct product and homomorphism, join-irreducible, meet-irreducible, atoms, anti atoms of Boolean Algebra, Stone's representation theorem. (Without Proof), **Note**: No proof is required for Theorems or Results on lattices and Boolean Algebra. Theorems should be justified and explained by suitable examples.	**[10]**
2	**Applications of Boolean Algebra**: Boolean expressions and their equivalence, Minterms and Maxterms, Free Boolean algebra, Values of Boolean expression, canonical forms, Boolean functions, representation of Boolean function, Karnaugh maps, minimization of Boolean function, Quine_ McCluskey algorithm, Application to Relational Database; Design examples using Boolean Algebra.- 1's Complementer, 2's Complementer, Half-adder, Full-adder,	**[12]**

	Full-adder-subtractor module, Single parity bit generator	
3	**Algebraic Structures**: **Semi-groups and Monoids**: Definition and examples, Homomorphism, Endomorphism, Automorphism, Isomorphism, Natural Homomorphism, Direct Product **Groups**: Definition and examples of groups, abelian group, cyclic groups, permutation groups, subgroups & Homomorphism, Cosets and Lagrange's Theorem (without proof), Normal subgroups, Quotient Groups.	**[10]**
4	**Graph Theory**: **Graph**: Definition; Directed and undirected graphs; Loop (sling); Parallel edges; Simple graph, multi-graph; Weighted graph; Isolated node; Null graph;Isomorphism of graphs; In-degree, out-degree, total degree of a graph; Subgraph; Reflexive, symmetric, transitive, anti-symmetric graphs; Converse and directional dual of a diagraph;Path of a graph; Length of a path; Simple path (edge simple), elementary path (node simple); Cycle (circuit); Path of minimum length (geodesic); Reachability;Reachable set; Node base; Connected graph – strongly connected, unilaterally connected, weakly connected; Subgraph generated by a given set;Maximal strongly (or unilaterally or weakly) connected subgraph; Matrix representation of graph; Adjacency matrix (A) of a graph; Deriving in (or out or total) degree from adjacency matrix; Path (reachability) matrix; Boolean matrix; Warshall algorithm to produce path matrix; Minimal path algorithm	**[10]**
5	**5. Trees**: Definition, root and leaf nodes; Directed tree; Weighted tree; Degree of node; Disjoint tree, forest; Full (complete) m-ary tree, binary tree; Different representations of trees; Conversion of m-ary tree into a binary tree; Binary tree representation of a forest	**[04]**

Main Reference Books:

1. J. P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw-Hill

Suggested Additional Reading:

1. K. H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill, 7th edition (2011)
2. D. S. Malik, M. K. Sen, "Discrete Mathematical Structure", Cengage Learning
3. Bernard Kolmann & others, "Discrete Mathematical Structure", Pearson Education, Sixth Edition
4. Edgar G. Goodaire, Michael M. Parmenter, ""Discrete Mathematics with Graph Theory", PHI
5. J. P. Tremblay and W. K. Grassman, "Logic and Discrete Mathematics", Pearson Education

Chapter wise coverage from the main reference books:
From the Main Reference Book
Chapter-2, Section 2-3 (2-3.8 to 2-3.9)
Chapter-3, Section 3.2 and Section 3-5 (3-5.1 to 3-5.4) up to Theorem 3-5.8
Chapter-4, Sections 4-1 to 4-5
Chapter-5, Section 5-1 (5-1.1 to 5-1.4)

Accomplishment of the student after completing the course:
The student will be able to apply concepts to RDBMS, perform minimization of Boolean functions, shall learn the fundamentals representations methods of graphs and trees. They shall be able to use different logical reasoning to understand proof of theorems.