G H RAISONI INSTITUTE OF ENGINEERING & TECHNOLOGY
(Approved by AICTE, New Delhi and Recognized by DTE, Maharashtra)
An Autonomous Institute Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Accredited by NAAC with A+ Grade
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Department of Science & Technology
Syllabus

MCA Semester-I

MCA14: Discrete Mathematics & Graph Theory										
Teaching Scheme				Credits	Continuous Evaluation Scheme					
					Theory			Practical		Total
Th.	Tu	Pr.	Total Hours		TAE	CAE	ESE	Int	Ext	
3	0	0	3	3	20	30	50	-	-	100

Course Objectives	**1.** Use set notation, including the notations for subsets, unions, intersections, differences, Complements cross products, and power sets.
	2. Apply logical reasoning to solve a variety of problems.
	3. Use mathematically correct terminology and notation.
	4. To study and use different ICs such as timers for application Write English sentences for logical expressions and vice-versa. Use standard notations of propositional logic.
	5. Determine if a logical argument is valid or invalid. Apply standard rules of inference including Modus Ponens, Modus Tollens, Transitivity, and Elimination.
	6. Define and use the terms function, domain, codomain, range, image, inverse image, preimage, & composition.
	7. Define and use the terms Lattices, Partial Order Relation and Boolean Functions.
	8. Understand Graph and Tree terms, and be able to relate these to practical examples.
Course Outcomes	**1.** Understand the basic principles of sets and operations in sets and Prove basic set equalities.
	2. Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.

	3. Write an argument using logical notation and determine if the argument is or is not valid.
	4. Demonstrate an understanding of relations and functions and be able to determine their properties. Determine when a function is 1-1 and "onto".
	5. Model problems in Computer Science using graphs and trees.

Course Contents:

Unit	Contents	Hours
I	**Fundamentals** Fundamental: Sets and Relations, Operations on sets, Addition Principle: for 2 Sets and 3 Sets, Sequences, Characteristics Function, Strings and Regular Expression, Properties of integers, Matrices, Boolean Matrix Operations, Logic: Proposition and logical operations, conditional statements, Methods of proof, Mathematical Induction.	8
II	**Mathematical Logic** Statements and notations, Connectives, Well-formed formulas, Truth Tables, tautology, equivalence implication, Normal forms. Theory of inference for the statement calculus: Rules of inference, Consistency, proof of contradiction, Automatic Theorem Proving. Predicate calculus: Predicative logic, Free and Bound variables, The Universe of Discourse. Inference theory of predicate calculus involving quantifiers.	10
III	**Relations & Algebraic Structure** Properties of binary Relations, equivalence, transitive closure, compatibility and partial ordering relations, Lattices, Hasse Diagram. Functions: Composition of functions, Inverse Function, Hashing functions, Algebraic structures: Algebraic systems, Examples and general properties, Semi groups and monoids, groups and sub groups, homomorphism. Lattice as partially ordered sets, Boolean algebra.	12
IV	**Elementary Combinatorics** Basics of counting, Combinations & Permutations, with repetitions, the principles o Inclusion – Exclusion, Pigeon hole principles and its application. Recurrenc Relations: Generating Functions, Function of Sequences, Calculating Coefficients o generating functions, Recurrence relations, solving recurrence relation b substitution and Generating functions, the method of Characteristic roots, an solution of homogeneous Recurrence Relations.	8
V	**Graphs**	10

	Graph Theory: Basic Concept of Graph Theory, Isomorphism and Sub graphs, Planar Graphs, Multi graphs, Euler Path & Circuits, Hamiltonian Path & Circuits, Other Relations & Structure: Partially Ordered Sets Lattices, Finite Boolean Functions as Boolean Polynomials. Trees: Introduction, Trees and their properties, Spanning Trees, Directed trees, Undirected Trees, Minimal Spanning Trees.	

Text Books	**1.** Discrete Mathematical Structures by Kolman, Ross and Busby, PHI Publication.
	2. Discrete Mathematics with Applications to Computer Science, J P Trembley and R Manohar, TMH, 2008. (Units I and II).
	3. Discrete Mathematics for Computer Scientists and Mathematicians, second edition, J. L. Mott, A. Kandel, T.P. Baker, PHI
Reference Books	1. Elements of Discrete Mathematics- A Computer Oriented Approach, C.L.Liu, D.P. Mohapatra, 3rd edition, TMH.
	2. Discrete and Combinatorial Mathematics- An Applied Introduction-5th Edition– Ralph. P.Grimaldi, Pearson Education.
On-line TL Material	https://onlinecourses.nptel.ac.in/noc21_cs34/unit?unit=17&lesson=18 https://onlinecourses.nptel.ac.in/noc21_cs34/unit?unit=58&lesson=59 https://onlinecourses.nptel.ac.in/noc21_cs34/unit?unit=89&lesson=90 https://onlinecourses.nptel.ac.in/noc21_cs34/unit?unit=141&lesson=142