DISCRETE MATHEMATICAL STRUCTURES
(Common to Computer Sci. Engg. & Information Technology)

23MA1103 **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40
End Exam : 3 Hours End Exam Marks:60

Prerequisites: Elementary knowledge of set theory, Matrices and functions.

Course Objectives:

This course will discuss fundamental concepts and tools in discrete mathematics with emphasis on their applications to computer science. Topics include logic, functions, relations, recurrence relations, fundamental concepts of number theory and graph theory.

Course Outcomes: At the end of the course, students will be able to

1.	Identify logical skills in solving mathematical problems.
2.	Determine properties of binary relations, identify equivalence and partial order relations, and sketch relations.
3.	Analyze recurrence relations, generating functions and solving problems involving recurrence relations.
4.	Evaluate the concepts related divisibility, congruences and number theoretic functions and identify the structure of group, ring, and field.
5.	Explain the basic concepts of graph theory and develop a graph theoretical model for a real time situations.

CO-PO –PSO Mapping:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1			
CO2	3	2										1			
CO3	3	2										1			
CO4	3	2										1			
CO5	3	2										1			

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping of Course Outcomes with Program Outcomes &Program Specific Outcomes:

CO-PO-PSO Justification	
1	CO1 deals with the logical inferences and first-order logic is used to make deductions and draw conclusions from given facts or premises.
2	CO2 deals with the relations are used to represent connections or relationships between objects in graph theory.
3	CO3 deals with the recurrence relations help identify recurring structures, repetitive patterns or sequences in problems, allowing for the formulation of efficient solutions.
4	CO4 deals with the concepts of prime numbers, modular arithmetic, and the Euclidean algorithm are used in cryptographic protocols to ensure secure communication, data encryption, and digital signatures and algebraic structures which are mainly used in encryption and decryption algorithms in computer science engineering.
5	CO5 deals with the concepts of the fundamental concepts of graph theory.

SYLLABUS

UNIT I **10 Periods**

MATHEMATICAL LOGIC

Fundamentals of logic – Logical inferences – Methods of proof of implication – First order logic and other proof methods – Rules of inference for quantified propositions – Pigeonhole principle – Mathematical induction.

UNIT II **10 Periods**

RELATIONS

Cartesian products of sets – Relations – Properties of binary relations in a set – Relation matrix and graph of a relation – Partition and covering of set – Equivalence relations – Composition of binary relations – Transitive closure of a relation – Partial ordering – Partially ordered set – Hasse diagram – Lattice.

UNIT III **10 Periods**

RECURRENCE RELATIONS

Generating functions of sequences – Calculating their coefficients – Recurrence relations – Solving recurrence relations – Method of characteristic roots – Non-homogeneous recurrence relations and their solutions.

UNIT IV **10 Periods**

NUMBER THEORY

Divisibility and Modular Arithmetic – Integer representations and algorithms – Primes and greatest common divisors – Solving congruences.

ALGEBRAIC STRUCTURES

Semi Groups – Monoids – Groups – Subgroups and their properties – Introduction to rings and fields. (Only definitions and examples)

UNIT V **10 Periods**

GRAPHS

Introduction to graphs – Types of graphs – Graphs basic terminology and special types of simple graphs – Representation of graphs and graph isomorphism – Euler paths and circuits – Hamilton paths and circuits – Planar graphs – Dual of a graph – Euler's formula – Graph coloring – Chromatic number.

TEXT BOOKS:

1. **Joe L. Mott, Abraham Kandel & T. P. Baker**, *Discrete Mathematics for computer scientists & Mathematicians,* Prentice Hall of India Ltd, New Delhi., 2008.
2. **Keneth. H. Rosen**, *Discrete Mathematics and its Applications*, 7/e, Tata McGraw-Hill, 2015.
3. **J. P. Tremblay, R. Manohar**, *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw-Hill Publishing Company Limited,1997.

REFERENCE BOOKS:

1. **Richard Johnsonburg**, *Discrete mathematics*, 7/e, Pearson Education, 2008.
2. **Narsingh Deo**, *Graph Theory with Applications to Engineering and Computer Science*, Prentice Hall of India, 2006.