Course Code	DISCRETE MATHEMATICAL STRUCTURES [common to CSE & I.T.]	L 2	T 1	P 0	C 3

1. Prerequisites : Elementary knowledge of Set theory, Matrices and Algebra.

2. Course Objective :

The main objectives of the course are to:

- Introduce concepts of mathematical logic for analyzing propositions and proving theorems.
- Use sets for solving applied problems binary relations and introduce concepts of algebraic structures
- Work with an ability to solve problems in Combinatorics
- Solve problems involving recurrence relations and generating functions.
- Introduce basic concepts of graphs, digraphs and trees

3. Course Outcomes: At the end of the course student should be able to:

CO - 1	Understand mathematical logic, mathematical reasoning and to study about the validity of the arguments and also prove mathematical theorems using mathematical induction.
CO - 2	Determine properties of binary relations, identify equivalence and partial order relations, sketch relations and Familiarize with algebraic structures.
CO - 3	Apply counting techniques to solve combinatorial problems and identify, formulate, and solve computational problems in various fields.
CO - 4	Understand Recurrence Relation, Generating functions and solving problems involving recurrence equations.
CO - 5	Familiarize with the applications of graphs , trees and algorithms on minimal spanning tress and apply graph theory in solving computing problems

DETAILED SYLLABUS:

UNIT-I: MATHEMATICAL LOGIC (12Periods)

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

Learning outcome: At the end of this unit, student will be able to

- Find equivalence formulas, implementation of logic for mathematical proofs (L_1)
- Apply inference theory to verify the consistence of data (L_3)
- Construct logical statements from informal language to propositional logic expressions(L_6)
- Apply the pigeonhole principle in the context of a contradiction proof (L_3)
- Prove mathematical theorems using mathematical induction(L_5)

(Sections: 1.5 to 1.10 of Text book [1])

UNIT-II : RELATIONS AND ALGEBRAIC SYSTEMS (12 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.

(Sections :2-1.9,2-3.1 to 2-3.5,2-3.7, 2-3.8, 2-3.9 of Text book [2])

ALGEBRAIC SYSTEMS:

Definitions and simple examples on Semi groups, Monoids , Group, Ring and Fields.

Learning Outcomes:

Learning outcome: At the end of this unit, student will be able to

- Determine properties of relations, identify equivalence and partial order relations, sketch relations. (L_5)
- Understand concepts of Semi group, Monoid, Group, Ring and Fields. (L_2)

(Sections:3-1.1, 3-2.1,3-2.2, 3-5.1,3-5.11and 3-5.12 of Text book [2])

UNIT-III: ELEMENTARY COMBINATORICS (10Periods)

Basics of counting- Combinations and permutations-Their enumeration with and without repetition-Binomial coefficients-Binomial and multinomial theorems-The principle of inclusion-Exclusion.

Learning outcome: At the end of this unit, student will be able to

- Solve problems on Permutation and Combinations with and without repetition (L_3)
- Solve problems on binomial and Multinomial coefficients(L_3)
- Solve counting problems by using principle of inclusion-exclusion (L_3)

(Sections :2.1to 2.8 of Text book [1])

UNIT-IV: RECURRENCE RELATIONS (10Periods)

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

Learning outcome: At the end of this unit, student will be able to

- Formulate recurrence relations of the sequences
- Solve problems using generating functions(L_3)

- Solve homogeneous linear recurrence relations(L_3)
- Evaluate complementary function and particular integral for non homogeneous linear recurrence relations (L_5)
- Apply substitution method to solve non-linear recurrence relations (L_3)

(Sections: 3.1 to 3.6 of Text book [1])

UNIT- V: GRAPH THEORY (16Periods)

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 – Euler's formula

Introduction to Trees and their properties – Spanning Trees — Minimum Spanning Trees – Kruskal's Algorithm .

Learning outcome: At the end of this unit, the student will be able to

- Identify different graphs and their properties(L_3)
- prove elementary results about graphs and trees(L_5)
- Construct Euler and Hamiltonian graphs (L_3)
- Construct the graph for the given data (L_3)
- Construct the spanning tree and binary tress from graphs (L_3)
- Build minimal spanning tree by using different algorithms (L_3)

(Sections: 5.1 to 5.4, 5.7,5.8,5.9,5.10 of Text book [1])

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) J.PTremblay,R.Manohar,"DiscreteMathematicalStructures with Applications to Computer Science", Tata McGraw-Hill Publishing Company Limited,1997

REFERENCE BOOKS:

1. Keneth. H. Rosen, Discrete Mathematics and its Applications, 6/e, Tata McGraw-Hill, 2009.
2. Richard Johnsonburg, Discrete mathematics, 7/e, Pearson Education, 2008.