2/4 B.Tech. FIRST SEMESTER

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

CS3T1 **Required** **Credits: 4**

Lecture: 4 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Course context and Overview: This course will discuss fundamental concepts and tools in discrete mathematics with emphasis on their applications to computer science. Example topics include logic and Boolean circuits; sets, functions relations, analysis techniques based on counting methods and recurrence equations; trees and more general graphs.

Prerequisites: Basic Mathematics

Objectives:

1. To know the notations used in the discrete mathematics associated with computer science and engineering.
2. To learn the rudiments of elementary mathematical reasoning (elementary proofs; proofs by induction, Normal forms)
3. To understand the theoretical parts of all further courses in Computer Sciences.
4. To understand the fundamentals of counting and discrete probability
5. To understand basic set-theoretical notions: relations, functions, graphs, equivalence relations, and orderings.
6. To relate these notions to applications in Computer Sciences.

Learning Outcomes:

Ability to:

1. Apply fundamentals of mathematical logic for proof techniques.
2. Use the concepts of counting and recurrence relations to solve the problems.
3. Determine various types of relations and their applications.
4. Demonstrate various types of graphs and its applications.

UNIT- I

Statements and Notation, Connectives- Negation, Conjunction, Disjunction, Conditional and Bi-conditional, Statement formulas and Truth Tables. Well formed formulas, Tautologies, equivalence of formulas, Duality Law, Tautological Implications, Functionally Complete Sets of Connectives, Other connectives.

UNIT-II

Normal Forms: Disjunctive Normal Forms, Conjunctive Normal Forms, Principal Disjunctive Normal Forms (PDNF), Principal Conjunctive Normal Forms (PCNF).

UNIT-III

Logical inferences, Methods of proof of an implication, First Order Logic and other methods of proof, Rules of Inference for Quantified Propositions, Mathematical induction.

UNIT-IV

Basics of counting, Combinations and Permutations, Enumeration of combinations and permutations, Enumerating Combinations and Permutations with repetitions, Enumerating permutations with constrained repetitions, The Principle of Inclusion-Exclusion.

UNIT –V

Generating functions of Sequences, Recurrence relations, solving recurrence relations by Substitution and Generating functions, the method of Characteristic roots, Solutions of In-homogeneous Recurrence Relations.

UNIT –VI

Relations and Directed Graphs, Special properties of binary relations, Equivalence relation, Ordering relations, Lattices, and Enumerations.

UNIT –VII

Operations on relations, Paths and Closures, Directed graphs and Adjacency matrices. Warshall's algorithm- Transitive closure.

UNIT –VIII

Basic concepts, Representation of Graphs, Isomorphism and sub graphs, Planar graphs,Multi graphs, Euler circuits, Euler Graphs and Hamiltonian graphs, Chromatic number.

Learning Resources

Text Books:

1. Joe L. Mott. Abraham Kandel and Theodore P.Baker, Discrete Mathematics for Computer Scientists & Mathematicians. PHI,Second Edition(For Units III to VIII).
2. J P Trembly and R Manohar , Discrete Mathematical Structures with Applications to Computer Science. TMH (For Units I and II).

Reference Books:

1. Swapan kumar Chakrabothy, Bikash Kanti Sarkar, Discrete Mathematics. Oxford publications.
2. Dr.J Rajendra Prasad, T.Rama Rao, A.Madana Mohana Rao, Mathematical Foundations of Computer Science, Lakshmi publications.