Prasad V. Potluri Siddhartha Institute of Technology, Kanuru, Vijayawada.

1/2 M.Tech. FIRST SEMESTER

CSCS1T2 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE Credits: 4

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

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

Objectives:

1. To discuss the concepts associated with mathematical logics, propositions well formed formulas and their applications. Ability to learn the notations, connectives. To understand the construction of truth Tables. To know the universal quantifier, existential quantifier.
2. To discuss the concepts associated with predicates, Rule of inferences and their applications. To know the difference between free and bound variables. To know how to apply Antecedent rules, Consequent rules.
3. To discuss the basic concepts associated with relations and functions, and their applications. To know about sets, relations, functions and their properties. Ability to learn lattice and its properties. To draw different diagrams like Lattice, Hasse diagrams.
4. To present the concepts of Groups and Monoids. Also, we aim to at describing the application of groups to error detection and correction. To know the concepts of homomorphism, Isomorphism. Ability to learn basic definitions groups, monoids, subgroups, semi groups and abelian groups.
5. To discuss the basic concepts of permutations, combinations, discrete probability and conditional probability. To understand the Permutations and Combinations Problems. To know the Pigeon hole principle and its applications.
6. To present various types of recurrence relations and the methods to find out their solutions. How to calculate Coefficient of generating function? To discuss the problems on characteristics roots for solving homogeneous and non homogeneous recurrence relations
7. Applications of graph theory. What are sub graphs, multi graphs and their differences? Euler circuits, Hamiltonian graphs, Chromatic numbers. How Chromatic numbers are useful?
8. Basic concepts of graphs, Planar graphs. Representation of graphs, trees. Difference between DFS, BFS

Learning Outcomes:

1. Is able to formulate mathematical proofs using logic
2. Can recall key definitions from set theory
3. Is able to formulate combinatorial arguments
4. Is able to distinguish between various computational methods using Recurrence Relations and Generating Functions.
5. Can get an idea about graphs and tress.

UNIT - I

Propositional Logic: Propositions, Conditional Statements, TruthTables of Compound Propositions, Precedence of Logical Operators, Translating English Sentences, Propositional Equivalences, Logical Equivalences, Using De Morgan's Laws, Constructing New Logical Equivalences

UNIT - II
Predicate Logic: Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy

Unit - III
Set theory: Sets, Set Operations, Functions, Sequences and Summations
Relations: Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings

UNIT - IV
Algebraic Structures: Algebraic Structures, Semi groups and Monoids, Definition, Examples, and Elementary Properties, Homomorphism, Isomorphism, and Cyclic Groups

UNIT – V
Counting: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations

UNIT - VI
Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion-Exclusion, Applications of Inclusion-Exclusion

UNIT - VII
Graphs: Graph and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring

UNIT - VIII
Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

Learning Resources

Text Book:

1. Discrete Mathematics & its Applications Kenneth H. Rosen, Tata McGraw-Hill, 6th Edition

Reference Books:

1. Discrete and Combinatorial Mathematics, An Applied Introduction, Ralph P. Grimaldi, B.V.Ramana.5th edition, Pearson Education
2. Discrete Mathematical Structures with Applications to computer science J.P. Tremblay, R.Manohar, TMH
3. Discrete Mathematics for Computer Scientists and Mathematicians, J.L.Mott, A.Kandel, T.P.Baker, 2nd edition, PHI.