SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY

Discrete Mathematics

(Common to CSE, CSM & CSD)

II B.Tech - II Semester								SRIT R20
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
R204GA05401	**BSC**	3	0	0	3	40	60	100

Objectives

- This course will introduce and illustrate in the elementary discrete mathematics for computer science and engineering students.
- To equip the students with standard concepts like formal logic notation, methods of proof, induction, sets, relations, graph theory, permutations and combinations, counting principles.

Unit I – Mathematical Logic

Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof.

Predicate Calculus: Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

Learning Outcomes:

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

1. Simplify and evaluate basic logic statements using truth tables.
2. Express a logic sentence in terms of predicates, quantifiers and logical connectives.
3. Apply rules of inference and methods of proof including direct and indirect proof forms.
4. Understand the inference theory for predicate calculus.

Unit II – Set Theory

Introduction, Operations on Binary Sets, Principle of Inclusion and Exclusion.

Relations: Properties of Binary Relations, Relation Matrix and Digraph, Operations on Relations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering Relations, Hasse Diagrams.

Functions: Bijective Functions, Composition of Functions, Inverse Functions, Permutation Functions, Recursive Functions, Lattice and its Properties.

Learning Outcomes:

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

1. Understand the operations of sets and use Venn diagrams to solve applied problems.
2. Determine the domain and range of a function and apply the properties of functions to application problems.
3. Identify the types of functions, finding the inverse of function and perform the composition of functions.
4. Understand about lattice and its properties.

Unit III - Algebraic Structures and Number Theory

Algebraic Structures: Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism.

Number Theory: Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem).

Learning Outcomes:

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

1. Understand the various algebraic structures and their properties.
2. Use elementary number theory including divisibility properties, prime numbers, GCD and perform modulo arithmetic.
3. Apply algorithm such as Euclidean and theorems such as Fermat's and Euler's for solving the problems.

Unit IV – Combinatorics

Basic of Counting, Permutations, Permutations with Repetitions, Circular Permutations, Restricted Permutations, Combinations, Restricted Combinations, Generating Functions of Permutations and Combinations, Binomial and Multinomial Coefficients, Binomial and Multinomial Theorems. The Principles of Inclusion, Exclusion, Pigeonhole Principle and its Application.

Learning Outcomes:

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

1. Know the fundamentals of counting and understanding the difference between permutation and combination.
2. Solve the counting problems by applying product and sum rules, permutations and combinations.
3. Understand the pigeonhole principle and its applications.
4. Apply Binomial Theorem for solving problems.

Unit V – Graph Theory

Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Coloring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees.

Learning Outcomes:

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

1. Determine if a graph is simple / multi-graph, directed / undirected,cyclic/acyclic.
2. Represent a graph using adjacency list and adjacency matrix and apply graph theory to problems in computer networks.
3. Determine if a graph has Euler or Hamilton path /circuit.
4. Understand about spanning tree and apply the algorithms for spanning trees in solving the problems.

Text Books:

1. Tremblay J. P., and Manohar P., Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill,2015.
2. Liu C. L. and Mohapatra D.P., Elements of Discrete Mathematics-A Computer Oriented Approach, Tata McGraw Hill, 3rd Edition,2008.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India,10th Edition, 2014.
2. Ramana B.V., Higher Engineering Mathematics, Mc Graw Hill publishers, Sixth Reprint, 2008.
3. Alan Jeffrey, Advanced Engineering Mathematics, Elsevier, 1st Edition, 2010.

Course Outcomes:

At the end of the course, student will be able to

1. Prove the logical connectives, normal forms, predicates and verify the validity of an argument by the rules of inference.
2. Compute the operations on Sets, Relations and functions, their properties such as homomorphism and isomorphism.
3. Implement the general Properties of Semigroups, Monoids, Groups, and Lattices.
4. Use the modular arithmetic theorem for transformation.
5. Implement the concepts of permutations & combinations for solving the counting problems.
6. Compute operations on Graphs and spanning trees.