Name of Course: Discrete Mathematics **Course Code:** CSE 24231

Core / Elective / Other: Core

Prerequisite:

1. Nil

Course Outcomes:

After completing the course, the students must be able to:

1. Explain formal logic and different proof techniques.
2. Analyze, formulate and recognize relation between different entities using sets, functions, and relations.
3. Apply number theory and counting techniques to solve problems in modular arithmetic and combinatorics.
4. Use graph theory concepts and algorithms to solve problems related to paths, circuits, and trees.
5. Understand algebraic structures like groups, rings, and fields and apply them in computer science.

Description of Contents in brief:

Module –I: Set Theory, Logic and Proofs: Propositions, Conditional Propositions, Logical Connectivity, Propositional calculus, predicates and Quantifiers, First order logic, Proofs: Proof Techniques, Mathematical Induction, Set, Combination of sets, Finite and Infinite sets, countable and Uncountable sets, Principle of inclusion and exclusion

Module –II: Relations, Functions, Recurrence Relations: Definitions, Properties of Binary Relations, Equivalence Relations and partitions, Partial ordering relations and lattices, Chains and Anti chains, Theorem on chain, Warshall's Algorithm & transitive closure, Recurrence relations. Functions: Definition, Domain, Range, Image, etc. Types of functions: Surjection, Injection, Bijection, Inverse, Identity, Composition of Functions, Generating Function

Module –III: Number Theory and Counting: Basics of Modulo Arithmetic, Basic Prime Number Theory, GCD, LCM, Divisibility, Euclid's algorithm, Factorization, Congruences, inverse, multiplicative inverse, Chinese Remainder Theorem, Basic Counting Techniques (sum, product, subtraction, division, exponent), Pigeonhole and Generalized Pigeonhole Principle with many examples, Permutations and Combinations and numerical problems, Binomial Coefficients Pascal's, Identity and Triangle

Module –IV: Graphs & Trees: Basic terminology, multi graphs and weighted graphs, paths and circuits, shortest path Problems, Euler and Hamiltonian paths and circuits, factors of a graph, planar graph and Kuratowski's graph and theorem, independent sets, connectivity graph coloring. Trees, rooted trees, path length in rooted trees, binary search trees, spanning trees and, theorems on spanning trees, cut sets, circuits, minimum spanning trees, Kruskal's and Prim's algorithms for minimum spanning tree.

Module –V: Algebraic Systems: Algebraic Systems, Groups, Semi Groups, Monoids, Subgroups, Permutation Groups, Codes and Group codes, Isomorphism and Automorphisms, Homomorphism and Normal Subgroups, Ring, Field.

List of Text Books:

1. "Discrete Mathematics and Its Applications", Kenneth H. Rosen, 7th Edition, Tata McGraw-Hill, 2017, ISBN: 9780073383095.
2. "Elements of Discrete Mathematics", C. L. LIU, 4th Edition, Tata McGraw-Hill, 2017, ISBN-10: 1259006395 ISBN-13: 978125 9006395.

List of Reference Books:

1. "Discrete Mathematical Structures", G. Shanker Rao, 2 nd Edition2009, New Age International, ISBN-10: 8122426697, ISBN-13: 9788122426694
2. "Discrete Mathematics", Lipschutz, Lipson, 2nd Edition, 1999, Tata McGraw-Hill, ISBN: 007 463710X.
3. "Graph Theory", V. K. Balakrishnan, 1 st Edition, 2004, Tata McGraw-Hill , ISBN-10: 0- 07-058718-3, ISBN-13: 9780070587182.
4. "Discrete Mathematical Structures", B. Kolman, R. Busby and S. Ross, 4th Edition, Pearson Education, 2002, ISBN: 8178085569
5. "Discrete Mathematical Structures with application to Computer Science", J. Tremblay, R. Manohar, Tata McGraw-Hill, 2002, ISBN: 0070651426
6. "Discrete Mathematics", R. K. Bisht, H. S. Dhami, Oxford University Press, ISBN: 9780199452798

URLs:

Nptel

1. https://nptel.ac.in/courses/106108227
2. https://nptel.ac.in/courses/106106094
3. https://nptel.ac.in/courses/106106183

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