SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

Year: B. Tech II (Semester III)

Subject Name: Discrete Mathematics **Subject Code:** BTIT13301
Type of course: Professional Core Course
Prerequisite: Algebra, Logic

Rationale: This course introduces the basic concepts of discrete mathematics as applicable to the field of computer science. It covers set theory, mathematical logic and reasoning, functions, relations, graph theory and algebraic structures. These topics are very useful in computer science as they help in the development of algorithms as well as the representation and solving of real-world problems.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	1	0	4	60	25	15	0	0	100

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Contents	Total Hours
1.	**Mathematical Logic** Introduction**,** Statements & Notation, Truth Values, Connectives, Statement Formulas & Truth Tables, Conditional and Biconditional, Well-formed Formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Examples, Normal Forms, The theory of Inference for Statement calculus, Rules of Inference, Predicate Calculus: Definition of Predicates; Statement functions, Variables, Quantifiers, Predicate Formulas, Free & Bound Variables; The Universe of Discourse, Examples, Valid Formulas & Equivalences.	10
2.	**Set Theory:** **Basic Concepts of Set Theory**: Definitions, Inclusion, Equality of Sets, Cartesian product, The Power Set, Some operations on Sets, Venn Diagrams, Some Basic Set Identities, Computer Representation of Sets **Relations:** Binary Relation, Properties of Binary Relations in a Set: Reflexive, Symmetric, Transitive, Anti-symmetric Relations, Relation Matrix and Graph of a	15

	Relation; Partition and Covering of a Set, Equivalence Relations, Compatibility Relations, Composition of Binary Relations **Partial Ordering:** Definitions, Representation of Partially Ordered Sets, Hesse Diagrams, Minimal & Maximal, Upper Bound and Lower Bound, Well-ordered Partially Ordered Sets, Lattices as partially ordered sets **Functions:** Introduction & definition, Co-domain, range, image, value of a function; surjective, injective, bijective; Composition of functions, Inverse functions, binary and n-ary operations, characteristic function of a Set. **Recursion :** Recursive Functions, Sets and Predicates, Recursion in Programming Languages, Euclid's algorithm	
3.	**Algebraic Structures:** Definitions and Examples, homomorphism, Congruence relation, Semigroups and Monoids, homomorphism of Semigroups and Monoids, Groups, Subgroups and homomorphisms, Coset, Lagrange's theorem, Normal subgroups	06
4.	**Counting:** The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations	06
5.	**Graphs Theory:** Basic definitions-graph, directed and undirected graphs, Isomorphic graphs, Degree, Indegree, out-degree, total degree of a node, Paths, Reachability and connectedness, Matrix representation of graph, Adjacency matrix, Determine number of paths of length n through Adjacency matrix, Path (Reachability) matrix of a graph, examples; Warshall's algorithm to produce Path matrix, **Trees**: Definitions, Different representations of a tree, examples; Binary tree, m-ary tree, Full (or complete) binary tree, examples; Tree traversal: Pre-order, in-order, post-order traversal, examples, algorithms; Applications of List structures and graphs	08

Suggested Specification table with Marks (Theory): (For B. Tech only)

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	25	20	0	0	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr no	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Discrete Mathematical Structures with Applications to Computer Science	J. P. Tremblay and R. Manohar	Tata McGraw-Hill	1997	Edition 1997
2	Schaum's Outline of Theory and Problems of Discrete Mathematics	S. Lipschutz and M. L. Lipson	Tata McGraw-Hill	1999	
3	Discrete Mathematics and its applications	K. H. Rosen	Tata McGraw-Hill	2007	6th Ed.
4	Discrete Mathematics for Computer Science	David Liben-Nowell	Wiley publication	July 2017	
5	Discrete Mathematics with Proof	Eric Gossett	Wiley publication	July 2009	2nd Edition

Course Outcomes:

Sr. No.	CO statements	Marks % weightage
CO-1	To represent, simplify and evaluate logic statements in terms of predicates, quantifiers, and logical connectives using truth tables and the properties of logic.	20%
CO-2	Understand the basic operations in sets, concepts of domain, range of a function, and apply the properties of functions and relations to application problems.	35%
CO-3	Use the properties of algebraic structures.	15%
CO-4	Apply the concepts and principles in order to compute permutations and combinations.	15%
CO-5	Interpret different traversal methods for trees and graphs. Model problems in Computer Science using graphs and trees.	15%

List of Open learning website:

- NPTEL Discrete Mathematics lectures