SARDAR VALLABHBHAI PATEL EDUCATION SOCIETY'S
R. N. G. PATEL INSTITUTE OF TECHNOLOGY - RNGPIT
An Autonomous Institute u/s UGC Act 1956
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Program Name: Integrated M.Sc. (IT)
Level: Post Graduate Program
Branch: Integrated M.Sc. (IT)
Course / Subject Code: 1BS202
Course / Subject Name : Discrete Mathematics

w. e. f. Academic Year:	2025-26
Semester:	2nd
Category of the Course:	Basic Science Course

Prerequisite:	Mathematics Fundamentals
Rationale:	The study of Relation, Partial ordering, Recurrence relation, Counting, Logic, Algebraic structure Graphs and Tree.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Understand the basic concept of Graph and tree.
02	Apply relations and to determine their properties.
03	Utilize the Pigeonhole Principle and Use binomial coefficients to solve related counting problems.
04	Simplify the basic logic statements using truth tables and their properties.
05	Be familiar with Partial ordering and recurrence relations.
06	Understand the properties of algebraic structures.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)				Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
					Theory		Tutorial / Practical		
L	T	PR	SL	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	0	3	3	70	30	0	0	100

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Graph Theory:** Introduction, Components of Graph(Types of nodes, Types of edges, Types of Graph), Degree of Graph: Directed & Undirected Graphs, Isomorphism of Graphs, Subgraphs, Converse (reversal or directional dual) of a digraph, Walk, Trail, Path, length of path, Types of path(Simple path, elementary path, Cycle (circuit), elementary cycle, Reachability: geodesic distance, Properties of reachability, the triangle inequality; Reachable set of a given node, Node base, Connectedness. Matrix representation of graph: Adjacency matrix, Determine number of paths of length *n* through Adjacency matrix, Path (Reachability) matrix of a graph, Warshall's algorithm to produce Path matrix. **Trees:** Definition, Types of nodes (branch nodes, leaf (terminal) nodes, root); Different representations of a tree, Binary tree, m-ary tree, Full (or complete) binary tree, Converting any m-ary tree to a binary tree, Representation of a binary tree; Tree traversal.	12	25%
2.	**Relations:** Definition, Types of Relation, Representation of Relation, Algebra of Relation Properties of Binary Relations, Partition and Covering of a Set, Composite Relation, Converse of a Relation, Closure of Relation.	6	15%
3.	**Counting:** The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations.	4	10%
4.	**Logic:** Definition, Statements & Notation, Truth Values, Connectives, Statement Formulas & Truth Tables, logical gate, Well-formed Formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Examples.	5	10%
5.	**Partial Ordering:** Definition, Examples, Simple or Linear Ordering, Totally Ordered Set (Chain), Frequently Used Partially Ordered Relations, Representation of Partially Ordered Sets, Hasse Diagrams, Least & Greatest Members, Minimal & Maximal Members, Least Upper Bound (Supremum), Greatest Lower Bound(infimum), Well ordered Partially Ordered Sets(Posets). Lattice as Posets, complete Lattice. **Recurrence Relation:** Introduction, Recursion, Recurrence Relation, Solving Recurrence Relation.	9	20%
6.	**Algebraic Structures:** Algebraic structures with one binary operation- Semigroup, Monoid, Group, Subgroup, normal subgroup, group Permutations, Coset, homomorphic subgroups, Lagrange's theorem, Congruence relation and quotient structures. Algebraic structures (Definitions and simple examples only) with two binary operation- Ring, Integral domain and field.	9	20%
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**25**	**35**	**-**	**-**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Textbooks:

1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill,1997.
2. A Textbook of Discrete Mathematics, 9th Edition , Dr. Swapan kumar Sarkar, S Chand And Company Limited, 2016.

(b) Reference Books:

1. K. H. Rosen, Discrete Mathematics and its applications, Tata McGraw-Hill, 6th Ed., 2007.
2. David Liben-Nowell, Discrete Mathematics for Computer Science, Wiley publication, July 2017.
3. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill,1999.

(b) Open source software and website:

1. https://nptel.ac.in/courses/111107058 (NPTEL)
2. Graph Theory and Additive Combinatorics | Mathematics | MIT OpenCourseWare (MIT Opencourseware)

CO- PO Mapping:

Semester 2	**Discrete Mathematics(1BS102)**										
	POs										
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	1	1	1	1	1	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	1	1	1	1	1	1	1	1
CO4	1	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	1	1	1	1
CO6	1	1	1	1	1	1	1	1	1	1	1

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

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