

Course code: Course Title	Course Structure			Pre-Requisite
CO102: Discrete Structures	L	T	P	NIL
	3	1	0	

**Course Objective:** The objective of the course is to learn the Concepts of Formal Logics and appraise the need for properties of relations, functions, and sequences to complete operations on discrete structures such as sets, functions, relations, and sequences and mathematical proofs using counter-examples, direct proofs, proof by contrapositive, proof by contradiction, case analysis, and mathematical induction. This course shall also illustrate the use of Lattices and Boolean Algebra and demonstrate the use of Graph Theory and counting techniques and combinatorics to determine the discrete Probability.

CO No.	Course Outcomes (CO)
1	Apply the properties of relations, functions, and sequences to complete operations on discrete structures such as sets, functions, relations, and sequences.
2	Verify the correctness of an argument using propositional logic, predicate logic, and truth tables.
3	Construct mathematical proofs using counter-examples, direct proofs, proof by contrapositive, proof by contradiction, case analysis, and mathematical induction
4	Apply counting techniques and combinatorics to determine discrete probability.
5	Model relationships using graphs and trees.

S. No	Contents	Contact Hours
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<b>UNIT 1</b>	<b>Formal Logic:</b> Statement, Symbolic Representation and Tautologies, Quantifiers, Predicator and validity, Normal form, Prepositional Logic, Predicate Logic, Logic Programming and Proof of correctors	<b>3</b>
<b>UNIT 2</b>	<b>Proof, Relation and Analysis of Algorithm:</b> Technique for theorem proving: Direct Proof, Proof by Contra position, proof by exhausting cases and proof by contradiction, Principle of mathematical induction, principle of complete induction, recursive definition, solution methods for linear, first-order recurrence relations with constant coefficients, analysis of algorithms involving recurrence relations-recursive selection sort, binary search, quick sort, solution method for a divide-and-conquer recurrence relation.	<b>7</b>
<b>UNIT 3</b>	<b>Sets and Combinations:</b> Sets, Subsets, power sets, binary and unary operations on a set, set operations/set identities, fundamental counting principles, principle of inclusion, exclusion and pigeonhole, permutation and combination, Pascal's triangles, binomial theorem, representation of discrete structures.	<b>8</b>
<b>UNIT 4</b>	<b>Relation/function and matrices:</b> Relations, properties of binary relations, operation on binary relation, closures, partial ordering, equivalence relation, properties of function, composition of function, inverse, binary and n-ary operations, characteristics of permutation function, composition of cycles, Boolean matrices, Boolean matrices multiplication.	<b>8</b>
<b>UNIT 5</b>	<b>Lattices &amp; Boolean Algebra:</b> Lattices: definition, sublattices, direct product, homomorphism Boolean algebra: Definition, properties, isomorphic structures (in particular, structures with binary operations) sub algebra, direct product and homomorphism, Boolean function, Boolean expression, representation & minimization of Boolean function.	<b>8</b>
<b>UNIT 6</b>	<b>Graph Theory:</b> Terminology, isomorphic graphs, Euler's formula (Proof) four color problem and the chromatic number of a graph, five color theorem. Trees terminology, directed graphs, Computer representation of graphs, Warshall's algorithms, Decision Trees, Euler path & Hamiltonian circuits, Shortest path & minimal spanning trees, Depth-first and breadth first searches, analysis of search algorithm, trees associated with DFS & BFS Connected components, in order, preorder & post order tree traversal algorithms.	<b>8</b>
<b>TOTAL</b>		<b>42</b>

<b>REFERENCES</b>		
<b>S.No.</b>	<b>Name of Books/Authors/Publishers</b>	<b>Year of Publication / Reprint</b>
<b>1</b>	Kenneth H. Rosen, "Discrete Mathematics and Its Applications", TMH (ISBN: 9780070681880), 1999	1999

2	C.L. Liu, "Elements of Discrete Mathematics", TMH (ISBN: 9780007043477),2000	2000
3	Kolman, Busby & Ross, "Discrete Mathematical Structures", PHI (ISBN- 978-0132297516),1996	1996
4	NarsinghDeo, "Graph Theory With Application to Engineering and Computer Science", PHI (ISBN: 9788120301450),2004	2004
5	J. P. Trembly& P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw Hill (ISBN: 0070651426),1997	1997

## **B. Tech. Electrical Engineering**