Course code: Course Title	Course Structure			Pre-Requisite
	L	T	P	
IT102: Discrete Structures	3	1	0	NIL

Course Objective: The objective of the course is to **l**earn 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.

S. NO	Course Outcomes (CO)
CO1	Apply the properties of relations, functions, and sequences to complete operations on discrete structures such as sets, functions, relations, and sequences.
CO2	Verify the correctness of an argument using propositional logic, predicate logic, and truth tables.
CO3	Construct mathematical proofs using counter-examples, direct proofs, proof by contrapositive, proof by contradiction, case analysis, and mathematical induction.
CO4	Apply counting techniques and combinatorics to determine discrete probability.
CO5	Model relationships using graphs and trees.

S. NO	Contents	Contact Hours

UNIT 1	Formal Logic: Statement, Symbolic Representation and Tautologies, Quantifiers, Predicator and validity, Normal form, Prepositional Logic, Predicate Logic, Logic Programming and Proof of correctors.	3
UNIT 2	Proof, Relation and Analysis of Algorithm: 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 rotations-recursive selection sort, binary search, quick sort, solution method for a divide-and-conquer recurrence relation.	7
UNIT 3	Sets and Combinations: 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.	8
UNIT 4	Relation/function and matrices: Rotations, properties of binary rotations, operation on binary rotation, 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.	8
UNIT 5	Lattices & Boolean Algebra: Lattices: definition, sublattices, direct product, homomorphism Boolean algebra: Definition, properties, isomorphic structures (in particular, structures with binary operations) subs algebra, direct product and homomorphism, Boolean function, Boolean expression, representation & minimization of Boolean function.	8
UNIT 6	Graph Theory: 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.	8
	TOTAL	**42**

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	Discrete Mathematics and Its Applications; K. H. Rosen, TMH.	1999
2	Elements of Discrete Mathematics; C. L. Liu, TMH.	2000
3	Discrete Mathematical Structures; Kolman, Busby & Ross, PHI.	1996
4	Graph Theory With Application to Engineering and Computer Science; N. Deo, PHI.	2004
5	Discrete Mathematical Structures with Applications to Computer Science; J. P. Trembly, P. Manohar, McGraw Hill.	1997

B. Tech. Mechanical Engineering