MMA-E312
DISCRETE MATHEMATICS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L T P Pass Marks : 40
5 1 0

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

Logic and Propositional Calculus: Introduction to proposition (or statement) and compound propositions; basic logical operations (conjunction, disjunction and negation) and their truth tables; derived logical operations (NAND, NOR, XOR) and their truth tables; nature of compound propositions (as tautology, contradiction and contingency);algebra of propositions; conditional and bi-conditional statements; precedence of logical operations; principle of duality; logical equivalence and logical implications of compound propositions; converse, inverse and contra-positive of propositions; arguments and their nature (as valid and fallacy); elementary valid argument forms; proof of validity without using truth tables; predicates (or propositional functions) and their truth sets; free and binding variables; quantifiers; negation of quantified statements.

Partially Ordered Sets and Lattices: Partial order, dual order and quasi-order relation on a set; subsets of a partially ordered set (POSet); comparability of elements in a POSet; linear order, product order and lexicographical order on a set; Kleene closure of a set of alphabets; Hasse diagram of a POSet; various elements (first element, last element, lower bound, upper bound, minimal, maximal, supremum and infimum) in a POSet; well ordered set; lattices, sub-lattices, isomorphic lattices, bounded lattices, distributive lattices; elements (join irreducible, meet irreducible, atoms, anti-atoms, complements) in a lattice; complemented, modular and product lattices.

Boolean Algebra: Unary and binary operations on a set; Boolean algebra and sub-algebra; elements of Boolean algebra; isomorphic Boolean algebras; basic laws for Boolean algebra; principle of duality; alternative definition of Boolean algebra; Boolean function; literal and fundamental products; sum-of-products(SOP) and product-of-sums(POS) forms; canonical and non-canonical forms of SOP and POS; complete SOP and POS forms; disjunctive normal form (DNF) and conjunctive normal form (CNF); minimal SOP and minimal POS; prime implicants; consensus of fundamental products; Boolean expansion theorem; determination of Boolean function from its truth table; logic gates (AND, OR, NOT, NAND, NOR, XOR) and circuits; Karnaugh maps (up to three variables); coding of binary information and error detection; encoding function and parity check codes; Hamming distance and group codes; parity check matrix; decoding function and error correction; algorithms and their complexity; rate of growth for complexity of an algorithm; asymptotic notations (big-O, big-omega and big-theta); worst-case, best-case and average-case.

Graphs: Introduction, Finite and infinite graphs, Weighted graph, Sub-graph, Walks, Paths, Circuits, Connected and Disconnected graphs, Components, Euler graph, Unicursal graph, Operations on graphs, Hamiltonian paths and circuits, Directed graphs, Types of digraphs, Digraphs and binary relations, Directed paths and Connectedness, Euler Digraphs, Trees with directed edges, Trees, Properties of Trees, Distance and Centres in a tree, Counting trees: Counting labeled and unlabeled trees, Fundamental circuits, Spanning trees of a graph and weighted graph.

Text /Reference Books

1. B. Colman, R. C. Busby and S. Ross, Discrete Mathematical Structures, PHI.
2. K. H. Rosen, Discrete mathematics and its applications, McGraw-Hill.
3. S. Lipschutz and M. L. Lipson, Discrete Mathematics, Tata Mc-Graw- Hill.
4. J. Gallier and J. Quaintance, Mathematical Foundations and Aspects of Discrete Mathematics, Springer.
5. U. S. Gupta, Discrete Mathematical Structure, Pearson Education.