18MAB302T- DISCRTE MATHEMATICS FOR ENGINEERS

Module-1 Set Theory

Sets and examples. Operations on sets.- Laws of Set theory- Proving set identities using laws of set theory.- Partition of a set – examples.- Cartesian product of sets.- Relations – Properties.- Equivalence relation and partial order relation - Poset - Graphs of relations Digraphs- Hasse diagram – problems. - Closures of relations- examples - Transitive closure and warshall's algorithm - Functions – definitions, domain and range of a function – examples - Types of functions- one- one and onto bisection- examples.- Composition of functions – examples. - Associativity of composition of functions – Identity and inverse of functions. - Necessary and sufficiency of existence of inverse of a function. - Uniqueness of identity - Inverse of composition - Checking if a given function is bijection and if so, finding inverse, domain and range problems. - Applications of sets, relations and functions in Engineering.

Module-2 Combinatorics and Number Theory

Permutation and Combination- Simple problems using addition and product rules.- Principle of inclusion and exclusion- Problems using inclusion and exclusion principle.- Pigeon-hole principle and generalized pigeon hole principle.- Problems on pigeon-hole principle - Finding prime factorization of a given number..- Divisibility and prime numbers.- Fundamental theorem of arithmetic –problems- Some more problems using fundamental theorem of arithmetic.- Division algorithm- greatest common divisor and properties-problems.- Euclid's algorithm for finding GCD(a,b)-examples..- Problems using Euclid's algorithm.- Least common Multiple(LCM)- relation between LCM and GCD.- Problems on LCM.- Finding LCM and GCD using prime factorization.- Finding GCD and LCM using Euclid's algorithm.- More problems on GCD and LCM.- Applications of sets, relations and functions in Engineering.

Module-3 Mathematical Logic

Propositions and Logical operators- Truth values and truth tables.- Propositions generated by a set-Symbolic writing using conditional and biconditional connectives.- Writing converse inverse and contra positive of a given conditional.- Tautology, contradiction and contingencyexamples.- Proving tautology and contradiction using truth table method.- Equivalences – truth table method to prove equivalences.- Implications- truth table method to prove implications- Laws of logic and some equivalences.- Proving equivalences and implications using laws of logic.- Rules of inference – Rule P, Rule T and Rule CP - Direct proofs - Problems using direct method.- Problems using CP rule.- Inconsistency and indirect method of proof.- Inconsistent premises and proof by contradiction (indirect method).- Principle of mathematical induction. - Problems based on Mathematical Induction - Applications of sets, relations and functions in Engineering.

Module-4 Groups

Binary operation on a set- Groups and axioms of groups.- Properties of groups. - Permutation group, equivalence classes with addition modulo m and multiplication modulo m.- Cyclic

groups and properties.- Subgroups and necessary and sufficiency of a subset to be a subgroup.- Group homomorphism and properties.- Rings- definition and examples..Zero devisors.- Integral domain- definition , examples and properties.- Fields – definition, examples and properties.- Coding Theory – Encoders and decoders- Hamming codes.- Hamming distance.Error detected by an encoding function.- examples.- Error correction using matrices.- Problems on error correction using matrices - Group codes-error correction in group codes-parity check matrix.- Problems on error correction in group codes.- Procedure for decoding group codes.- Problems on decoding group codes.- Applications of sets, relations and functions in Engineering.

Module-5 Graphs

Basic concepts - Basic Definitions- degree and Hand shaking theorem - Some Special Graphs – complete, regular and bipartite graphs.- Isomorphism of graphs – necessary conditions.- Isomorphism- simple examples.- Paths, cycles and circuits.- Connectivity in undirected graphs – connected graphs and odd degree vertices.- Eulerian and Hamiltonian graphs.- Necessary and sufficient condition for a graph to be Eulerian- examples- Matrix representation of graphs- adjacent and incidence matrices and examples.- Isomorphism using adjacency.- Digraphs – in degree and out degree – Hand shaking theorem.- Verification of hand shaking theorem in digraphs.- Graph coloring – chromatic number examples.- Four colour theorem(statement only) and problems.- Trees – definitions and examples. Properties.- Properties continued.- Spanning trees – examples.- Kruskal's algorithm for minimum spanning trees.- Applications of sets, relations and functions in Engineering.

Learning Resources :

1. Kenneth H.Rosen, Discrete Mathematics and its Application, Seventh edition, Tata McGraw-Hill Publishing company PVT .Ltd., New Delhi, 2012.
2. Tremblay J. P. and Manohar R., Discrete Mathematical Structures with applications to Computer Science, Tata Mc Graw Hill Publishing Co., 35th edition,2008.
3. . Narsing Deo, Graph Theory with applications to Engineering and Computer science, Prentice-Hall of India pvt. Ltd., New Delhi, 2004.
4. C.L. Liu, Elements of Discrete Mathematics, 4th Edition, McGraw Higher ED, 2012.
5. T.Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hill, 2015.