



# MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Mathematics & Statistics

Course Hand-out

Discrete Mathematics | MA 1212 | 4 Credits | 3 | 0 4

Session: July 18 – Dec. 18 | Faculty: Dr. Ram Naresh Saraswat/Dr Anamika Jain | Class: B. Sc. (Hons) II Semester

**Course Outcomes:** At the end of the course, students will be able to

- [1212.1]. Apply the operations of sets, find the partition for a set through equivalence classes
- [1212.2]. Express a logic sentence in terms of predicates, quantifiers, and logical connectives which enhance their logical skills and make them employable in the relevant field.
- [1212.3]. Demonstrate an understanding of relations and functions and be able to determine their properties and also determine when a function is 1-1 and "onto".
- [1212.4]. Solve counting problems by applying elementary counting techniques using the product and sum rule, model a recurrent relation and finding solution to the problem by solving recurrence relation which enhance their employability skills.
- [1212.5]. Use tree and graph algorithms to solve problems and applications to develop skills.

## A. SYLLABUS

Set Theory: Types of relations on sets and their properties, Relational matrix and the graph of a relation, Partitions, Equivalence relations, Poset, Hasse diagram. Definitions & Classification of functions, Characteristic function of a set, Hashing functions, Recursive functions, Permutation functions. Combinatorics: Discrete numeric function, Basic counting principles, Generating functions, Recurrence relations, Inclusion and exclusion principle, Euler's  $\phi$  function and its applications to Cryptography. Propositional Calculus: Logical connectives, Truth tables, Tautologies and contradictions, Contrapositive, Logical equivalences and implications, De Morgan's Laws, Normal forms, Rules of inference, Arguments, Validity of arguments. Predicate Calculus: Free and bound variables, Quantifiers, Theory of inference, the rules of universal specification and generalization, Validity of arguments. Graph Theory: Definition and examples of graphs, Incidence and degree, Handshaking lemma, Isomorphism Sub-graphs, Weighted Graphs, Walks, Paths and Circuits, Eulerian Graphs, Hamiltonian Graphs. Trees: Definition and properties of trees, pendent vertices, center of a tree, rooted and binary tree, spanning tree, minimum spanning tree algorithms, fundamental circuits, cut-sets and cut vertices, fundamental cut-sets, the four-colour theorem. Directed Graphs: Types of digraphs, directed paths and connectedness, Directed trees.

## B. TEXT BOOKS

1. R. P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction, Fourth edition, Pearson Education Asia, 2002.
2. T. Veerarajan, Discrete Mathematics, Tata McGraw Hill, 2010.
3. S. K. Chakraborty, B. K. Sarkar, Discrete Mathematics, Oxford Univ. Press, 2012.

