

TRIBHUVAN UNIVERSITY
INSTITUTE OF SCIENCE AND TECHNOLOGY
SCHOOL OF MATHEMATICAL SCIENCES
Bachelor in Mathematical Sciences (B.Math.Sc.)

Course of Study

Code No.: MSMT 253

Paper: **Discrete Mathematics**

Nature: Theory + Lab

Full Mark: 75

Pass Mark: 30

Credit: 3

Course Description:

This is a gentle introduction to the fundamentals of Discrete Mathematics. It deals with mathematical structures that are discrete in nature rather than continuous. Its core area is combinatorics. It covers the key combinatorial topics of combinatorial enumeration and is useful and accessible not only for pure mathematics students, but also for those inclined towards computer science, statistics or applied fields. It has many real-world applications that can be explained using only a few simple definitions. Sets, function, relation, logic, elementary number theory, counting techniques, Induction and recursion, lattices, partially ordered sets are key topics treated in a way that will facilitate the students in being able to think logically and mathematically, and finally making them capable of applying the techniques of discrete mathematics in solving problems.

Learning Objectives:

After successful completion of this course the student will be able to

- Apply the techniques of logic in order to understand and create mathematical proofs.
- Apply the principles of mathematical induction in proofs.
- Apply the concepts of set theory to problems that involve set operations, cardinality and counting techniques.
- Work with order relation and equivalence relation.
- Apply the concepts of relations and functions to problems involving recursion, sequences and set equivalence.

Mode of Delivery:

The course will be taught by lecture (48 hrs), and problem solving and class discussion (24 hrs). Students will be encouraged to utilize the computer whenever possible and wherever applicable.

Unit 1 Foundations

11 hrs

Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Proofs, Proof Methods and Strategy
Sets, Set Operations, Relations and Their Properties, Representing Relations, Functions, Sequences and Summations,

Unit 2 Number Theory

8 hrs

The Integers and Division, Primes and Greatest Common Divisors, Partial Orderings, Integers and Algorithms, Applications of Number Theory

Unit 3 Induction and Recursion**8 hrs**

Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recurrence Relations

Unit 4 Counting**11 hrs**

Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients and Identities, Equivalence Relations, Generalized Permutations and Combinations, Generating Functions, Inclusion-Exclusion, Applications of Inclusion-Exclusion

Unit 5 Graph Theory**10 hrs**

Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Introduction to Trees, Applications of Trees, Spanning Trees, Minimum Spanning Trees

Text Book

Discrete Mathematics and its Applications (6th edition), Kenneth H. Rosen, Tata McGraw Hill, Bombay, India

Reference Books

1. *Discrete Mathematics with Applications* Susanna S. Epp, Brooks/Cole 2011,
2. *Discrete Mathematics an Introduction to Proofs and Combinatorics*, Kevin Ferland, Houghton Mifflin Company, 2009
3. *Combinatorics: Topics, Techniques, Algorithms*. Peter J. Cameron. CUP, 1995.
4. *Graphs, networks, and algorithms*. Dieter Jungnickel, Springer, 2005.
5. *A First Course in Discrete Mathematics*. Ian Anderson. Springer, 2001.
6. *An Introduction to Enumeration*. Alan Camina and Barry Lewis Springer, ,2011.

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