**Topics for Discrete Mathematics Course**

1. **Sets**

Algebra of sets. Venn diagrams. Set identities. Counting elements in finite sets. In- clusion-exclusion principle. Power sets.

1. **Sets and Functions**

One-to-one, onto, bijective functions. Inverse functions. Countable infinite sets.

1. **Relations**

Binary relations. Types of relations. Properites of relations.  Representing Relations. N-ary Relations and their applications.

1. **Equivalence Relations and Partial Ordering.**

Equivalence Relations. Partial Orderings. Lexicographic order. Hasse diagrams. Maximal and minimal elements.

1. **Counting and Combinatorics**

Basic counting principles. The inclusion-exclusion principle. The Pigeonhole Principle. Permutations and Combinations. The binomial theorem. Permutations with repetition. Permutations of sets with indistinguishable objects.

1. **Propositional Logic**

Propositions. Logical operators. Truth tables of compound propositions. Propositional equivalence. Functionally complete collection of logical operators.

1. **Predicates and Quantifiers**

Predicates and Quantifiers. Binding variables. Logical Equivalences Involving Quantifiers. Negating Quantified Expressions. Nested Quantifiers.

1. **Methods of proof**

Rules of inference. Rules of inference for quantified statements. Methods of proving theorems. Mathematical induction.

1. **Boolean algebra**

Boolean functions and expressions. Representing Boolean Functions. Logic gates. Minimization of Circuits.

1. **Introduction to Number Theory**

Divisibility and Modular Arithmetic. Integer Representations and Algorithms. Primes and Greatest Common Divisors.

1. **Number Theory and Introduction to Cryptography**

Classical cipher. Symmetric and Asymmetric encryption. Euler's algorithm. RSA.

1. **Elements of Cryptography**

Feistel Cipher. DES.

1. **Elements of Graph Theory (part 1)**

Graph Terminology and Special Types of Graphs. Bipartite graphs.

1. **Elements of Graph Theory (part 2)**

Representing Graphs and Graph Isomorphism. Paths.  Connectedness in directed graphs.

1. **Binary trees**

Tree definitions and properties. Binary trees and binary search trees. Tree traversal algorithms. Spanning trees.