

**Details of Syllabus:****Semester – I****MT 111- Algebra****Unit 1: Sets Relations and Functions (8 Lectures)**

- 1.1 Sets, Relations, Equivalence relations, Equivalence classes and partitions of a set
- 1.2 Functions, Basic terminology, Types of Functions, Inverse of a Function, Composition of Functions (Excluding theorems only examples).

**Unit2: Divisibility Theory in the Integers(10 Lectures)**

- 2.1 Mathematical Induction:Well-Ordering Principle.
- 2.2 The Division Algorithm, The Greatest Common Divisor, Euclid's Lemma, The Least Common Multiple, The Euclidean Algorithm.

**Unit 3: Primes and the theory of Congruence (8 Lectures)**

- 3.1 The Fundamental Number of Arithmetic: Prime Numbers, Euclid's Lemma.
- 3.2 The theory of Congruence: Basic Properties of congruence.
- 3.3 Fermat's Theorem

**Unit 4: Complex Numbers (10 Lectures)**

- 4.1 Sums and Products, Basic Algebraic Properties, Moduli, Complex Conjugates, Exponential form, Products and Quotients, De-Moivre's theorem.
- 4.2 Roots of Complex Numbers: The  $n^{\text{th}}$  roots of unity.
- 4.3 Regions in Complex Plane.

**Text Books:**

1. **A Foundation Course in Mathematics, Ajit Kumar, S. Kumeresan and Bhaba Kumar Sarma, Narosa Publication House.**  
Unit 1: Chapter 2: Sec. 2.1 to 2.5, Chapter 3: Sec. 3.1 to 3.6, Chapter 4: Sec. 4.1 to 4.4.
2. **Elementary Number Theory, David M. Burton, Tata McGraw Hill, Sixth Edition.**  
Unit 2: Textbook 2: Chapter 1: Sec. 1.1, Chapter 2: Sec. 2.2 to 2.4  
Unit 3: Textbook 2: Chapter 3: Sec. 3.1, Chapter 4: Sec. 4.1, 4.2, Chapter 5: Sec. 5.2.
3. **Complex Variables and Applications, James Ward Brown and Ruel V. Churchill, Mc-Graw Hill, Seventh Edition.**

Unit 4: Textbook 3: Chapter 1: Sec 1 to 10.

**Reference Books:**

1. Textbook of Algebra, S. K. Shah and S. C. Garg, Vikas Publishing House Pvt. Ltd. Edition 2017.
2. Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley and Sons Inc, Fourth Edition.

**MT 112: CALCULUS - I****Unit 1: Real Numbers (06 Lectures)**

- 1.1 The Algebraic and Order Properties of  $\mathbb{R}$ :  
Algebraic properties of  $\mathbb{R}$ , Order properties of  $\mathbb{R}$ , Well-Ordering Property of  $\mathbb{N}$ .  
Arithmetic mean-Geometric mean inequality, Bernoulli's inequality.  
(Revision: essential properties should be revised with illustrative examples)
- 1.2 Absolute Value and the Real Line:  
Absolute value function and its properties, triangle inequality and its consequences, neighborhood of a point on real line.
- 1.3 The Completeness Property of  $\mathbb{R}$ :  
Definitions of Upper bound, Lower bound, supremum, infimum of subsets of  $\mathbb{R}$ , completeness property of  $\mathbb{R}$ .
- 1.4 Applications of the Supremum Property:  
Archimedean property and its consequences, The density theorem (without proof).

**Unit 2. Sequences (10 Lectures)**

- 2.1 Sequences and Their Limits:  
Definition and examples of sequences of real numbers, Definition of limit of sequence and uniqueness of limit, Examples on limit of sequence.
- 2.2 Limits Theorems:  
Definition of bounded sequence, Every convergent sequence is bounded, Algebra of limits.
- 2.3 Monotone Sequences:  
Definition and examples of monotone sequences, Monotone convergence theorem and examples.
- 2.4 Subsequences and Bolzano -Weierstrass Theorem:  
Definition of subsequence and examples, Divergence criteria, Monotone Subsequence theorem (without proof), Bolzano -Weierstrass theorem (first proof).

**Unit 3. Limits (08 lectures)**

- 3.1 Functions and their Graphs: