

Syllabus for F.Y.B.Sc. as per NEP-2020

Subject: Mathematics

Semester - I

MTS 101-Algebra and Calculus I

Course type: Theory

No. of Credits: 02

Course Objectives: This course aims

1. To provide a first approach to Algebra, a basic pillars of mathematics.
2. To cover the basic knowledge of integers and polynomials.
3. To study the theory of integers and polynomials.
4. To establish the fundamental theorem and applications of single variable functions.
5. To understand real numbers and its properties.
6. To understand the concept of limiting process, and continuity in terms of limit.
7. To develop mathematical thinking and skills.

Course Outcomes: The student will able

1. To know the concept of divisibility in integers.
2. To find Greatest Common Divisor of integers using the Euclidean algorithm.
3. To understand the concept of Fermat's theorem and Euler's phi function.
4. To understand the method of finding roots of polynomials and relationship between roots and coefficients of a polynomial.
5. To classify real numbers and recognize various properties of real numbers.
6. To understand the concept of limit and continuity.
7. To draw the graphs of algebraic and transcendental functions considering limits and continuity.
8. To apply the concept of limit and continuity for advanced study of different mathematics courses, and in physical, chemical and biological sciences.

Course Content

Section I: Algebra

Unit 1: Integers

(09 Hours)

- 1.1 Well Ordering Principle and Principle of Mathematical Induction (First Principle).
- 1.2 Divisibility in integers (\mathbb{Z}) -Definition and elementary properties, Division algorithm, Greatest Common Divisor (GCD), Least Common Multiple (LCM) of integers, basic properties of GCD, Euclidean Algorithm, relatively prime integers.

- 1.3 Prime numbers- Definition, fundamental theorem of Arithmetic, Euclid's lemma, Theory of Congruences, basic properties, Fermat's theorem, Euler's phi function, Euler's theorem.

Unit 2: Polynomials

(06 Hours)

- 2.1 Definition of a polynomial, degree of a polynomial, algebra of polynomials, division algorithm (Statement only) and examples, Greatest Common Divisor (GCD) of two polynomials (Definition and examples).
- 2.2 Synthetic division, Remainder theorem, Factor theorem.
- 2.3 Relation between roots and co-efficient of a polynomial.

Reference Books:

1. Elementary Number Theory, David M. Burton, Tata McGraw Hill, Seventh Edition. Chapter 1: Sec. 1.1, Chapter 2: Sec. 2.2, 2.3, 2.4, Chapter 3: Sec. 3.1, Chapter 4: Sec. 4.2, Chapter 5: Sec. 5.2 up to corollary on Theorem 5.1, Chapter 7: Sec. 7.2 only definition, Section 7.3, lemma and Theorem 7.5.
2. Theory of Equations, J. V. Uspensky, McGraw Hill Book Company. Chapter 2, Chapter 3: Sec. 5
3. Textbook of Algebra, S. K. Shah and S. C. Garg, Vikas Publishing House Pvt. Ltd. Edition 2017.

Section II: Calculus

Unit 3: Real Numbers

(06 Hours)

- 3.1 Number system - $\mathbb{N}, \mathbb{Z}, \mathbb{Q}, \mathbb{R}$, Algebraic and Order properties of \mathbb{R} .
- 3.2 Absolute Value of a real number, geometrical meaning, Absolute value properties of \mathbb{R} , triangle inequality, examples on absolute value of \mathbb{R} .
- 3.3 Boundedness of \mathbb{R} - Neighborhood of a point on real line, Intervals, Lower bound, Upper bound and examples, Well Ordering Principle of \mathbb{N} , Supremum and Infimum of a subset of \mathbb{R} and examples, Completeness property of \mathbb{R} .

Unit 4: Limits and Continuity

(09 Hours)

- 4.1 Limit of Real valued function-Definitions and examples, Algebra of limits and examples.
- 4.2 Limit theorems- Squeeze theorem and some results, one sided limits and limits at infinity and examples.
- 4.3 Continuity - Definition of deleted neighborhood of a point, Continuity of a function at a point - Definitions and examples, Algebra of continuous functions, properties, Continuity on an interval - Definition and examples, Bounded function, Boundedness theorem (Statement only), Absolute maximum and minimum of a function - definition, Maximum-Minimum theorem (statement only), Location of roots theorem statement only), Bolzano's theorem (statement only) the intermediate value theorem

Text Books:

1. Calculus, Vol. I: One Variable Calculus with an Introduction to Linear Algebra- Tom M. Apostol, Second Edition, Reprint 2011, Wiley Students Edition, John Wiley and Sons Inc., U.K

- (a) Introduction Part 3: 1.3.1, 1.3.2, 1.3.4, 1.3.7, 1.3.8, 1.3.13 (without Theorem 1.3.5), 1.4.3, 1.4.8 (Theorem 1.3.8, Theorem 1.3.9, Theorem 1.4.0)
- (b) Chapter 3: 3.2, 3.3, 3.4, 3.5 - Theorem 3.2, Theorem 3.3, Theorem 3.4, Theorem 3.6, Theorem 3.7, Theorem 3.8, Theorem 3.10, Theorem 3.11 (without proof), Theorem 3.12.

Reference Books:

1. Introduction to Real Analysis - R. G. Bartle and D. R. Sherbert, Third Edition, John Wiley and Sons, Inc.
 - (a) Chapter 1: Section 1.2 - 1.2.1, 1.2.2, 1.2.3.
 - (b) Chapter 2: Section 2.1: 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7 Theorem), 2.1.8 (Theorem), 2.1.9 (Statement only), 2.1.10 (Theorem), 2.1.11, 2.1.12, 2.1.13. Section 2.3: 2.3.1, 2.3.2, 2.3.3, 2.3.6, 2.4.3, 2.4.8, 2.4.9.
2. Differential Calculus- Shantinarayan Tenth Revised Edition
3. Introduction to Real Analysis - William F. Trench, Free Edition, 2010.
4. Calculus of single Variable - Ron Larson, Bruce Edwards, Tenth Edition.
5. Elementary analysis: the theory of Calculus - Kenneth A. Ross, Second Edition, Springer Publication.

MTS 102 - Practicals based on MTS-101 (Algebra and Calculus I)

Course type: Practical

No. of Credits: 02

IKS 101 MTS: Generic IKS

Course type: IKS

No. of Credits: 02
