



**Bhartiya Shiksha Board**  
**Syllabus- Mathematics-Class 11<sup>th</sup>**

**Academic Session- 2026-27**

**Subject Code-161**

**CLASS XI**

<b>Units</b>	<b>Unit Name</b>	<b>Marks</b>
I.	Sets, Relations and Functions	28
II.	Algebra	22
III.	Coordinate Geometry	10
IV.	Calculus	10
V.	Statistics and Probability	10
	<b>Total Marks</b>	<b>80</b>
VI.	Application of Mathematics in AI (Only for Internal Assessment purposes)	

<b>S.No.</b>	<b>Internal Assessment</b>	<b>Marks</b>
01	Application of Mathematics in AI (Computer Lab Activity)	05
02	Mathematical Models, Projects etc.	10
03	Periodic test (average of best two)	05
	<b>Total</b>	<b>20</b>

## Proposed sequencing of the chapters in Classes XI and XII

Chapter No.	Class XI	Periods Duration: 50 min
1	Sets	12
2	Relations	12
3	Functions	12
4	Trigonometric Functions and Equations.	24
5	Mathematical Reasoning and Proofs	08
6	Limit, Continuity and Differentiability	24
7	Permutation and Combination	12
8	Binomial Theorem	12
9	Sequence and Series	12
10	Straight Lines	14
11	Conic Sections	14
12	Complex Numbers and Equations	12
13	Statistics	12
14.	Probability	12
15.	Application of Mathematics in AI	12
	Total Periods	204

### Unit I: Sets and Functions

#### 1. Sets

Sets and their representations, Cardinality of a set. Types of sets: empty set, finite and infinite sets, Universal set, power set, equal and Equivalent Sets. Subsets: proper and improper subsets, subsets of a set of real numbers especially intervals (with notations and visuals). Operations on Sets: Union and Intersection of sets, Complement of a set, Difference of sets, Symmetric difference, Properties of Complement, De-Morgan Laws and difference of Sets, Venn diagrams and representation of different operations with the help of Venn diagram, practical applications of operations on set/Venn diagram.

#### 2. Relations

Cartesian product of sets, ordered pairs, Number of elements in the cartesian product of two non-empty finite sets, Cartesian product of the set of reals with itself (up to  $\mathbb{R} \times \mathbb{R} \times \mathbb{R}$ ). Definition of relation, pictorial diagrams, domain, co-domain and range of a relation. Types

of relations: reflexive, symmetric, transitive and equivalence relations and equivalence class. Partial order relation.

### 3. Functions

Function as a special type of relation, Graphical representation of function, real valued functions, illustration of domain, range (image set), and graphical illustration of different functions: constant, identity, polynomial, rational, modulus, signum, exponential, logarithm, greatest integer. Sum, difference, product, and quotients of functions. Definition of injective (one-one), many one, Surjective (onto), Bijective (one-one-onto) and into function. Composition of functions and discussion about its range and domain, Invertible function condition of existence of inverse function (only algebraic function), graphical representation of function and its inverse, illustration of  $y = f(x)$  and  $y = |f(x)|$ . Representation of real-life problem with the help of functions. Binary operations.

### 4. Trigonometric functions and Equations

Measure of angles beyond triangles. Trigonometric functions: definition, and properties of six circular trigonometric functions with the help of standard unit circle. Trigonometric functions on real line, domain and range of trigonometric functions, periodicity and/or symmetricity of functions, graphs of standard trigonometric functions. Trigonometric functions of sum and difference of two angles and multiple of angles such as  $\sin(A \pm B)$ ,  $\cos(A \pm B)$  and  $\tan(A \pm B)$ ,  $\sin 2A$ ,  $\cos 2A$  and  $\tan 2A$ ,  $\sin 3A$ ,  $\cos 3A$ ,  $\tan 3A$  etc. Sum to product and product to sum formulae such as  $\sin A \pm \sin B$  and  $\cos A \pm \cos B$  etc. Representation of  $a\cos\theta + b\sin\theta$  in the forms  $R\cos(\theta \mp \alpha)$  and  $R\sin(\theta \mp \alpha)$ . Solutions of simple trigonometrical equations. Small angle approximation of  $\sin x$  and  $\cos x$ .

## Unit II: Algebra

### 1. Mathematical Reasoning and Proofs

Statements and truth tables. Operations 'OR' ( $\cup$ ); 'AND' ( $\cap$ ) to combine any two statements and their truth table. Negation of statement. Implication  $\Rightarrow$  (if and then), various forms of implications including direct implication, inverse implication, converse implication and Biconditional implication [ $\Leftrightarrow$  or if and only if (iff)] and contrapositive of a given statement. Necessary and sufficient parts of an implication ( $\Leftarrow$ ) and biconditional implication ( $\Leftrightarrow$ ). Types of reasoning (a) Inductive reasoning and (b) deductive reasoning, Principle of mathematical induction. Different types of proofs.

### 2. Permutation and Combination

Fundamental principle of counting, definition of the terms 'permutation' and 'combination', Factorial  $n$ , derivation of formulae for  $nPr$  and  $nCr$  and their relation, simple applications, problems involving arrangements and selection of objects in a line or in a circle, repetition, and with different restrictions.

### 3. Binomial Theorem

Earlier Bhartiya concept of Meru Prastar (Pascal's Triangle) and its simple applications, statement and proof of the binomial theorem for positive integral indices, Proof of binomial theorem by using the principle of mathematical induction, Binomial Theorem for expansion

of  $(a + b)^n$  for positive integer  $n$ , use of general term from beginning and middle term for simple applications. Properties of binomial coefficients.

#### 4. Sequence and Series

Recall Arithmetic progression,  $n^{\text{th}}$  term and sum of  $n$ -terms of an A.P. Geometric progression (G.P). Derivation of the formulae of  $n^{\text{th}}$  term and sum of  $n$ -terms of an G.P. Harmonic Progression (H.P). Relation between arithmetic mean, geometric mean and Harmonic Mean. Sum of infinite terms of a geometric series. Special series.

#### 5. Complex Numbers and Equations

Geometrical interpretation of *iota*. complex number, 'real part', 'imaginary part', 'conjugate' 'modulus', 'principal argument'. Algebraic Operations on complex numbers and their representation in standard form  $(x + iy)$ , properties of complex numbers. Fundamental theorem of algebra without proof.

Use the result for a polynomial equation with real coefficients (up to quadratic only), for any non-real roots occur in conjugate pairs,

Argand diagram, carry out operations of multiplication and division of two complex numbers expressed in polar form  $r(\cos\theta + i\sin\theta) = re^{i\theta}$ , explanation of  $e^{i\pi} + 1 = 0$ . Simple equations and inequalities involving complex numbers by means of loci in an Argand diagram (e.g.  $|z - a| < k$ ,  $|z - a| = |z - b|$ ,  $\arg(z - a) = \alpha$ , De-Moivre's formula (without proof), square root of a complex number, basic introduction of cube root of unity.

### Unit III: Coordinate Geometry

#### 1. Straight Line

Recall two-dimensional geometry from earlier classes. Various forms of equations of a line: parallel to axes, point-slope form, slope- intercept form, two-points form, intercept form and normal form. Angle between two lines. General equation of a line, equation of family of lines passing through the point of intersection of two lines. Distance of a point from a line, distance between two parallel lines. Applications of lines in daily life.

#### 2. Conic Sections

Sections of a cone: circles, ellipse, parabolas and hyperbola. A pair of intersecting lines as a degenerated case of a conic section. Standard equations including parametric forms and simple properties of circle, ellipse, parabola, hyperbola as loci of points in motion and their general equations. Tangent and normal. Application of conic section.

### Unit IV: Calculus

#### 1. Limit, Continuity and Differentiability

Introduction to Madhava's contributions to Calculus. Need and idea of limit and continuity. Indeterminate forms. Limits and continuity of polynomials, rational, trigonometric, exponential and logarithmic functions. Differentiability, definition of derivative using first principle. Geometrical interpretation of derivatives. Derivatives of polynomials, trigonometric, exponential and logarithmic functions.

## **Unit V: Statistics and Probability**

### **1. Statistics**

Measures of Dispersion of grouped data: Range, mean deviation about Mean and Median, variance, and standard deviation, Analysis of frequency distributions with equal means but different variances.

### **2. Probability**

Random experiment, Sample space, Events, types of events, 'not', 'and' and 'or' events, mutually exclusive events, exhaustive events, Axiomatic (set theoretic) approach of probability, connections with other theories of earlier classes, Probability of an event, probability of 'not', 'and' and 'or' events.

## **Unit VI: Application of Mathematics in AI**

Use of Python coding in solving mathematical problems based on the above chapters. Machine learning and Artificial Intelligence.