# MATHEMATICS

## CLASS - XI

*Time : 3 Hours* *100 Marks*

| Units | Unitwise Weightage | Marks | Periods |
|---|---|---|---|
| I. | **Sets, Relations and Functions [29 marks]** | | |
| | 1. Sets, Relations and Functions | 13 | 23 |
| | 2. Trigonometric Functions | 16 | 29 |
| II. | **Algebra [37 marks]** | | |
| | 1. Complex Number, Quadratic Equations and Linear Inequalities | 13 | 23 |
| | 2. Permutations, Combinations, Mathematical Induction and Binomial Theorem | 15 | 27 |
| | 3. Sequence and Series | 9 | 16 |
| III. | **Co-ordinate Geometry [13 marks]** | | |
| | 1. Straight Lines | 6 | 11 |
| | 2. Circle, Conic Section and Introduction to Three-dimension Geometry | 7 | 13 |
| IV. | **Calculus [6 marks]** | | |
| | Limits and Derivatives | 6 | 11 |
| V. | **Mathematical Reasoning [3 marks]** | 3 | 5 |
| VI. | **Statistics and Probability [12 marks]** | 12 | 22 |
| | **Total =** | **100** | **180** |

### Unit-I: Sets, Relations and Functions [29 marks]

#### 1. Sets

Sets and their representations, Finite and infinite sets, Empty set, Equal sets, Subsets, Subsets of the set of real numbers, especially intervals (with notations), Power sets, Universal set, Venn diagrams, Complements of a set, Operation on sets (union, intersection and difference of sets).

#### 2. Relations and Functions

Ordered pairs, Cartesian product of sets, Number of elements in the Cartesian product of two finite sets. The product sets $R \times R$ (or $R^2$) and $R \times R \times R$ (or $R^3$) where R is the set of real numbers.

Relation from one set to another, Domain and range of a relation. Function as a special kind of relation from one set to another. Domain, Co domain and range of a function. Diagramatic (Pictorial) representation of a function. Real valued function of a real variable and their domain and range. Some specific functions and their graphs including constant, identity, polynomial, rational, modulus, signum and greatest integer function. Sum, difference, product and quotients of real valued functions.

**3. Trigonometric functions**

Positive and negative angles, Measurement of angles, Sexagesemal system and circular system, Conversion from one system to another. Definition of trigonometric functions with the help of unit circle. Signs of trigonometric functions (Quadrant Rule). The identity $\sin^2 x+\cos^2 x = 1$. Graphs of trigonometric functions. To express $\cos(x \pm y)$ and $\sin(x \pm y)$ in terms of $\sin x$, $\sin y$, $\cos x$ and $\cos y$. Deduction of other addition and subtraction formulae. To express $\sin x \pm \sin y$ and $\cos x \pm \cos y$ as products. Identities related to multiple and submultiple angles. General solution of trigonometric equations. Sine and Cosine formulae in a triangle and their simple applications.

**Unit-II: Algebra** **[37 marks]**

**1. Complex numbers and Quadratic Equations.**

Need for complex numbers. The fundamental imaginary $\sqrt{-1}$ unit (or i). Complex numbers in the form of a + ib, Real and imaginary parts of a complex number, Complex conjugates, Representation of a complex number by a point in a plane, Argand diagram, Modulus and argument (or amplitude) of a complex number, Algebra of complex numbers, Polar representation of a complex number. Statement of Fundamental Theorem of Algebra, Solution of quadratic equation in the complex number system. Square root of a complex number.

**2. Linear Inequalities.**

Linear inequalities, Algebraic solution of linear inequalities in one variable and their representation on the number line. Graphical solution of linear inequalities in two variables. Solution of system of linear inequalities in two variables - graphically.

**3. Premutations and Combinations.**

Fundamental principle of counting, Factorial $n$ where $n$ is a non-negative integer, Permutation as an arrangement, Meaning of ${}^nP_r$ or $P(n,r)$, Permutations in which things (i) may be repeated (ii) are not all different. Combination, Meaning of ${}^nC_r$ or $C(n,r)$. Important properties of ${}^nP_r$ and ${}^nC_r$. Applications of permutations and combinations.

**4. Mathematical Induction.**

Principles of Mathematical Induction and its applications.

**5. Binomial Theorem.**

Bionomial theorem for a positive integral index. Pascal's triangle, General term, Middle terms, Equidistant terms, properties of Binomial co-efficients, Simple Applications.

**6. Sequence and Series.**

Sequence and Series, Arithmetic Progression (A.P.), Arithmetic Mean (A.M.) Insertion of arithmetic means between two numbers, Geometric progression (G.P.), First term, Common ratio, general term, sum to $n$ terms of a G.P., Geometric Mean (G.M.), Insertion of geometric means between two numbers. Relation between A.M. and G.M. sum to $n$ terms of special series $\sum n$, $\sum n^2$ and $\sum n^3$. Infinite G.P. and its sum.

**Unit-III: Coordinate Geometry [13 marks]**

**1. Straight lines :**

Brief recall of 2D geometry from earlier classes. Shifting of origin. Slope of a line and angle between two lines, various forms of equation of a straight line, Parallel to axes, slope-intercept form, point-slope form, two point form, intercepts form and normal form. General equation of first degree in two variables represents a straight line. Reduction of the general equation of a line to different forms. System of lines passing through the point of intersection of two lines. Distance of a point from a line.

**2. Circle :**

Definition, Equation of circle with given centre and radius, General equation of a circle, its centre and radius. Equation of a circle when the end points of a diameter are given. Interior and exterior of a circle.

**3. Conic section :**

Sections of a cone. Definition of a conic section. Equation of a conic section having given eccentricity, focus and directrix. Standard equation and simple properties of parabola, ellipse and hyperbola.

**4. Introduction to Three-dimentional Geometry :**

Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points and section formula.

**Unit-IV: Calculus [06 marks]**

Limits and derivatives :

Idea of limit, Left hand and right hand limits, conditions for existence of limit. Fundamental Theorem on limit (statement only) and standard limits

(i) $\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}$ (with proof)

iii) $\lim_{x\to 0}\frac{e^x-1}{x}=1$ (with proof)

(ii) $\lim_{x\to 0}\frac{\sin x}{x}=1$ (with proof)

iv) $\lim_{x\to 0}\frac{\lim(1+x)}{x}=1$ (with proof)

Derivative introduced as rate of change both as that of distance function and geometrically. Definition of derivative, relate it to slope of tangent to a curve; Derivative of sum, difference, product and quotient of functions. Derivative of polynomial and trigonometric functions.

**Unit-V: Mathematical Reasoning : [03 marks]**

Mathematically acceptable statements. Basic connecting words or phrases. Simple and compound statements. Truth tables. Understanding of "and", "or" "implies", "implies by", "if and only if", "there exists", "for all" and their use through variety of examples related to Mathematics. Negation of a statement. Contra positive and converse of an implication.

Validating statement involving connecting words. Checking the truth of a statement by method of contradiction.

**Unit-VI: Statistics and Probability** **[12 marks]**

**1. Statistics :**

Measure of dispersion, Mean deviation, Variance and Standard deviation of ungrouped/ grouped data. Analysis of frequency distribution with equal means but different variances.

**2. Probability :**

Random experiment, Outcomes, sample spaces (set representation), Events, occurrence of events, "not", "and" & "or" events, exhaustive events, mutually exclusive events, Axiomatic (set theoretic) probability, connections with the theories of earlier classes. Probability of an event, probability of "not", "and" & "or" events.

**Appendix :**

**1. Infinite series :** Exponential and Logarithmic series.

**2. Mathematical Modelling :**

Consolidating the understanding developed upto Class X. Focus on modelling problems related to real life (like environment, travel, etc.) and connecting with other subjects of study where many constraints may really need to be ignored, formulating the model, looking for solutions, interpreting them in the problems situation and evaluating the model.

**PRESCRIBED TEXTBOOK :**

Mathematics (Textbook for Class XI)
Published by : The Council of Higher Secondary Education, Manipur with copy right from the NCERT, New Delhi.

**REFERENCE BOOKS :**

1. A Textbook of Mathematics Book-I for Class XI
By : S.N. Chhibber, G.D. Dhall & J.C. Nijhawan.
Published by : Macmillan Publishers India Pvt. Ltd.

2. Modern's abc of Mathematics for Class XI
By : J.P. Mohindru
Published by : Modern Publishers, Jalandhar.

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