CLASS XI

(Total Periods 180)

UNIT I: SETS AND FUNCTIONS

1. Sets **(Periods 12)**

Sets and their representations. Empty set. Finite and Infinite sets. Equal sets. Subsets. Subsets of the set of real numbers especially intervals (with notations). Power set. Universal set. Venn diagrams. Union and intersection of sets. Difference of sets. Complement of a set, Properties of Complement sets.

2. Relations and Functions **(Periods 14)**

Ordered pairs, Cartesian product of sets. Number of elements in the Cartesian product of two finite sets. Cartesian product of the reals with itself (upto $R \times R \times R$).

Definition of relation, pictorial diagrams, domain, co-domain and range of a relation. Function as a special kind of relation from one set to another. Pictorial representation of a function, domain, co-domain and range of a function. Real valued function of the real variable, domain and range of these functions, constant, identity, polynomial, rational, modulus, signum and greatest integer functions with their graphs. Sum, difference, product and quotients of functions.

3. Trigonometric Functions **(Periods 18)**

Positive and negative angles. Measuring angles in radians and in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Truth of the identity $\sin^2 x + \cos^2 x = 1$, for all x. Signs of trigonometric functions and sketch of their graphs. Expressing $\sin(x+y)$ and $\cos(x+y)$ in terms of $\sin x$, $\sin y$, $\cos x$ and $\cos y$. Deducing the identities like following:

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \times \tan y}, \cot(x \pm y) = \frac{\cot x \cot y \mp 1}{\cot y \pm \cot x}$$

$$\sin x + \sin y = 2\sin\frac{x+y}{2}.\cos\frac{x-y}{2}, \cos x + \cos y = 2\cos\frac{x+y}{2}\cos\frac{x-y}{2}$$

$$\sin x - \sin y = 2\cos\frac{x+y}{2}.\sin\frac{x-y}{2}, \cos x - \cos y = -2\sin\frac{x+y}{2}\sin\frac{x-y}{2}$$

Identities related to $\sin 2x$, $\cos 2x$, $\tan 2x$, $\sin 3x$, $\cos 3x$ and $\tan 3x$. General solution of trigonometric equations of the type $\sin\theta = \sin\alpha$, $\cos\theta = \cos\alpha$ and $\tan\theta = \tan\alpha$. Proofs and simple applications of sine and cosine formulae.

UNIT II : ALGEBRA

1. Principle of Mathematical Induction (Periods 06)

Process of the proof by induction, motivating the application of the method by looking at natural numbers as the least inductive subset of real numbers. The principle of mathematical induction and simple applications.

2. Complex Numbers and Quadratic Equations (Periods 10)

Need for complex numbers, especially $\sqrt{-1}$, to be motivated by inability to solve every quadratic equation. Brief description of algebraic properties of complex numbers. Argand plane and polar representation of complex numbers. Statement of Fundamental Theorem of Algebra, solution of quadratic equations in the complex number system, Square-root of a Complex number.

3. Linear Inequalities (Periods 10)

Linear inequalities, Algebraic solutions 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 - graphially.

4. Permutations and Combinations (Periods 12)

Fundamental principle of counting. Factorial *n*. Permutations and combinations derivation of formulae and their connections, simple applications.

5. Binomial Theorem (Periods 08)

History, statement and proof of the binomial theorem for positive integral indices. Pascal's triangle, general and middle term in binomial expansion, simple applications.

6. Sequence and Series (Periods 10)

Sequence and Series. Arithmetic Progression (A.P.), Arithmetic Mean (A.M.), Geometric Progression (G.P.), general term of a G.P., sum of *n* terms of a G.P. Arithmetic and geometric series, infinite G.P. and its sum, geometric mean (G.M.). Relation between A.M. and G.M. Sum to *n* terms of the special series : $\sum n$, $\sum n^2$ and $\sum n^3$

UNIT III : COORDINATE GEOMETRY

1. Straight Lines (Periods 09)

Brief recall of 2-D from earlier classes, shifting of origin. Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axes, point-slope form, slope-intercept form, two-point form, intercepts form and normal form. 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.

2. Conic Sections **(Periods 12)**

Sections of a cone: Circles, ellipse, parabola, hyperbola, a point, a straight line and pair of intersecting lines as a degenerated case of a conic section. Standard equations and simple properties of parabola, ellipse and hyperbola. Standard equation of a circle.

3. Introduction to Three-dimensional Geometry **(Periods 08)**

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

UNIT IV : CALCULUS

Limits and Derivatives **(Periods 18)**

Derivative introduced as rate of change both as that of distance function and geometrically, intuitive idea of limit. $\lim_{x \to 0} \frac{\log_e (1+x)}{x}, \lim_{x \to 0} \frac{e^x - 1}{x}$. Definition of derivative, relate it to slope of tangent of the curve, derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions.

UNIT V: MATHEMATICAL REASONING **(Periods 08)**

Mathematically acceptable statements. Connecting words/phrases - consolidating the understanding of "if and only if (necessary and sufficient) condition", "implies", "and/or", "implied by", "and", "or", "there exists" and their use through variety of examples related to real life and Mathematics. Validating the statements involving the connecting words - difference between contradiction, converse and contrapositive.

UNIT VI : STATISTICS AND PROBABILITY

1. Statistics **(Periods 10)**

Measure of dispersion; mean deviation, variance and standard deviation of ungrouped/grouped data. Analysis of frequency distributions with equal means but different variances.

2. Probability **(Periods 15)**

Random experiments: 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.