

## 6. MATHEMATICS (Code No 041)

The Syllabus in the subject of Mathematics has undergone changes from time to time in accordance with growth of the subject and emerging needs of the society. Senior Secondary stage is a launching stage from where the students go either for higher academic education in Mathematics or for professional courses like engineering, physical and Bioscience, commerce or computer applications. The present revised syllabus has been designed in accordance with National Curriculum Framework 2005 and as per guidelines given in Focus Group on Teaching of Mathematics 2005 which is to meet the emerging needs of all categories of students. Motivating the topics from real life situations and other subject areas, greater emphasis has been laid on application of various concepts.

### Objectives

The broad objectives of teaching Mathematics at senior school stage intend to help the pupil:

- to acquire knowledge and critical understanding, particularly by way of motivation and visualization, of basic concepts, terms, principles, symbols and mastery of underlying processes and skills.
- to feel the flow of reasons while proving a result or solving a problem.
- to apply the knowledge and skills acquired to solve problems and wherever possible, by more than one method.
- to develop positive attitude to think, analyze and articulate logically.
- to develop interest in the subject by participating in related competitions.
- to acquaint students with different aspects of mathematics used in daily life.
- to develop an interest in students to study mathematics as a discipline.
- to develop awareness of the need for national integration, protection of environment, observance of small family norms, removal of social barriers, elimination of sex biases.
- to develop reverence and respect towards great Mathematicians for their contributions to the field of Mathematics.

### COURSE STRUCTURE

#### Class XI

One Paper

Three Hours

Max Marks. 100

Units	Marks
I. SETS AND FUNCTIONS	29
II. ALGEBRA	37
III. COORDINATE GEOMETRY	13
IV. CALCULUS	06
V. MATHEMATICAL REASONING	03
VI. STATISTICS AND PROBABILITY	12
	100

## UNIT-I: SETS AND FUNCTIONS

### 1. Sets : (12) Periods

Sets and their representations. Empty set. Finite & Infinite sets. Equal sets. Subsets. Subsets of a 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 & Functions: (14) Periods

Ordered pairs, Cartesian product of sets. Number of elements in the cartesian product of two finite sets. Cartesian product of the set of reals with itself (upto  $\mathbb{R} \times \mathbb{R} \times \mathbb{R}$ ). Definition of relation, pictorial diagrams, domain, codomain 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 & range of a function. Real valued functions, 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: (18) Periods

Positive and negative angles. Measuring angles in radians & 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. Domain and range of trigonometric functions and their graphs. Expressing  $\sin(x \pm y)$  and  $\cos(x \pm y)$  in terms of  $\sin x$ ,  $\sin y$ ,  $\cos x$  &  $\cos y$ . Deducing the identities like the following:

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

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

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

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  $\tan \theta = \tan \alpha$ . Proof and simple applications of sine and cosine formulae.

## UNIT-II: ALGEBRA

### 1. Principle of Mathematical Induction: (06) Periods

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: (10) Periods**  
Need for complex numbers, especially  $\sqrt{-1}$ , to be motivated by inability to solve some of the quadratic equations. 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: (10) Periods**  
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. Graphical solution of system of linear inequalities in two variables.
- 4. Permutations & Combinations: (12) Periods**  
Fundamental principle of counting. Factorial  $n$ .  $(n!)$  Permutations and combinations, derivation of formulae and their connections, simple applications.
- 5. Binomial Theorem: (08) Periods**  
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: (10) Periods**  
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  $\sum_{k=1}^n k$ ,  $\sum_{k=1}^n k^2$  and  $\sum_{k=1}^n k^3$ .

### UNIT-III: COORDINATE GEOMETRY

- 1. Straight Lines: (09) Periods**  
Brief recall of two dimensional geometry 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, intercept 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: (12) Periods**  
Sections of a cone: circles, ellipse, parabola, hyperbola, a point, a straight line and a 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 (08) Periods**  
Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points and section formula.

## UNIT-IV: CALCULUS

### 1. Limits and Derivatives:

(18) Periods

Limit of function intuitive idea of derivative introduced as rate of change of distance function

and its geometric meaning.  $\lim_{x \rightarrow 0} \frac{\log_e (1+x)}{x}$ ,  $\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$  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

### 1. Mathematical Reasoning:

(08) Periods

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 & PROBABILITY

### 1. Statistics:

(10) Periods

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

### 2. Probability:

(10) Periods

Random experiments; outcomes, sample spaces (set representation). Events; occurrence of events, 'not', 'and' 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.