# 3. 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. 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 which is to meet the emerging needs of all categories of students. Motivating the topics from real life problems and other subject areas, greater emphasis has been laid on applications of various concepts.

The curriculum at Secondary stage primarily aims at enhancing the capacity of students to employ Mathematics in solving day-to-day life problems and studying the subject as a separate discipline. It is expected that students should acquire the ability to solve problems using algebraic methods and apply the knowledge of simple trigonometry to solve problems of heights and distances. Carrying out experiments with numbers and forms of geometry, framing hypothesis and verifying these with further observations form inherent part of Mathematics learning at this stage. The proposed curriculum includes the study of number system, algebra, geometry, trigonometry, mensuration, statistics, graphs and coordinate geometry etc.

The teaching of Mathematics should be imparted through activities which may involve the use of concrete materials, models, patterns, charts, pictures posters, games, puzzles and experiments.

**OBJECTIVES**

The broad objectives of teaching of Mathematics at secondary stage are to help the learners to:

- consolidate the Mathematical knowledge and skills acquired at the upper primary stage;
- acquire knowledge and understanding, particularly by way of motivation and visualization, of basic concepts, terms, principles and symbols and underlying processes and skills.
- develop mastery of basic algebraic skills;
- develop drawing skills;
- feel the flow of reasons while proving a result or solving a problem.
- apply the knowledge and skills acquired to solve problems and wherever possible, by more than one method.
- to develop positive ability to think, analyze and articulate logically;
- 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 necessary skills to work with modern technological devices such as calculators, computers etc;

- to develop interest in Mathematics as a problem-solving tool in various fields for its beautiful structures and patterns, etc;
- to develop reverence and respect towards great Mathematicians for their contributions to the field of Mathematics.
- to develope 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.

**General Instructions**

- As per CCE guidelines, the syllabus of Mathematics for classes IX and X has been divided termwise.
- The units specified for each term shall be assessed through both formative and summative assessment.
- In each term, there will be two formative assessments, each carrying 10% weightage
- The summative assessment in term I will carry 30% weightage and the summative asssessment in the II term will carry 30% weightage.
- Listed laboratory activities and projects will necessarily be assessed through formative assessments.

## Course Structure
### Class IX

| First Term | | Marks : 90 |
|---|---|---|
| **UNITS** | | **MARKS** |
| I. | NUMBER SYSTEM | 17 |
| II. | ALGEBRA | 25 |
| III. | GEOMETRY | 37 |
| IV. | CO-ORDINATE GEOMETRY | 06 |
| V. | MENSURATION | 05 |
| | **TOTAL THEORY** | **90** |

## UNIT I : NUMBER SYSTEMS

### 1. REAL NUMBERS (18) Periods

Review of representation of natural numbers, integers, rational numbers on the number line. Representation

of terminating / non-terminating recurring decimals, on the number line through successive magnification. Rational numbers as recurring/terminating decimals.

Examples of nonrecurring / non terminating decimals such as $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ etc. Existence of non-rational numbers (irrational numbers) such as $\sqrt{2}$, $\sqrt{3}$ and their representation on the number line. Explaining that every real number is represented by a unique point on the number line and conversely, every point on the number line represents a unique real number.

Existence of $\sqrt{x}$ for a given positive real number x (visual proof to be emphasized).

Definition of $n$th root of a real number.

Recall of laws of exponents with integral powers. Rational exponents with positive real bases (to be done by particular cases, allowing learner to arrive at the general laws.)

Rationalization (with precise meaning) of real numbers of the type (& their combinations)

$\frac{1}{a + b\sqrt{x}}$ & $\frac{1}{\sqrt{x} + \sqrt{y}}$ where $x$ and $y$ are natural number and $a$, $b$ are integers.

## UNIT II : ALGEBRA

### 1. POLYNOMIALS (23) Periods

Definition of a polynomial in one variable, its coefficients, with examples and counter examples, its terms, zero polynomial. Degree of a polynomial. Constant, linear, quadratic, cubic polynomials; monomials, binomials, trinomials. Factors and multiples. Zeros/roots of a polynomial / equation. State and motivate the Remainder Theorem with examples and analogy to integers. Statement and proof of the Factor Theorem. Factorization of $ax^2 + bx + c$, $a \neq 0$ where $a$, $b$, $c$ are real numbers, and of cubic polynomials using the Factor Theorem.

Recall of algebraic expressions and identities. Further verification of identities of the type $(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$, $(x \pm y)^3 = x^3 \pm y^3 \pm 3xy\,(x \pm y)$, $x^3 \pm y^3 = (x \pm y)(x^2 \pm xy + y^2)$

$x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)$ and their use in factorization of polymonials. Simple expressions reducible to these polynomials.

## UNIT III : GEOMETRY

### 1. INTRODUCTION TO EUCLID'S GEOMETRY (6) Periods

History - Geometry in India and Euclid's geometry. Euclid's method of formalizing observed phenomenon into rigorous mathematics with definitions, common/obvious notions, axioms/postulates and theorems. The five postulates of Euclid. Equivalent versions of the fifth postulate. Showing the relationship between axiom and theorem, for example.

(Axim) 1. Given two distinct points, there exists one and only one line through them.

(Theorem) 2. (Prove) two distinct lines cannot have more than one point in common.

## 2. LINES AND ANGLES (10) Periods

1. (Motivate) If a ray stands on a line, then the sum of the two adjacent angles so formed is $180^\circ$ and the converse.
2. (Prove) If two lines intersect, the vertically opposite angles are equal.
3. (Motivate) Results on corresponding angles, alternate angles, interior angles when a transversal intersects two parallel lines.
4. (Motivate) Lines, which are parallel to a given line, are parallel.
5. (Prove) The sum of the angles of a triangle is $180^\circ$.
6. (Motivate) If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two interiors opposite angles.

## 3. TRIANGLES (20) Periods

1. (Motivate) Two triangles are congruent if any two sides and the included angle of one triangle is equal to any two sides and the included angle of the other triangle (SAS Congruence).
2. (Prove) Two triangles are congruent if any two angles and the included side of one triangle is equal to any two angles and the included side of the other triangle (ASA Congruence).
3. (Motivate) Two triangles are congruent if the three sides of one triangle are equal to three sides of the other triangle (SSS Congruene).
4. (Motivate) Two right triangles are congruent if the hypotenuse and a side of one triangle are equal (respectively) to the hypotenuse and a side of the other triangle.
5. (Prove) The angles opposite to equal sides of a triangle are equal.
6. (Motivate) The sides opposite to equal angles of a triangle are equal.
7. (Motivate) Triangle inequalities and relation between 'angle and facing side' inequalities in triangles.

# UNIT IV : COORDINATE GEOMETRY

## 1. COORDINATE GEOMETRY (9) Periods

The Cartesian plane, coordinates of a point, names and terms associated with the coordinate plane, notations, plotting points in the plane, graph of linear equations as examples; focus on linear equations of the type $Ax + By + C = 0$ by writing it as $y = mx + c$ .

# UNIT V : MENSURATION

## 1. AREAS (4) Periods

Area of a triangle using Hero's formula (without proof) and its application in finding the area of a quadrilateral.

# Course Structure
## Class IX

| Second Term | | Marks : 90 |
|---|---|---|
| **UNITS** | | **MARKS** |
| II. | ALGEBRA | 16 |
| III. | GEOMETRY (Contd.) | 38 |
| V. | MENSU RATION (Contd.) | 18 |
| VI. | STATISTICS AND PROBABILITY | 18 |
| | **TOTAL** | **90** |

## UNIT II : ALGEBRA (Contd.)

### 2. LINEAR EQUATIONS IN TWO VARIABLES (14) Periods

Recall of linear equations in one variable. Introduction to the equation in two variables. Prove that a linear equation in two variables has infinitely many solutions and justify their being written as ordered pairs of real numbers, plotting them and showing that they seem to lie on a line. Examples, problems from real life, including problems on Ratio and Proportion and with algebraic and graphical solutions being done simultaneously.

## UNIT III : GEOMETRY (Contd.)

### 4. QUADRILATERALS (10) Periods

1. (Prove) The diagonal divides a parallelogram into two congruent triangles.
2. (Motivate) In a parallelogram opposite sides are equal, and conversely.
3. (Motivate) In a parallelogram opposite angles are equal, and conversely.
4. (Motivate) A quadrilateral is a parallelogram if a pair of its opposite sides is parallel and equal.
5. (Motivate) In a parallelogram, the diagonals bisect each other and conversely.
6. (Motivate) In a triangle, the line segment joining the mid points of any two sides is parallel to the third side and (motivate) its converse.

### 5. AREA (4) Periods

Review concept of area, recall area of a rectangle.

1. (Prove) Parallelograms on the same base and between the same parallels have the same area.
2. (Motivate) Triangles on the same base and between the same parallels are equal in area and its converse.

## 6. CIRCLES (15) Periods

Through examples, arrive at definitions of circle related concepts, radius, circumference, diameter, chord, arc, subtended angle.

1. (Prove) Equal chords of a circle subtend equal angles at the center and (motivate) its converse.
2. (Motivate) The perpendicular from the center of a circle to a chord bisects the chord and conversely, the line drawn through the center of a circle to bisect a chord is perpendicular to the chord.
3. (Motivate) There is one and only one circle passing through three given non-collinear points.
4. (Motivate) Equal chords of a circle (or of congruent circles) are equidistant from the center(s) and conversely.
5. (Prove) The angle subtended by an arc at the center is double the angle subtended by it at any point on the remaining part of the circle.
6. (Motivate) Angles in the same segment of a circle are equal.
7. (Motivate) If a line segment joining two points subtendes equal angle at two other points lying on the same side of the line containing the segment, the four points lie on a circle.
8. (Motivate) The sum of the either pair of the opposite angles of a cyclic quadrilateral is $180^\circ$ and its converse

## 7. CONSTRUCTIONS (10) Periods

1. Construction of bisectors of line segments & angles, $60^\circ$, $90^\circ$, $45^\circ$ angles etc., equilateral triangles.
2. Construction of a triangle given its base, sum/difference of the other two sides and one base angle.
3. Construction of a triangle of given perimeter and base angles.

# UNIT V : MENSURATION (Contd.)

## 2. SURFACE AREAS AND VOLUMES (12) Periods

Surface areas and volumes of cubes, cuboids, spheres (including hemispheres) and right circular cylinders/ cones.

# UNIT VI : STATISTICS AND PROBABILITY

## 1. STATISTICS (13) Periods

Introduction to Statistics : Collection of data, presentation of data — tabular form, ungrouped / grouped, bar graphs, histograms (with varying base lengths), frequency polygons, qualitative analysis of data to choose the correct form of presentation for the collected data. Mean, median, mode of ungrouped data.

## 2. PROBABILITY (12) Periods

History, Repeated experiments and observed frequency approach to probability. Focus is on empirical probability. (A large amount of time to be devoted to group and to individual activities to motivate the concept; the experiments to be drawn from real - life situations, and from examples used in the chapter on statistics).

## CLASS X

**First Term** **Marks : 90**

| UNITS | | MARKS |
|---|---|---|
| I. | NUMBER SYSTEMS | 11 |
| II. | ALGEBRA | 23 |
| III. | GEOMETRY | 17 |
| IV | TRIGONOMETRY | 22 |
| V | STATISTICS | 17 |
| | **TOTAL** | **90** |

# UNIT I : NUMBER SYSTEMS

## 1. REAL NUMBERS (15) Periods

Euclid's division lemma, Fundamental Theorem of Arithmetic - statements after reviewing work done earlier and after illustrating and motivating through examples, Proofs of results - irrationality of $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$, decimal expansions of rational numbers in terms of terminating/non-terminating recurring decimals.

# UNIT II : ALGEBRA

## 1. POLYNOMIALS (7) Periods

Zeros of a polynomial. Relationship between zeros and coefficients of quadratic polynomials. Statement and simple problems on division algorithm for polynomials with real coefficients.

## 2. PAIR OF LINEAR EQUATIONS IN TWO VARIABLES (15) Periods

Pair of linear equations in two variables and their graphical solution. Geometric representation of different possibilities of solutions/inconsistency.