CLASS X

Units

I. Number Systems

II. Algebra

III. Trigonometry

IV. Coordinate Geometry

V. Geometry

VI. Mensuration

VII. Statistics and Probability

Appendix: 1. Proofs in Mathematics

2. Mathematical Modelling

Unit I: Number Systems

Real Numbers (Periods 15)

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* (Periods 6)

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

2. *Pair of Linear Equations in Two Variables* (Periods 15)

Pair of linear equations in two variables. Geometric representation of different possibilities of solutions/inconsistency.

Algebraic conditions for number of solutions. Solution of pair of linear equations in two variables algebraically – by substitution, by elimination and by cross multiplication. Simple situational problems must be included. Simple problems on equations reducible to linear equations may be included.

3. *Quadratic Equations* (Periods 15)

Standard form of a quadratic equation $ax^2 + bx + c = 0$, $(a \neq 0)$. Solution of quadratic equations (only real roots) by factorization and by completing the square, i.e., by using quadratic formula. Relationship between discriminant and nature of roots.

Problems related to day-to-day activities to be incorporated.

4. *Arithmetic Progressions* (AP) (Periods 8)

Motivation for studying AP. Derivation of standard results of finding the n^{th} term and sum of first n terms.

Unit III: Trigonometry

1. *Introduction to Trigonometry* (Periods 18)

Trigonometric ratios of an acute angle of a right-angled triangle. Proof of their existence (well defined); motivate the ratios, whichever are defined at 0° and 90°. Values (with proofs) of the trigonometric ratios of 30°, 45° and 60°. Relationships between the ratios.

Trigonometric Identities: Proof and applications of the identity $\sin^2 A + \cos^2 A = 1$. Only simple identities to be given. Trigonometric ratios of complementary angles.

2. *Heights and Distances* (Periods 8)

Simple and believable problems on heights and distances. Problems should not involve more than two right triangles. Angles of elevation/depression should be only 30^0, 45^0, 60^0.

Unit IV: Coordinate Geometry

Lines (In two-dimensions) (Periods 15)

Review the concepts of coordinate geometry done earlier including graphs of linear equations. Awareness of geometrical representation of quadratic polynomials. Distance between two points and section formula (internal). Area of a triangle.

Unit V: Geometry

1. *Triangles* (Periods 15)

Definitions, examples, counterexamples of similar triangles.

1. (Prove) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.
2. (Motivate) If a line divides two sides of a triangle in the same ratio, the line is parallel to the third side.
3. (Motivate) If in two triangles, the corresponding angles are equal, their corresponding sides are proportional and the triangles are similar.

4. (Motivate) If the corresponding sides of two triangles are proportional, their corresponding angles are equal and the two triangles are similar.
5. (Motivate) If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are proportional, the two triangles are similar.
6. (Motivate) If a perpendicular is drawn from the vertex of the right angle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and to each other.
7. (Prove) The ratio of the areas of two similar triangles is equal to the ratio of the squares on their corresponding sides.
8. (Prove) In a right triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.
9. (Prove) In a triangle, if the square on one side is equal to sum of the squares on the other two sides, the angles opposite to the first side is a right triangle.

2. *Circles* (Periods 8)

Tangents to a circle motivated by chords drawn from points coming closer and closer to the point.

1. (Prove) The tangent at any point of a circle is perpendicular to the radius through the point of contact.
2. (Prove) The lengths of tangents drawn from an external point to a circle are equal.

3. *Constructions* (Periods 8)

1. Division of a line segment in a given ratio (internally).
2. Tangent to a circle from a point outside it.
3. Construction of a triangle similar to a given triangle.

Unit VI: Mensuration

1. *Areas Related to Circles* (Periods 12)

Motivate the area of a circle; area of sectors and segments of a circle. Problems based on areas and perimeter/circumference of the above said plane figures.

(In calculating area of segment of a circle, problems should be restricted to central angle of 60°, 90° and 120° only. Plane figures involving triangles, simple quadrilaterals and circle should be taken.)

2. *Surface Areas and Volumes* (Periods 12)

1. Problems on finding surface areas and volumes of combinations of any two of the following: cubes, cuboids, spheres, hemispheres and right circular cylinders/cones. Frustum of a cone.

2. Problems involving converting one type of metallic solid into another and other mixed problems. (Problems with combination of not more than two different solids be taken.)

Unit VII: Statistics and Probability

1. *Statistics* (Periods 15)

Mean, median and mode of grouped data (bimodal situation to be avoided). Cumulative frequency graph.

2. *Probability* (Periods 10)

Classical definition of probability. Connection with probability as given in Class IX.
Simple problems on single events, not using set notation.

Appendix

1. *Proofs in Mathematics*

Further discussion on concept of 'statement', 'proof' and 'argument'. Further illustrations of deductive proof with complete arguments using simple results from arithmetic, algebra and geometry. Simple theorems of the "Given …… and assuming… prove ……..". Training of using only the given facts (irrespective of their truths) to arrive at the required conclusion. Explanation of 'converse', 'negation', constructing converses and negations of given results/statements.

2. *Mathematical Modelling*

Reinforcing the concept of mathematical modelling, using simple examples of models where some constraints are ignored. Estimating probability of occurrence of certain events and estimating averages may be considered. Modelling fair instalments payments, using only simple interest and future value (use of AP).

Higher Secondary Stage

General Guidelines

(i) All concepts/identities must be illustrated by situational examples.

(ii) The language of 'word problems' must be clear, simple and unambiguous.

(iii) Problems given should be testing the understanding of the subject.

(iv) All proofs to be produced in a manner that allow the learner to see flow of reasons. Wherever possible, give more than one proof.

(v) Motivate results, wherever possible. Prove explicitly those results where a short and clear argument reinforces mathematical thinking and reasoning. There must be emphasis on correct way of expressing the arguments.