

Class : 09
Subject : Mathematics

As the regular teaching – learning in schools, during the session 2020-21, has widely been affected due to the Covid – 19 pandemic, the subject experts committee, after due consideration, has recommended to reduce the syllabus by 30% in the following manner :

Almost 30% reduced syllabus :-

UNIT I: COORDINATE GEOMETRY

1. Coordinate Geometry

The Cartesian plane, coordinates of a point, names and terms associated with the coordinate plane, notations, plotting points in the plane.

UNIT II: GEOMETRY

1. Introduction of Euclid's Geometry

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:

- (Axiom) 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. Quadrilaterals

- (Prove) The diagonal divides a parallelogram into two congruent triangles.
- (Motivate) In a parallelogram opposite sides are equal, and conversely.
- (Motivate) In a parallelogram opposite angles are equal, and conversely.

- (Motivate) A quadrilateral is a parallelogram if a pair of its opposite sides are parallel and equal.
- (Motivate) In a parallelogram, the diagonals bisect each other and conversely.
- (Motivate) In a triangle, the line segment joining the mid points of any two sides is parallel to the third side and its converse.

3. Area

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 (or equal base) base and between the same parallels are equal in area.

4. Constructions

1. Construction of bisectors of line segments and angles of measure 60° , 90° , 45° 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 III: STATISTICS & PROBABILITY

1. Statistics

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.

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Subject : Mathematics
Only Paper

Time : 3 hours

Marks : 70

Unit	Name of Unit	Marks
I	Number System	12
II	Algebra	25
III	Geometry	15
IV	Mensuration	14
V	Probability	04
	Total	70
	Project Work	30
	(Written 70marks + project work 30marks)	100

Approximately 70% Syllabus :

UNIT I: NUMBER SYSTEMS

12 Marks

1. Real Numbers

- 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 non-recurring / non-terminating decimals. 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.

- Rationalization (with precise meaning) of real numbers of the type $\frac{1}{a+b\sqrt{x}}$ and $\frac{1}{\sqrt{x}+\sqrt{y}}$ (and their combinations) where x and y are natural number and a and b are integers.
- 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.)

UNIT II: ALGEBRA

25 Marks

1. Polynomials

Definition of a polynomial in one variable, with examples and counter examples. Coefficients of a polynomial, terms of a polynomial and zero polynomial. Degree of a polynomial. Constant, linear, quadratic and cubic polynomials. Monomials, binomials, trinomials. Factors and multiples. Zeros of a polynomial. Motivate and State the Remainder Theorem with examples. Statement and proof of the Factor Theorem. Factorization of $ax^2 + bx + c$, $a \neq 0$ where a , b and c are real numbers, and of cubic polynomials using the Factor Theorem.

Recall of algebraic expressions and identities. Verification of identities:

$$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$$

$$(x \pm y)^3 = x^3 \pm y^3 \pm 3xy(x \pm y)$$

$$x^3 \pm y^3 = (x \pm y)(x^2 \mp xy + y^2)$$

$$x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)$$

and their use in factorization of polynomials.

2. Linear Equations in Two Variables

Recall of linear equations in one variable. Introduction to the equation in two variables.

Focus on linear equations of the type $ax + by + c = 0$. 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. Graph of linear equations in two variables. Examples, problems from real life,

including problems on Ratio and Proportion and with algebraic and graphical solutions being done simultaneously.

Unit III : GEOMETRY

15 Marks

1. Lines and Angle

- (Motivate) If a ray stands on a line, then the sum of the two adjacent angles so formed is 180° and the converse.
- (Prove) If two lines intersect, the vertically opposite angles are equal.
- (Motivate) Results on corresponding angles, alternate angles, interior angles when a transversal intersects two parallel lines.
- (Motivate) Lines which are parallel to a given line are parallel.
- (Prove) The sum of the angles of a triangle is 180° .
- (Motivate) If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two interior opposite angles.

2. Triangles

- (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).
- (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).
- (Motivate) Two triangles are congruent if the three sides of one triangle are equal to three sides of the other triangle (SSS Congruence).
- (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. (RHS Congruence)
- (Prove) The angles opposite to equal sides of a triangle are equal.

- (Motivate) The sides opposite to equal angles of a triangle are equal.
- (Motivate) Triangle inequalities and relation between 'angle and facing side' inequalities in triangles.

3. Circles

Through examples, arrive at definition of circle and related concepts-radius, circumference, diameter, chord, arc, secant, sector, segment, subtended angle.

- (Prove) Equal chords of a circle subtend equal angles at the center and (motivate) its converse.
- (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.
- (Motivate) There is one and only one circle passing through three given non-collinear points.
- (Motivate) Equal chords of a circle (or of congruent circles) are equidistant from the center (or their respective centers) and conversely.
- (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.
- (Motivate) Angles in the same segment of a circle are equal.
- (Motivate) If a line segment joining two points subtends an equal angle at two other points lying on the same side of the line containing the segment, the four points lie on a circle.
- (Motivate) The sum of either of the pair of the opposite angles of a cyclic quadrilateral is 180° and its converse.

UNIT IV: MENSURATION**14 Marks****1. Areas**

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

2. Surface Areas and Volumes

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

UNIT V: PROBABILITY**04 Marks****1. Probability**

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).

PROJECT WORK**30 Marks****a- Internal Assessment****15 Marks**

(Questions should also be asked from the book "Bharat ka Paramparagat Ganit Gyan" – Class 9th)

b- Project Work**15 Marks**

Note : Student should prepare any two projects from the following (serial no- 1 to 10), teachers can also give other projects related to the subject from their level and one project from point 11 should be compulsorily prepared by the students.

- 1- To study the role of the different geometrical shapes in architecture and construction.
- 2- Elucidating the life and works of any one of the Medieval Mathematician of India (Aryabatt, Shridharacharya, Mahaviracharya etc.).
- 3- Discovery of π (Pi).
- 4- Making the income - expenditure budget of your home.

- 5- To do the functional formulation of Algebraic identities like $(a+b)^2 = a^2+2ab+b^2$, $(a-b)^2 = a^2-2ab+b^2$.
- 6- To study the different types of accounts opened in Bank and their interest rates.
- 7- To make different shapes by cutting a chart paper or a cardboard and define their features.
- 8- Representation of rational numbers on number line.
- 9- Survey of the height and weight of the students of your class and elaborate the relation between height and weight.
- 10- To do the comparative analysis of the price of grains of any three grain markets through the newspaper.
- 11- Any one project from the following three parts of the recommended book “Bharat ka Paramparagat Ganit Gyan” – Class 9th.
 - Part a. Bright traditions of Mathematics in India.
 - Part b. Traditional methods of calculation .
 - Part c. Renowned Mathematicians of India.