

MATHEMATICS

It is rightly said, that "Mathematics is King of Arts and Queen of Sciences". Mathematics is highly connected with the field of mathematical sciences namely Physics, Chemistry, Statistics, Economics, Business Analytics (Management) and even in Bioscience and Computer Science. After completion of degree oriented studies at School, College and University levels, everybody seeks a job oriented exam, focusing its proper syllabus, where Mathematics plays a vital role. So, learning Maths is part and parcel of our daily life. Consequently, optimization theory (mainly min. and max. principle) is adopted. So constant Online exams are essential to perform better results in the long run. Mathematics is the science and study of quality, structure, space and change. Mathematicians set out patterns, formulate new conjectures and establish truth by rigorous deductions through appropriately chosen axioms and definitions. Mathematics holds a crucial role in education for several reasons as cognitive development, develop critical thinking, problem solving skill, logical reasoning, analytical abilities. These skills are very vital for having correct results or solutions. It is concluded that the main goal of it is to develop children's logical abilities and sharpen skills, required in near future.

Mathematics clears fears and simultaneously creates mental ability among the students. So, a suitable platform must be selected from school level for the benefit of the students. RITA ACME FOCUS [RAF] will help the students to take the best fruitful decision for their future.

SYLLABUS

Class V

- A. Large numbers and Whole numbers.
- B. Fractions.
- C. Factors and multiples.
- D. Percentage.
- E. Decimals and Estimation (Rounding off Numbers).
- F. Average.
- G. Profit and Loss.
- H. Data Handling.
- I. Perimeter, Area and Volume.

Class VI

(A) Number system: Indian System of Numeration/ International System of Numeration of Large Numbers, Addition of Large Numbers upto 6-Digits, Subtraction of Large Numbers up to 6-Digits, Multiplication of Large Numbers up to 6-Digits, Division of Large Numbers up to 6-Digits, Estimating and rounding up to 6-Digits.

(B) Addition: Counting objects and writing in numbers Addition using pictures Addition with carry forward Counting numbers from different groups, what is Fraction, Types of Fractions, Equivalent Fraction, Comparing Fractions, Addition of Fractions, Subtraction of Fractions, Multiplication of Fractions, Division of Fractions, Combined Operation on Fractions.

(C) Decimal: What are Decimals, Comparison of Decimals, Addition of Decimals, Subtraction of Decimals, Problems on Decimals, Factors of a Number, Multiples of a Number, Prime and Composite Numbers, Divisibility Tests, Finding HCF by Observation, Finding HCF by Prime Factors, Finding HCF by Division, Finding LCM by Observation, Finding LCM by Prime Factors, Finding LCM by Division, Problems on HCF and LCM.

(D) Ratio and Proportion: What is Ratio, what is Proportion, Unitary Method, Speed, Distance, and Time.

(E) Percentage: What is Percentage, Interpreting Percentage, Introduction to basics of algebra – Variable, Constant, Algebraic Expressions, Problems on Algebraic Expressions.

(F) Equation: What are Equations, Solving Equation, Setting Up an Equation, Solving an Equation by Balancing, Point, Line, Line Segment, Ray, Vertex, Arm, Interior, and Exterior of an Angle, Measure of Angles

Type of Angles, Circle, Triangle – Naming and Classification, Quadrilateral – Naming and Classification.

(G) Perimeter: Perimeter of a Rectangle, Perimeter of a Square, Problems on the Perimeter of Rectangles and Square, Area of a Rectangle, Area of a Square, Problems with the Area of Rectangles and Square.

(H) 3D Shapes: Identifying 3D Shapes, Elements of 3D Shapes – Faces, Edges, and Vertices, Nets of 3D Shapes.

(I) Data: Collection of Data, Organization of Data, Graphical Representation of Data – Pie Graph, Graphical Representation of Data – Bar Graphs.

Class VII

(A) Number System: Division and multiplication of integers. Properties of operations on integers: Associativity, commutativity, the existence of identity and inverse and distributivity. Using integer operations to solve problems. Solution of integer word puzzles (all operations). Basics of rational numbers (with representation on a number line), Word problems on rational numbers (all operations), Representation of rational numbers in decimal form. Solving problems using operations on rational numbers and decimal fractions, Fraction as an operator Reciprocal of a fraction. Division and multiplication of decimal fractions

Exponents are only natural numbers. Exponential laws (through observing patterns to arrive at generalization) Solving simple problems from everyday life using exponentiation principles. Sets revision concept. Equivalent, equal and universal Sets' cardinal property.

(B) Ratio and Proportion: Proportion and ratio (revision), Continuation, consolidation, and general description of the unitary method, An introduction to ratio and proportion.

(C) Percentage: Recognizing percentages as fractions with a denominator of 100. Converting decimals and fractions into percentages and vice versa.

(D) use concerning profit and loss (single transaction only) use with regard to simple interest (the time period in complete years).

(E) Time, distance, and speed.

(F) Algebra: Algebraic concepts include constants, variables, coefficients, like and unlike expressions, etc. Creation of algebraic expressions. Performs operations (addition and subtraction) exclusively on integral coefficient algebraic formulas, Simple one-variable, two-operation linear equations in problems of context. Inequalities are simple inequalities in one variable and their solutions.

(G) Geometry: Recognizing shapes, Angles in pairs (linear, supplementary, complementary, adjacent, vertically opposite) Characteristics of parallel lines with transversal (corresponding, alternate, interior, exterior angles). Triangles' properties, The Angle Sum Property, Exterior angle property, The Pythagorean Theorem (Verification only).

(H) Circle's perimeter and concept of its circumference Area – Concept of measuring employing the basic unit area of a square, circle, ring, triangle, rectangle, and parallelogram.

(I) Data Handling: Selecting the data to gather for a hypothesis test during data organization and collection. Understanding what the mean, median, and mode of ungrouped data signify, Constructing and analyzing bar graphs, Using data from experiments, estimate probability. The idea of chance in activities like throwing dice or money, counting and adding up the instances of numbers 1 through 6 throughout several throws and comparing the observation with the coin observation and noticing patterns in throws and the idea of randomness.

Class VIII

(A) Number System: 1) Rational Numbers, Properties of rational numbers (including identities). Using the general form of expression to describe properties, Representation of rational numbers on the number line, between

any two rational numbers, there lies another rational number, Word problem, Exponents Powers, Laws of exponents with integral powers, square and square roots using the factor method and division method for numbers containing no more than total 4 digits no more than 2 decimal places Cubes and cubes roots (only factor method for numbers containing at most 3 digits).

(B) Playing with numbers: Writing and understanding a^2 and 3-digit numbers in the generalized form $(100a + 10b + c)$, where a, b, c can be only digit 0-9) and engaging with various puzzles children to solve and create problems and puzzles. Deducing the divisibility test rules of 2, 3, 5, 9, 10 for a two or three-digit number expressed in the general form.

Sets: Union and intersection of sets, Disjoint-set, Complement of a set.

(C) Ratio and Proportion: Slightly advanced problems involving applications on percentages, profit & loss, overhead expenses, Discount, tax. Difference between simple and compound interest (compounded yearly up to 3 years or half-yearly up to 3 steps only) Direct and inverse variations – Simple and direct word problems, Time and work problems – Simple and direct word problems.

(D) Algebra: Algebraic Expressions, Multiplication and division of algebraic expression (Coefficient should be integers), Identities $(a \pm b)^2 = a^2 \pm 2ab + b^2$, $a^2 - b^2 = (a - b)(a + b)$. Properties of inequalities, Factorization (simple cases only) as examples of the following types $a(x + y)$, $(x \pm y)^2$, $a^2 - b^2$, $(x + a)(x + b)$. Solving linear equations in one variable in contextual problems involving multiplication and division (word problems) (avoid complex coefficient in the equations).

(E) Geometry: Understanding shapes: i. Properties of quadrilaterals – Angle Sum property, ii. Properties of a parallelogram (By verification). Opposite sides of a parallelogram are equal, opposite angles of a parallelogram are equal, Diagonals of a parallelogram bisect each other

Diagonals of a rectangle are equal and bisect each other, Diagonals of a rhombus bisect each other at right angles, Diagonals of a square are equal and bisect each other at right angles.

(F) Representing 3D in 2D: Identify and match pictures with objects [more complicated, e.g., nested, joint 2D and 3D shapes (not more than 2)]. Drawing 2D representation of 3D objects (Continued and extended); Counting vertices, edges & faces & verifying Euler's relation for 3D figures with flat faces (cubes, cuboids, tetrahedrons, prisms and pyramids).

(G) Construction of Quadrilaterals: Given four sides and one diagonal; Three sides and two diagonals, Three sides and two included angles, Two adjacent

sides and three angles, The idea of reflection symmetry and symmetrical shapes. Circle: Circle, center, radius/diameter, arc, chord, sector and segment. (H) Mensuration: Area of a trapezium, a polygon and semi-circle. Surface area of a cube, cuboid, cylinder. Idea of Total surface area and curved surface areas of various 3D figures, Concept of volume, measurement of volume using a basic unit, the volume of a cube, cuboid and cylinder, Volume and capacity (the measurement of capacity).

(I) Data Handling: Arranging ungrouped data, it into groups, representation of grouped data through bar-graphs, constructing and interpreting bar-graphs. Simple Pie charts with reasonable data numbers, Consolidating and generalizing the notion of chance in events like tossing coins, dice, etc. Relating it to chance in life events.

Class IX

(A) Pure Arithmetic: Rational and Irrational Numbers Rational, Irrational numbers as real numbers, their place in the number system. Surds and rationalization of Surds. Simplifying an expression by rationalizing the denominator. Representation of rational and irrational numbers on the number line. Proofs of the irrationality of $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$.

(B) Commercial Mathematics: Compound Interest (a) Compound interest as a repeated Simple Interest computation with a growing Principal. Use of this in computing Amount over a period of 2 or 3 years. Finding CI from the relation $CI = A - P$. Interest compounded half-yearly included using the formula to find one quantity given different combinations of A, P, r, n, CI and SI; difference between CI and SI type included. Rate of growth and depreciation.

(C) Algebra: (i) Expansions Recall of concepts learned in earlier classes. $(a \pm b)^2$, $(a \pm b)^3$, $(x \pm a)(x \pm b)$, $(a \pm b \pm c)^2$. (ii) Factorization $a^2 - b^2$, $a^3 \pm b^3$, $ax^2 + bx + c$, by splitting the middle term. (iii) Simultaneous Linear Equations in two variables. (With numerical coefficients only). Solving algebraically by: - Elimination - Substitution and - Cross Multiplication method. Solving simple problems by framing appropriate equations. (iv) Indices/ Exponents, Handling positive, fractional, negative and "zero" indices. Simplification of expressions involving various exponents, $am \times an = am+n$, $am \div an = am-n$, $(am)^n = amn$ etc. Use of laws of exponents. (v) Logarithms: (a) Logarithmic form vis-à-vis exponential form: interchanging. (b) Laws of Logarithms and their uses. Expansion of expression with the help of laws of logarithms e.g.

(D) Geometry (1): Triangles: (a) Congruency: four cases: SSS, SAS, AAS, and RHS. Illustration through cutouts. Simple applications. (b) Problems based on: Angles opposite equal sides are equal and converse. If two sides of a triangle

are unequal, then the greater angle is opposite the greater side and converse. Sum of any two sides of a triangle is greater than the third side. Of all straight lines that can be drawn to a given line from a point outside it, the perpendicular is the shortest. (c) Mid-Point Theorem and its converse, equal intercept theorem: (i) simple applications of mid- point theorem and its converse, (ii) Equal intercept theorem: simple application. (d) Pythagoras Theorem: Area-based simple applications of Pythagoras Theorem and its converse.

(E) Geometry (2): Rectilinear Figures :(a) theorems on parallelogram. Both pairs of opposite sides equal, Both pairs of opposite angles equal. One pair of opposite sides equal and parallel, Diagonals bisect each other and bisect the parallelogram. Rhombus as a special parallelogram whose diagonals meet at right angles. In a rectangle, diagonals are equal, in a square, they are equal and meet at right angles. (b) Constructions of Polygons Construction of quadrilaterals (including parallelograms and rhombus) and regular hexagon using ruler and compasses only. (c) Area theorems on parallelograms: Parallelograms on the same base and between the same parallels are equal in area. The area of a triangle is half that of a parallelogram on the same base and between the same parallels. Triangles between the same base and between the same parallels are equal in area, Triangles with equal areas on the same bases have equal corresponding altitudes. (iii) Circle: (a) Chord properties; A straight line drawn from the center of a circle to bisect a chord which is not a diameter is at right angles to the chord. The perpendicular to a chord from the center bisects the chord. Equal chords are equidistant from the center. Chords equidistant from the center are equal. There is one and only one circle that passes through three given points not in a straight line. (b) Arc and chord properties: If two arcs subtend equal angles at the center, they are equal, and its converse. If two chords are equal, they cut off equal arcs, and its converse.

(F) Statistics: Introduction, collection of data, presentation of data, Graphical representation of data, Mean, Median of ungrouped data. (i) Understanding and recognition of raw, arrayed and grouped data. (ii) Tabulation of raw data using tally-marks. (iii) Understanding and recognition of discrete and continuous variables. (iv) Mean, median of ungrouped data. (v) Class intervals, class boundaries and limits, frequency, frequency table, class size for grouped data. (vi) Grouped frequency distributions: the need to and how to convert discontinuous intervals to continuous intervals. (vii) Drawing a frequency polygon.

(G) Mensuration: Area and perimeter of a triangle and a quadrilateral. Area and circumference of circle. Surface area and volume of Cube and Cuboids. (a) Area and perimeter of triangle (including Heron's formula), all types of Quadrilaterals. (b) Circle: Area and Circumference. Direct application problems including Inner and Outer area. Areas of sectors of circles other than quarter-circle and semicircle are not included. (c) Surface area and volume of 3-D solids: cube and cuboid including problems of type involving: Different internal and external dimensions of the solid. Cost, Concept of volume being equal to area of cross-section \times height. Open/closed cubes/cuboids.

(H) Trigonometry: Trigonometric Ratios: sine, cosine, tangent of an angle and their reciprocals. (b) Trigonometric ratios of standard angles - 0, 30, 45, 60, 90 degrees. Evaluation of an expression involving these ratios. (c) Simple 2-D problems involving one right-angled triangle. (d) Concept of trigonometric ratios of complementary angles and their direct application: $\sin A = \cos (90 - A)$, $\cos A = \sin (90 - A)$; $\tan A = \cot (90 - A)$, $\cot A = \tan (90 - A)$; $\sec A = \operatorname{cosec} (90 - A)$, $\operatorname{cosec} A = \sec (90 - A)$.

(I) Coordinate Geometry: Cartesian System, plotting of points in the plane for given coordinates, solving simultaneous linear equations in 2 variables graphically and finding the distance between two points using distance formula. (a) Dependent and independent variables. (b) Ordered pairs, coordinates of points and plotting them in the Cartesian plane. (c) Solution of Simultaneous Linear Equations graphically.

Class X

(A) Goods and Services Tax (GST): Computation of tax including problems involving discounts, list-price, profit, loss, basic/cost price including inverse cases. Candidates are also expected to find price paid by the consumer after paying State Goods and Service Tax (SGST) and Central Goods and Service Tax (CGST) - the different rates as in vogue on different types of items will be provided. Problems based on corresponding inverse cases are also included.

(B) Algebra: (i) Linear Inequations. Linear Inequations in one unknown for $x \in \mathbb{N}, \mathbb{W}, \mathbb{Z}, \mathbb{R}$. Solving: Algebraically and writing the solution in set notation form. Representation of solution on the number line. (ii) Quadratic Equations in one variable: (a) Nature of roots. Two distinct real roots if $b^2 - 4ac > 0$. Two equal real roots if $b^2 - 4ac = 0$. No real roots if $b^2 - 4ac < 0$; (b) Solving Quadratic equations by: Factorization Using Formula; (c) Solving simple quadratic equation problems). Ratio and Proportion; (d) Proportion, Continued proportion, mean proportion; (e) Componendo, dividendo, alternendo,

invertendo properties and their combinations; (f) Direct simple applications on proportions only.

(C) Factorization of polynomials: (a) Factor Theorem. (b) Remainder Theorem. (c) Factorizing a polynomial completely after obtaining one factor by factor theorem. Note: $f(x)$ not to exceed degree 3. (d) Matrices: (i) Order of a matrix. Row and column matrices. (ii) Compatibility for addition and multiplication. (iii) Null and Identity matrices. (iv) Addition and subtraction of 2×2 matrices. (v) Multiplication of a 2×2 matrix by a non-zero rational number a matrix. (vi) Arithmetic and Geometric Progression. Finding their general term. Finding Sum of their first 'n' terms. Simple Applications. (vii) Co-ordinate Geometry: (a) Reflection: (i) Reflection of a point in a line: $x=0$, $y=0$, $x=a$, $y=a$, the origin. (ii) Reflection of a point in the origin. (iii) Invariant points. (b) Co-ordinates expressed as (x,y) , Section formula, Midpoint formula, Concept of slope, equation of a line, Various forms of straight lines. (i) Section and Mid-point formula (Internal section only, co-ordinates of the centroid of a triangle included). (ii) Equation of a line: Slope –intercept form $y = mx + c$. Two-point form $(y-y_1) = m(x-x_1)$ Geometric understanding of 'm' as slope/gradient/ \tan where is the angle the line makes with the positive direction of the x axis. Geometric understanding of 'c' as the y-intercept/the ordinate of the point where the line intercepts the y axis/ the point on the line where $x=0$. By Conditions for two lines to be parallel or perpendicular. Simple applications of all the above.

(D) Factorization of polynomials: (a) Factor Theorem. (b) Remainder Theorem. (c) Factorizing a polynomial completely after obtaining one factor by factor theorem. Note: $f(x)$ not to exceed degree 3. (v) Matrices: (a) Order of a matrix. Row and column matrices. (b) Compatibility for addition and multiplication. (c) Null and Identity matrices. (d) Addition and subtraction of 2×2 matrices. (e) Multiplication of a 2×2 matrix by a non-zero rational number a matrix. (vi) Arithmetic and Geometric Progression Finding their general term. Finding Sum of their first 'n' terms. Simple Applications. (vii) Co-ordinate Geometry: (a) Reflection: (i) Reflection of a point in a line: $x=0$, $y=0$, $x=a$, $y=a$, the origin. (ii) Reflection of a point in the origin. (iii) Invariant points. (b) Co-ordinates expressed as (x,y) , Section formula, Midpoint formula, Concept of slope, equation of a line, Various forms of straight lines. (i) Section and Mid-point formula (Internal section only, co-ordinates of the centroid of a triangle included). (ii) Equation of a line: Slope –intercept form $y = mx + c$. Two-point form $(y-y_1) = m(x-x_1)$ Geometric understanding of 'm' as slope/gradient/ \tan where is the angle the line makes with the positive direction of

the x axis. Geometric understanding of 'c' as the y-intercept/the ordinate of the point where the line intercepts the y axis/ the point on the line where $x=0$. Conditions for two lines to be parallel or perpendicular. Simple applications of all the above.

(E) Geometry: (a) Similarity, conditions of similar triangles: (i) As a size transformation. (ii) Comparison with congruency, keyword being proportionality. (iii) Three conditions: SSS, SAS, AA. Simple applications (proof not included). (iv) Applications of Basic Proportionality Theorem. (v) Areas of similar triangles are proportional to the squares of corresponding sides. (vi) Direct applications based on the above including applications to maps and models. (b) Loci: Definition, meaning, Theorems and constructions based on Loci. (i) The locus of a point at a fixed distance from a fixed point is a circle with the fixed point as center and fixed distance as radius. (ii) The locus of a point equidistant from two intersecting lines is the bisector of the angles between the lines. (iii) The locus of a point equidistant from two given points is the perpendicular bisector of the line joining the points.

(F) Circles: (i) Angle Properties. The angle that an arc of a circle subtends at the center is double that which it subtends at any point on the remaining part of the circle. Angles in the same segment of a circle are equal (without proof). Angle in a semi-circle is a right angle. (ii) Cyclic Properties: Opposite angles of a cyclic quadrilateral are supplementary.

The exterior angle of a cyclic quadrilateral is equal to the opposite interior angle (without proof). (iii) Tangent and Secant Properties: The tangent at any point of a circle and the radius through the point are perpendicular to each other. If two circles touch, the point of contact lies on the straight line joining their centers. From any point outside a circle, two tangents can be drawn, and they are equal in length. If two chords intersect internally or externally then the product of the lengths of the segments are equal. If a chord and a tangent intersect externally, then the product of the lengths of segments of the chord is equal to the square of the length of the tangent from the point of contact to the point of intersection. If a line touches a circle and from the point of contact, a chord is drawn, the angles between the tangent and the chord are respectively equal to the angles in the corresponding alternate segments.

(G) Mensuration: Area and volume of solids – Cylinder, Cone and Sphere. Three-dimensional solids - right circular cylinder, right circular cone and sphere: Area (total surface and curved surface) and Volume. Direct application problems including cost, Inner and Outer volume and melting and recasting methods to find the volume or surface area of a new solid. Combination of solids included.

(H) Trigonometry: (a) Using Identities to solve/prove simple algebraic trigonometric expressions. $\sin^2 A + \cos^2 A = 1$; $1 + \tan^2 A = \sec^2 A$; $1 + \cot^2 A = \operatorname{cosec}^2 A$; $0 \leq A \leq 90$. (b) Heights and distances: Solving 2-D problems involving angles of elevation and depression using trigonometric tables.

(I) Statistics: basic concepts, Mean, Median, Mode. Histograms and Ogive. (a) Computation of: Measures of Central Tendency: Mean, median, mode for raw and arrayed data. Mean*, median class and modal class for grouped data. (Both continuous and discontinuous). Mean by all 3 methods included: Jagran josh. (b) Graphical Representation. Histograms and Less than Ogive. Finding the mode from the histogram, the upper quartile, lower Quartile and median etc. from the ogive. Calculation of inter Quartile range. 7. Probability, Random experiments, Sample space, Events, definition of probability, Simple problems on single events.

Class XI

(A): 1. Sets: (Sets and their representations. Empty set. Finite and infinite sets. Equal sets. Subsets. 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 (Ordered pairs, Cartesian product of sets. Definition of relation, pictorial diagram, domain, codomain and range of a relation. Function as a special kind of relation from one set to another. 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 grasp. Sum, difference, product and quotients of functions.)

(B): 3. Principle of Mathematical Induction (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.); 4. Complex Numbers (Introduction of complex numbers and their representation, Algebraic properties of complex numbers. Argand plane and polar representation of complex numbers. Square root of a complex number. Cube root of unity.) 5. Quadratic Equations (Statement of Fundamental Theorem of Algebra, solution of quadratic equations.)

(C): 6. Trigonometry- 1: 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. Domain and range of trigonometric functions and their graphs. Expressing $\sin(x \pm y)$ and

$\cos(x \pm y)$ in terms of $\sin x$, $\sin y$, $\cos x$ & $\cos y$ and their simple applications. Deducing the identities like the following: (picture 1) Identities related to $\sin 2x$, $\cos 2x$, $\tan 2x$, $\sin 3x$, $\cos 3x$ and $\tan 3x$.

(D): 7. Linear Inequalities: (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.); 8. Sequences and Series. Sequence and Series. Arithmetic Progression (A.P.), Arithmetic Mean (A.M.). Geometric Progression (G.P.), general term of a G.P., sum of first n terms of a G.P., infinite G.P. and its sum, geometric mean (G.M.), relation between A.M. and G.M. Formulae for the following special sums $\sum n$, $\sum n^2$, $\sum n^3$.

(E): 9. Trigonometry- 2: General solution of trigonometric equations of the type $\sin y = \sin a$, $\cos y = \cos a$ and $\tan y = \tan a$. Properties of triangles (proof and simple applications of sine rule cosine rule and area of triangle). 10. Permutations and Combinations: Fundamental principle of counting. Factorial n . ($n!$) Permutations and combinations, derivation of formulae and their connections, simple application. 11. Binomial Theorem History, statement and proof of the binomial theorem for positive integral indices. Pascal's triangle, General and middle term in binomial expansion, simple applications.

(F): 12. Straight Lines: Shifting of origin. Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axis, 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. 13. Coordinate Geometry: Brief recall of two-dimensional geometry from earlier classes.

(G): 14. Conic Sections: Sections of a cone, 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. 15. Mathematical Reasoning 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 the mathematics and real life. Validating the statements involving the connecting words, difference between contradiction, converse and contrapositive. 16. Introduction to 3-D Geometry: Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points and section formula.

(H): 17. Limits and Derivatives: Derivative introduced as rate of change both as that of distance function and geometrically. Intuitive idea of limit. Limits of polynomials and rational functions trigonometric, exponential and logarithmic functions. 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.

(I): 18. Statistics: Measures of dispersion: range, mean deviation, variance and standard deviation of ungrouped/grouped data. Analysis of frequency distributions with equal means but different variances; 19. Probability: 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 other theories studied in earlier classes. Probability of an event, probability of 'not', 'and' and 'or' events.

Class XII

(A): 1. Continuity and Differentiability: Continuity, Differentiability and Differentiation. Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit functions. Concept of exponential and logarithmic functions. Derivatives of logarithmic and exponential functions. Logarithmic differentiation, derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems and their geometric interpretation.

2. Application of Derivatives: Applications of derivatives: rate of change of bodies, increasing/decreasing functions, tangents and normal, use of derivatives in approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations).

(B): 3. Relations and Functions: Types of relations: reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, inverse of a function. Binary operations. 4. Inverse Trigonometric Functions. Definition, domain, range, principal value branch. Graphs of inverse trigonometric functions. Elementary properties of inverse trigonometric functions.

(C): 5. Matrices: Concept, notation, order, equality, types of matrices, zero and identity matrix, transpose of a matrix, symmetric and skew symmetric matrices. Operation on matrices: Addition and multiplication and

multiplication with a scalar. Simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order up to 3). Concept of elementary row and column operations. Invertible matrices and proof of the uniqueness of inverse, if it exists (here all matrices will have real entries). 6. Determinants: Determinant of a square matrix (up to 3×3 matrices), properties of determinants, minors, co-factors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

(D): 7. Integration- 1: (Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, Evaluation of simple integrals of the following types and problems based on them.)

(E): 8. Integration- 2: (Definite integrals as a limit of a sum, Fundamental Theorem of Calculus. Basic properties of definite integrals and evaluation of definite integrals) 9. Application of Integration Application in finding the area bounded by simple curves and coordinate axes. Area enclosed between two curves.

(F): 10. Differential Equations- 1: Definition, order and degree, general and particular solutions of a differential equation. Solution of differential equations by method of separation of variables solutions of homogeneous differential equations of first order and first degree. Formation of differential equation whose general solution is given. Solution of differential equations by method of separation of variables solutions of homogeneous differential equations of first order and first degree.

(G): 11. Differential Equations-2: Solutions of linear differential equation of the type: $dy/dx + py = q$, where p and q are functions of x or constants. $dx/dy + px = q$, where p and q are functions of y or constants. 12. Vector Algebra: Vectors and scalars, magnitude and direction of a vector. Direction cosines and direction ratios of a vector. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position, vector of a point dividing a line segment in a given ratio. Definition, Geometrical Interpretation, properties and application of scalar (dot) product of vectors, vector (cross) product of vectors, scalar triple product of vectors.

(H): 13. Three-Dimensional Geometry: Direction cosines and direction ratios of a line joining two points. Cartesian equation and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes, (iii) a line and a plane. Distance of a point from a plane. 14. Linear Programming: Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming (L.P.) problems, mathematical formulation of L.P. problems, graphical method of solution for problems in two variables, feasible and infeasible regions (bounded and unbounded), feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).

(I): 15. Probability: Conditional probability, multiplication theorem on probability, independent events, total probability, Bayes' theorem, Random variable and its probability distribution, mean and variance of random variable. Repeated independent (Bernoulli) trials and Binomial distribution.