

Mathematics - XI

Time/ Periods	Topic/ Theme	Subject Matter	Activities
Unit-I			
Sets and Functions			
Periods 10	1. Sets	<p>Sets and their representation, types of sets, equality of sets, subsets, subsets of the set of real numbers especially intervals (with notations) power set, universal set. Venn Diagrams union and intersection of sets. Difference of sets. Complement of set.</p> <p>*Ordered pairs, Cartesian product of sets, Number of elements in the Cartesian product of two finite sets. Cartesian product of the reals with itself (upto $\mathbb{R} \times \mathbb{R} \times \mathbb{R}$).</p>	
Periods 14	2. Relations and Functions.	<p>Definition of relation, pictorial diagrams, domain, Co-domain and range of a relation, Functions as a special kind of relations from one set to another. Pictorial representation of a</p>	

		function, domain, co-domain and range of a function, Real valued functions, Constant identity, polynomial, rational, modulus and greatest integer functions with their graphs, sum, difference, product and quotient of functions.	
Unit-II Trigonometry			
Periods 16	3. Trigonometry	Recall of the concept of measurement of angle in different systems, Sexagesimal, Centesimal, and Circular and also of trigonometric ratios.	
		* Extension of the concept of T-Ratios with the help of unit circle, Truth of identity, $\sin^2x + \cos^2x = 1$ for all x . Trigonometric ratios as functions. Graphs of trigonometric functions. Addition and subtraction formula of $\sin\theta$, $\cos\theta$, $\tan\theta$ and $\cot\theta$ etc. A, B and C, D formulae. Trigonometric ratios of multiples and sub-multiples of angles. Genera	

		I solutions of trigonometric equations. Proofs and simple applications of sine & cosine formulae.	
Unit-III			
Logarithms			
Periods 5	1. Logarithms	Meaning of logarithm of a number of a given base 'a' $a > 0, a \neq 1$. Laws of logarithms including change of base. Common logarithms (base 10) Characteristics and mantissa. Antilogarithms, Logarithmic tables	
		.Simple Problems on Logarithms.	
Unit-IV			
Algebra			
Periods 6	1. Principle of Mathematical Induction	Processes of 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.	
Periods 10	2. Complex Numbers and Quadratic Equations	— Need for complex numbers especially $\sqrt{-1}$ to be motivated by inability t	

		<p>o solve every quadratic equation. Brief discussion of algebraic properties of complex numbers. Argand diagram. Argand plane and polar representation of complex numbers.</p> <p>*To find the square root of a complex nos. Cube roots of unity. Statement of Fundamental theorem of algebra.</p> <p>Recall of the concept of quadratic equations and its solutions in real No. system Solution of quadratic equation with real coefficient in the complex number system.</p>	
<p>Periods 10</p>	<p>3. Linear Inequalities</p>	<p>Linear inequalities, Algebraic solution of liner inequalities in one variable and their representation on the number line. Graphical solution of linear inequalities in two variables. Solution of system of linear inequalities in two variables graphically.</p>	

<p>Periods 10</p>	<p>4. Sequence and Series</p>	<p>Sequence and series. Recall of the concept of A.P. its n^{th} term and sum of n terms. Arithmetic mean (A.M.). Geometric progression. General term of G.P., Sum of n terms of a G.P. , Geometric Mean (G.M.) Relation between A.M. and G.M. sum to n terms of the special series $\sum n$, $\sum n^2$, $\sum n^3$.</p>	
<p>Periods 12</p>	<p>5. Permutations & Combination</p>	<p>Fundamental Principle of counting, Factorial n. Permutation and combination derivations of formulae and their connections, simple applications.</p>	
<p>Periods 8</p>	<p>6. Binomial Theorem</p>	<p>History, Pascal's Triangle, Statement and proof of binomial theorem for positive integral index. General and middle term in binomial expansion, simple applications.</p> <p>Binomial theorem for any index (without proof) Simple problems to be given.</p>	

Unit-V Co-ordinate Geometry			
Periods 9	1. Straight Lines	Brief recall of 2D Co-ordinate geometry from earlier classes. Slope of a line and angle between two	
		lines. Various forms of equation of lines: Parallel to axes, Point Slope form, Slope intercept form, two point form, intercepts form and normal form. General Equation of a line. Distance of a point from a line.	
Periods 12	2. Conic Section	Section of a cone, Circles, Ellipse, Parabola, Hyperbola, Point, A straight line and 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: its center and radius	Conic section can be shown to the students by sliding the cone at different positions.

Periods 8	3. Introduction to Three Dimensional Geometry	Co-ordinate axes and co-ordinate planes in three dimensions. Co-ordinates of a point. Distance between two points and section formulae.	
Unit-VI Calculus			
Periods 18	1. Limit Continuity & Derivatives	Concept of limit, Algebra of limits of polynomial and rational functions. Limits of Trigonometric functions, Continuity of a function. Derivative introduced as rate of change both as that of distance function and geometrically. Definition of a derivative, related to slope of tangent of the curve, derivative of sum, difference, product and quotient of functions, derivative of polynomial and trigonometric function.	
Unit-VII Mathematical Reasoning			

<p>Periods 8</p>	<p>1. Mathematical Reasoning</p>	<p>Mathematically acceptable statements. Connecting words/phrases. Consolidating the understanding of “if and only if” (necessary and sufficient conditions” , “implies”, and/or”, “implied by”, “and”, “or”, “there exists” and their use through variety of examples related to real life and</p>	
		<p>mathematics validating the statements involving the connecting words difference between contradiction, converse and contrapositive.</p>	
<p>Unit-VIII Statistics and Probability</p>			
<p>Periods 10</p>	<p>1. Statistics</p>	<p>Measures of dispersion, Mean deviation, Variance and Standard deviation of ungrouped/grouped data. Analysis of frequency distribution with equal means but different variance.</p>	

<p>Periods 14</p>	<p>2. Probability.</p>	<p>Recall the concept of probability from previous classes. Random experiments : Outcomes, sample spaces (set representation). Events :Occurance of events, 'not', 'and', & 'or' events. Exhaustive envents, mutually exclusive evetns. Axiomatic (set theoretic) Probability, connections with the theories of earlier classes. Probability of an event, probability of 'not'.</p>	
<p>Appendix</p>			
	<p>1. Infinite Series</p>	<p>Infinite geometric series, exponential and logarithmic series.</p>	
	<p>2. Mathematical Modelling</p>	<p>Consolidating the understanding developed upto Class X. Focus on modelling problems related to real life (Like environment, travel etc.) and connecting with other subjects of studies where many constraints may</p>	

		need to be ignored, formulating the model, looking for solutions, interpreting them in the problem situation and evaluating the model.	
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Mathematics – XII

Time Frame	Topic/ Theme	Subject Matter	Activities
		UNIT-I (More About Functions)	
	1. Functions	Recall of concept of functions from previous class. Types of functions i.e. One-One, Many One, Into and Onto functions, Composite functions, Inverse of a function, Binary Operations.	
	2. Inverse Trigonometric Functions	Definition, Range, Domain, Principal value, Principal branches, Graph of Inverse Trigonometric functions, Elementary properties of Inverse Trigonometric Functions.	
Unit-II			
Algebra			
	1. Matrices.	Concept, notation, order, equality, types of matrices, zero matrix, transpose of a matrix, Symmetric and skew-symmetric matrix, addition, multiplication and multiplication of matrix by a scalar, Properties of addition, multiplication of matrices and properties of multiplication of a matrix by a scalar. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (Restricted to	

		square matrices of order 2). Concept of elementary row and column operation. Invertible matrices and proof of the uniqueness of inverse if it exists (Here all matrices have real entries).	
	2. Determinants	Determinants of a square matrix (upto 3x3 matrices), Properties of determinants, minors, co-factors and application of determinants in finding the area of triangle, Adjoint and inverse of a square matrix, consistency, inconsistency, and number of solutions of system of linear equations in two or three variables (having unique solutions) using inverse of a matrix.	
Unit-III Calculus			
	1. Derivatives	Recall of the concept of derivatives of a function. Derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit functions, concept of exponential and logarithmic functions and their derivatives. Logarithmic differentiation, derivative of functions expressed in	

		parametric forms, Second order derivatives, Roll's and Lagrange's mean value theorms (without proof) and their geometric interpretations.	
	2. Applications of Derivatives.	Applications of derivatives, rate of change, increasing/decreasing functions, tangents and normals, 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).	
	3. Integrats	<p>Integration as inverse process of differentiation, integration of a variety of functions by substitution, by partial fractions and by parts, only simple integrals of the type :</p> $\int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{a^2 - x^2},$ $\int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}$ $\int \frac{(px + q)}{ax^2 + bx + c} dx, \int \frac{(px + q)}{\sqrt{ax^2 + bx + c}} dx,$ $\int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}$ $\int \frac{(px + q)}{ax^2 + bx + c} dx, \int \frac{(px + q)}{\sqrt{ax^2 + bx + c}} dx,$	

		$\int \sqrt{x^2 \pm a^2} dx \quad \int \sqrt{x^2 - a^2} dx,$ $\int \sqrt{ax^2+bx+c} dx \quad \int (px+q)$ $\sqrt{ax^2+bx+c} dx,$ $\int \frac{dx}{a + b \cos x}, \quad \int \frac{dx}{a + b \sin x},$ $\int \frac{dx}{a + b \cos x + c \sin x} \quad \int \frac{x^2 + 1}{x^4 + kx^2 + 1} dx,$ $\frac{x^2 - 1}{x^4 + kx^2 + 1} dx,$ <p>& integration of inverse trigonometric functions.</p>	
	4. Applications of the Integrals	Use of definite integrals in finding the area under simple curves, especially lines, areas of circles/parabolas/ ellipses (in standard form only), area between the two above said curves (The region should be clearly identifiable).	
Unit-IV Vectors & Three Dimensional Geometry			
	1. Vectors	Vectors and scalars, magnitude and direction of a vector, Direction Cosines/ratios of vectors, 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, position vector of a line, position vector of a point dividing a line segment in a given ratio. Scalar (dot) product of vectors, projection of a vector on a line. Vector (cross) product of vectors, Scalar triple product and vector triple product.	
	2. Three Dimensional Geometry	Direction cosines/ratio of a line joining two points, Cartesian and vector equation of a line, coplanar and skew lines, shortest distance between two lines, Cartesian and vector equation of a plane, Angles between (i) two lines (ii) two planes (iii) a line and a plane. Distance of a point from a plane. Sphere, its center and radius, diameter form of the equation of a sphere.	
UNIT-V (Linear Programming)			
	1. Linear Programming	Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming problems (L.P.P.). Mathematical formulation of L.P.P. Graphical method of solution for problems in two variables, feasible and infeasible regions. Feasible and	

		infeasible solutions, optimal feasible solution (upto three non-trivial constraints).	
Unit-VI Probability			
	1.Probability	Recall of the concept of probability from previous class. Addition and multiplication theorems on probability. Conditional probability, independent events, total probability. Baye's Theorem, Random variable and its probability distribution, mean and variance of random variables, Repeated independent (Bernoulli) trials and Binomial distribution.	
APPENDIX			
	1. Proofs in Mathematics	Through a variety of examples, related to mathematics and already familiar to	
		the learner, bring out different kinds of proofs, direct, contrapositive, by contradiction, by counter example.	

	2. Mathematical Modeling	Modeling real life problems where many constraints may really need to be ignored (Continuing from Class XI). However now the models concerned would use techniques / results of matrices, calculus and linear programming.	
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