MATHEMATICS

CLASS - XII

One Paper *Time : 3 Hours* *100 Marks*

Units	Unitwise Weightage	Marks	Periods
I.	**Relations and Functions [10 marks]**		
	1. Relations and Functions	5	9
	2. Inverse Trigonometric Functions	5	9
II.	**Algebra [13 marks]**		
	1. Matrices	7	13
	2. Determinants	6	11
III.	**Calculus [44 marks]**		
	1. Continuity and Differentiability	10	18
	2. Applications of Derivatives	8	14
	3. Integrals	14	26
	4. Applications of Integrals	4	7
	5. Differential Equations	8	14
IV.	**Vectors and Three Dimensional Geometry [17 marks]**		
	1. Vectors	8	14
	2. Three dimensional Geometry	9	16
V.	**Linear Programming [06 marks]**	6	11
VI.	**Probability [10 marks]**	10	18
	Total :	**100**	**180**

Unit-I: Relations and Functions [10 marks]

1. Relations and Functions :

Relation in a set. Types of relations, reflexive, symmetric, transitive and equivalence relations. Types of functions, injective (one-one), subjective (onto), bijective functions. Inverse of a function, Composite of functions. Binary operations.

2. Inverse Trigonometric Functions :

Definition, range, domain, principal value branches. Graphs of inverse trigonometric functions, Elementary properties of inverse trigonometric functions.

Unit-II: Algebra [13 marks]

Matrices :

Concept, notation, order, equality, types of matrices, zero-matrix, transpose of a matrix, symmetric and skew symmetric matrices. Addition, multiplication and scalar multiplication of matrices, 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 2) 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).

Determinants :

Determinant of a square matrix (upto 3x3 matrices), properties of determinants, minors, cofactors 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.

Unit-III: Calculus [44 marks]

1. Continuity and Differentiability :

Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit function. Concept of exponential and logarithmic functions and their derivatives. Logarithmic differentiation. Derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretations and simple applications.

$\int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}$,

2. Applications of Derivatives :

Applications of derivatives : rate of change, increasing/decreasing functions, tangents & 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. Integrals :

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

$$\int \frac{(px+q)}{ax^2+bx+c}dx, \int \frac{(px+q)}{\sqrt{ax^2+bx+c}}dx, \int \sqrt{a^2 \pm x^2}\,dx \text{ and } \int \sqrt{x^2 - a^2}\,dx$$

$$\int \sqrt{ax^2+bx+c}\,dx, \int (px+q)\sqrt{ax^2+bx+c}\,dx$$

to be evaluated.

Definite integrals as a limit of a sum. Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

4. Applications of Integrals :

Application in finding the area under simple curves, especially lines, areas of circles, parabolas/ellipses (in standard form only), area under the curves $y = \sin x$, $y = \cos x$, etc. area between the two above said curves (the region should be clearly identifiable).

5. Differential Equations :

Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given. Solution of differential equations by method of separation of variables, homogeneous differential equations of first order and first degree. Solutions of linear differential equations of the type :

$\frac{dy}{dx} + p(x)y = q(x)$, where $p(x)$ and $q(x)$ are functions of x and

$\frac{dx}{dy} + p(y) = q(y)$, where $p(y)$ and $q(y)$ are functions of y.

Unit-IV: Vectors and Three dimensional Geometry [17 marks]

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 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.

2. Three-dinensional Geometry :

Direction cosines, direction ratios. Cartesian and Vector equation of a line, Coplanar lines, 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. Conditions for perpendicularity and parallelism. Distance of a point from a plane.

Unit-V: Linear Programming [6 marks]

1. Linear Programming :

Introduction, definition of 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 of problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solutions (upto three non-trivial constraints).

Unit-VI: Probability [10 marks]

1. Probability :

Multiplication theorem on probability, Conditional probability, independent events, total probability, Baye's theorem. Random variable and its probability distribution, mean and variance of random variable. Repeated independent (Bernoulli) trails and Binomial distribution.

Appendix :

1. Proofs in Mathematics :

Through a variety of examples related to mathematics & already familiar to the learner, bring out different kinds of proofs : direct, contrapositive, by contradiction, by counter example.

2. Mathematical Modelling :

Modelling 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.

PRESCRIBED TEXTBOOK :

Mathematics Part I & II (Textbook for Class XII)
Published by : The Council of Higher Secondary Education, Manipur with copy right from the NCERT, New Delhi.

REFERENCE BOOKS :

1. A Textbook of Mathematics Book-II for Class XII
By : S.N. Chhibber, G.D. Dhall & J.C. Nijhawan.
Published by : Macmillan Publishers India Pvt. Ltd.

2. Modern's abc of Mathematics for Class XII
By : J.P. Mohindru
Published by : Modern Publishers, Jalandhar.

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