SYLLABUS

MATHEMATICS (041)
(THEORY)
CLASS XII (2022-23)

Time : 3 Hours			Marks : 80	
No.	Units	No. of Periods	Marks	
I.	Relations and Functions	30	8	
II.	Algebra	50	10	
III.	Calculus	80	35	
IV.	Vectors and Three-Dimensional Geometry	30	14	
V.	Linear Programming	20	5	
VI.	Probability	30	8	
	Total	240	80	
	Internal Assessment		20	

UNIT I : Relations and Functions

1. Relations and Functions   **15 Periods**

Types of relations : reflexive, symmetric, transitive and equivalence relations. One to one and onto functions.

2. Inverse Trigonometric Functions   **15 Periods**

Definition, range, domain, principal value branch. Graphs of inverse trigonometric functions.

UNIT II : Algebra

1. Matrices   **25 Periods**

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. On commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2). Invertible matrices and proof of the uniqueness of inverse, if it exists; (Here all matrices will have real entries).

2. Determinants   **25 Periods**

Determinant of a square matrix (up to 3×3 matrices), 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.

UNIT III : Calculus

1. Continuity and Differentiability
20 Periods

Continuity and differentiability, chain rule, derivative of inverse trigonometric functions, like $\sin^{-1}x$, $\cos^{-1}x$ and $\tan^{-1}x$, 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.

2. Applications of Derivatives
10 Periods

Applications of derivatives : rate of change of bodies, increasing/decreasing functions, 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
20 Periods

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.

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

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

$$\int \sqrt{ax^2 + bx + c}\; dx,$$

Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

4. Applications of the Integrals
15 Periods

Applications in finding the area under simple curves, especially lines, circles/parabolas/ellipses (in standard form only).

5. Differential Equations
15 Periods

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. Solutions of linear differential equation of the type :

$$\frac{dy}{dx} + py = q, \text{ where } p \text{ and } q \text{ are functions of } x \text{ or constants.}$$

$$\frac{dx}{dy} + px = q, \text{ where } p \text{ and } q \text{ are functions of } y \text{ or constants.}$$

Unit-IV : Vectors and Three-Dimensional Geometry

1. Vectors
15 Periods

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.

2. Three - dimensional Geometry

Direction cosines and direction ratios of a line joining two points. Cartesian equation and vector equation of a line skew lines, shortest distance between two lines. Angle between two lines.

Unit-V : Linear Programming

1. **Linear Programming**

Introduction, related terminology such as constraints, objective function, optimisation, graphical method of solution for problems in two variables, feasible and infeasible regions (bounded or unbounded), feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).

Unit-VI : Probability

1. **Probability**

Conditional probability, multiplication theorem on probability, independent events, total probability, Bayes' theorem, Random variable and its probability distribution, mean of random variable.