CLASS-XII
16. MATHEMATICS

Time: 3 Hrs

Theory: 90 Marks
CCE: 10 Marks
Total: 100 Marks

1.   All Questions are Compulsory.

2.   Q 1 will consist of 10 parts and each part will carry one (1) Mark.

3.   Q 2 to Q 9 each will be of 2 Marks.

4.   Q 10 to Q 19 each will be of 4 marks.

5.   Q 20 to 23 each will of 6 marks.

6.   There will be no overall choice. There will be an internal choice in any 3 questions of 4 marks each and all questions of 6 marks.(Total of 7 internal choices)

7.   Use of Calculator is not allowed.

Sr. No	Topic	Q. Carrying 1-Marks	Q. Carrying 2-Marks	Q.Carrying 4-Marks	Q.Carrying 6-Marks	Total Marks
1.	Relations & Functions	1	-	1	-	05
2.	Inverse Trigonometric Functions	1	-	1	-	05
3. 4.	Matrices Determinants	1	1	1	1	13
5.	Continuity & Differentiability	2	1	1	-	08
6.	Applications of Derivatives	-	-	1	1	10
7.	Integrals	1	2	1	-	09
8.	Applications of the Integrals	-	-	1	-	04
9.	Differential Equations	1	2	1	-	09
10.	Vectors	1	-	1	-	05
11.	Three-dimensional Geometry	1	1	-	1	09
12.	Linear Programming	-	-	-	1	06
13.	Probability	1	1	1	-	07
	Total Questions	**1 (10Parts)**	**8**	**10**	**4**	**23**
	Total Marks	**10**	**16**	**40**	**24**	**90**

SYLLABUS

1   Relations and Functions:
Types of relations: Reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, composite functions, inverse of a function. Binary operations.

2   Inverse Trigonometric Functions:
Definition, Range, Domain, Principal value branches. Graphs of inverse trigonometric functions. Elementary properties of inverse trigonometric functions.

3   **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).

4   **Determinants:**

Determinant of a square matrix (up to 3×3matrices), 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 equation by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

5   **Continuity and Differentiability**:

Continuity and Differentiability, derivative of composite functions, chain rule, derivative of inverse trigonometric functions, derivative of implicit function. Concepts of exponential and logarithmic functions. Derivatives of $\log_e x$ and e^x. 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.

6   **Applications of Derivatives**

Applications of derivatives: rate of change, increasing/decreasing functions, tangents and normal, 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).

7   **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:

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

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

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

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. .

8   Applications of the Integrals:

Applications 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).

9   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 equation of the type:

$$\frac{dy}{dx} + Py = Q$$

where P and Q are functions of x or constant.

$$\frac{dx}{dy} + Px = Q$$

where P and Q are functions of y or constant

10   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.

11   Three-dimensional Geometry:

Direction cosines/ ratios 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. Angle between (i) two lines, (ii) two planes, (iii) a line and a plane. Distance of a point from a plane.

12   Linear Programming:

Introduction, definition of related terminology such as constraints, objectives 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, feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constrains)

13   Probability:

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

Note:- The subtopics which are printed in the books published by Punjab School Education Board but are not mentioned in syllabus, should be considered as part of syllabus.