MATHEMATICS

SYLLABUS FOR HIGHER SECONDARY COURSE

The Syllabus in the subject of Mathematics has undergone changes from time to time in accordance with growth of the subject and emerging needs of the society. Senior Secondary stage is a launching stage from where the students go either for higher academic education in Mathematics or for professional courses like engineering, physical and Bioscience, commerce or computer applications. The present revised syllabus has been designed in accordance with National Curriculum Frame work 2005 and as per guidelines given in Focus Group on Teaching of Mathematics 2005 which is to meet the emerging needs of all categories of students. Motivating the topics from real life situations and other subject areas, greater emphasis has been laid on application of various concepts.

Objectives

The broad objectives of teaching Mathematics at senior school stage intend to help the pupil:

- ❖ To acquire knowledge and critical understanding, particularly by way of motivation and visualization, of basic concepts, terms, principles, symbols and mastery of underlying processes and skills.
- ❖ To feel the flow of reasons while proving a result or solving a problem.
- ❖ To apply the knowledge and skills acquired to solve problems and wherever possible, by more than one method.
- ❖ To develop positive attitude to think, analyze and articulate logically.
- ❖ To develop interest in the subject by participating in related competitions.
- ❖ To acquaint students with different aspects of mathematics used in daily life.
- ❖ To develop an interest in students to study mathematics as a discipline.
- ❖ To develop awareness of the need for national integration, protection of environment, observance of small family norms, removal of social barriers, elimination of sex biases.
- ❖ To develop reverence and respect towards great Mathematicians for their contributions to the field of Mathematics.

MATHEMATICS

SYLLABUS FOR HIGHER SECONDARY FINAL YEAR COURSE

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

Unitwise Distribution of Marks and Periods :

Unit No.	Title	Marks	Periods
Unit-I	Relations and Functions	10	28
Unit-II	Algebra	13	40
Unit-III	Calculus	44	72
Unit-IV	Vectors and Three-Dimensional Geometry	17	25
Unit-V	Linear Programming	06	15
Unit-VI	Probability	10	20
	Total	**100**	**200**

APPENDIX :

1. **Proofs in Mathematics :**
2. **Mathematical Modelling :**

Unitwise Distribution of Course contents :

Unit-I : RELATIONS AND FUNCTIONS

1. ***Relations and Functions :*** ***(Periods 14)***

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 :*** ***(Periods 14)***

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

Unit-II : ALGEBRA

1. ***Matrices :*** ***(Periods 20)***

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).

2. ***Determinants :*** ***(Periods 20)***

Determinant of a square matrix (up to 3×3 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 example, 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 :*** ***(Periods 20)***

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.

2. ***Application of Derivatives :*** ***(Periods 10)***

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. ***Integrals :*** ***(Periods 20)***

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.

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

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

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

and $\int \sqrt{x^2 - a^2}\,dx$ 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 the Integrals :*** ***(Periods 10)***

Applications in finding the area under simple curves, especially lines, arcs of circles/ parabolas/ ellipses (in standard form only), area between the two above said curves (the region should be clearly identifiable).

5. ***Differential Equations :*** ***(Periods 12)***

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.

Unit-IV : VECTORS AND THREE-DIMENSIONAL GEOMETRY

1. ***Vectors :*** ***(Periods 10)***

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.

2. ***Three-dimensional Geometry :*** ***(Periods 15)***

$\int \sqrt{a^2 + x^2}\,dx$.

Direction cosines/ ratios of a line joining two points. Cartesian and vectors 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.

Unit-V : LINEAR PROGRAMMING ***(Periods 15)***

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, feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).

Unit-VI : PROBABILITY ***(Periods 20)***

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.

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 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.

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