

WEST BENGAL COUNCIL OF HIGHER SECONDARY EDUCATION

SYLLABUS FOR CLASS XII

SUBJECT : MATHEMATICS (MATH)

Course Objectives

The Mathematics curriculum has undergone periodic revisions in response to the field's expansion and the changing demands of society. The senior secondary stage serves as a springboard for students to pursue professional programs in engineering, physical and biological science, commerce, or computer applications, or to pursue higher education in mathematics. In order to address the evolving demands of all student categories, the current revised syllabus has been created. More focus has been placed on the application of certain principles, drawing inspiration for the issues from real-world scenarios and other academic disciplines.

The following are the main goals of teaching mathematics to senior school students:

- To develop general interest in Mathematics as a discipline.
- To gain critical insight and knowledge of fundamental terminology, concepts, principles, symbols, and skills, especially through motivation and visualization, as well as mastery of underlying procedures and abilities.
- To experience the logic flowing while demonstrating an outcome or resolving an issue.
- To use the gained information and abilities to solve issues, using many approaches where feasible.
- To familiarize students with the various applications of mathematics in everyday life.
- Developing a sense of appreciation and respect for notable mathematicians and their contributions to mathematics is important.
- To cultivate an optimistic outlook in order to reason, evaluate, and speak coherently.
- To cultivate curiosity for the topic by taking part in competitions related to it.

Course Outcomes

At the end of the course the students are expected to develop expertise in various areas of the subject and gain critical insights into the background dynamics of the problem solving process.

The following are the major course outcomes. A student is expected to:

- Develop problem solving skills and apply mathematical concepts to real life situations.
- Cultivate critical thinking and analytical skills in mathematical context.
- Collaborate with peers to solve complex mathematical problems.
- Make predictions and draw conclusions based on statistical data.
- Get a preliminary idea of using technology, like calculators in problem solving.
- Effectively communicate mathematical ideas and solutions both verbally and in writing.
- Present mathematical arguments and justifications.
- Prepare for standardized examinations based on the curriculum.
- Understand the relevance of mathematics in real-world applications.

CLASS - XII

SEMESTER – III

SUBJECT: MATHEMATICS (MATH)

FULL MARKS: 40

CONTACT HOURS: 100 Hours

COURSE CODE : THEORY

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT-I	RELATIONS AND FUNCTIONS	20	7
	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.	10	4
	2. Inverse Trigonometric Functions Definition, range, domain, principal value branches. Graphs of inverse trigonometric functions. Elementary properties of inverse trigonometric functions.	10	3
UNIT- II	ALGEBRA	25	10
	1. Matrices Concept, notation, order, equality, types of matrices, zero matrix, identity matrix, transpose of a matrix, symmetric and skew-symmetric matrices. Addition, multiplication and scalar multiplication of matrices; properties of addition, multiplication and scalar multiplication. Simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices. Existence of non-zero matrices whose product is a 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).	15	6
	2. Determinants Determinant of a square matrix (upto 3×3 matrices), properties of determinants, minors, cofactors and application 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. Solutions of system of linear equations in two or three variables (having unique solution) using inverse of a matrix.	10	4

UNIT No.	TOPICS	CONTACT HOURS	MARKS
UNIT-III	CALCULUS	38	15
	<p>1. Continuity and Differentiability</p> <p>Concept of Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, 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.</p> <p>2. Application of Derivatives</p> <p>Application of derivatives, Rate of change of quantities, increasing and decreasing functions, tangents and normals, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems on basic principles and real life situations.</p>	<p>20</p> <p>18</p>	<p>8</p> <p>7</p>
UNIT-IV	PROBABILITY	17	8
	Conditional Probability, Multiplication theorem on probability, independent events, total probability, Bayes' theorem, Random variable and its probability distribution. Mean and variance of a random variable.		

SEMESTER – IV**SUBJECT: MATHEMATICS (MATH)****FULL MARKS: 40****CONTACT HOURS: 80 HOURS****COURSE CODE : THEORY**

UNIT No.	TOPICS	CONTACT HOURS	MARKS
Unit-I	VECTORS AND THREE-DIMENSIONAL GEOMETRY	30	15
	<p>1. Vectors</p> <p>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.</p> <p>2. Three-Dimensional Geometry</p> <p>Introduction to 3D geometry, Coordinate axes and coordinate planes in 3D. Coordinates of a point, distance between two points, Direction cosines and direction ratios of a line joining points. Cartesian equation and vector equation of a line, skew lines, shortest distance between two lines. Angle between two lines.</p>	<p>10</p> <p>20</p>	<p>5</p> <p>10</p>
Unit-II	CALCULUS	40	20
	<p>1. Integrals</p> <p>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.</p> $\int \frac{dx}{x^2 \pm a^2} \int \frac{dx}{\sqrt{x^2 \pm a^2}} \int \frac{dx}{\sqrt{a^2 - x^2}} \int \frac{dx}{ax^2 + bx + c} \int \frac{dx}{\sqrt{ax^2 + bx + c}}$ $\int \frac{px+q}{ax^2+bx+c} dx \int \frac{px+q}{\sqrt{ax^2+bx+c}} dx \int \sqrt{a^2 \pm x^2} dx \int \sqrt{x^2 - a^2} dx$ $\int \sqrt{ax^2 + bx + c} dx$ <p>Fundamental theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.</p>	<p>20</p>	<p>9</p>

UNIT No.	TOPICS	CONTACT HOURS	MARKS
	<p>2. Applications of the Integrals</p> <p>Applications in finding the area under simple curves, especially lines, circles/parabolas/ ellipses (in standard form only)</p> <p>3. Differential Equations</p> <p>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:</p> $\frac{dy}{dx} + py = q \text{ where } p \text{ and } q \text{ are functions of } x \text{ or constants}$ $\frac{dx}{dy} + px = q \text{ where } p \text{ and } q \text{ are functions of } y \text{ or constants}$	<p>10</p> <p>10</p>	<p>6</p> <p>5</p>
Unit-III	LINEAR PROGRAMMING	10	5
	Introduction, related terminology such as constraints, objective function, optimization, 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).		

[Note:20 Hours reserved for Remedial classes, Tutorials and Home Assignments.]

Course: Project for Class XII

Full Marks: 20

Projects should be conducted regularly throughout the year. A project notebook is to be prepared by each and every student where all the below mentioned activities should be recorded. There should be a project assessment once a year (once in Class XI and once in Class XII) where the student will be asked to do one of the activities and write it in his/her script provided for the purpose. The student should carry his/her project notebook during the assessment. A viva should also be conducted during the assessment to test the knowledge of the student regarding the project activity.

List of Projects for Class XII

<u>Sl. No.</u>	<u>Topics</u>	<u>Activities</u>
1.	Relations and Function	To verify that the relation R in the set L of all straight lines in a plane, defined by $R = \{(l, m): l \parallel m\}$ is an equivalence relation,
2.	Relations and Function	To demonstrate a function which is one-one but not onto.
3.	Relations and Function	To demonstrate a function which is not one-one but onto.
4.	Differential Calculus	To find analytically the limit of a function $f(x)$ at $x = c$ and also to check the continuity of the function at that point.
5.	Differential Calculus	To verify that amongst all the rectangles of the same perimeter, the square has the maximum area.
6.	Differential Calculus	To understand the concepts of absolute maximum and minimum values of a function in a given closed interval through its graph.
7.	Three-Dimensional Geometry	To explain the concept of octant by three mutually perpendicular planes in space.
8.	Three-Dimensional Geometry	To measure the shortest distance between two skew lines and verify it analytically.
9.	Probability	To explain the computation of conditional probability of a given event A , when event B has already occurred, through an example of throwing a pair of dice.
10.	Linear Inequalities	To verify that a given inequality of the form $ax + by + c < 0$, $a, b > 0$, $c < 0$ represents only one of the two half planes.

Marks division for the Project Assessment

<u>Sl. No.</u>	<u>Item</u>	<u>Marks</u>
1.	Project Notebook	10
2.	Doing and Writing a project during the project assessment	05
3.	Viva	05
	Total	20