

# **Modified Syllabus 2020-21**

## **MATHEMATICS (+2 2<sup>nd</sup> year) Course Structure**

### **UNIT - I : Relations and Functions**

#### **1. Relations and Functions**

Types of relations; reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, composite functions, inverse of function. Binary operations.

#### **2. Inverse Trigonometric Functions**

Definition, range, domain, principle value branch.

#### **3. Linear Programming**

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

### **UNIT - II : Algebra**

#### **1. Matrices**

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. 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

#### **2. Determinants**

Determinant of a square matrix (up to  $3 \times 3$  matrices), properties of determinants, minors, co-factors and applications of determinants in finding the area of a triangle, Adjoint and inverse of a square matrix. solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

### **UNIT-III : Differential Calculus**

#### **1. Continuity and Differentiability**

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 No problems on Mean Value Theorems.

## 2. Applications of Derivatives

Applications of derivatives : , increasing and decreasing functions, tangents and normals, , maxima and minima (first derivative test motivate 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).

## UNIT-IV Integral Calculus

### 1. Integrals

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.

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

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

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

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

### 2. Applications of the Integrals

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

### 3. 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, solutions of homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type :

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

## UNIT - V : Vectors and Three-Dimensional Geometry

### 1. Vectors

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, coplanar and skew lines, shortest distance between two lines.

Cartesian and vector equation of a plane. Distance of a point from a plane.

### Books Recommended:

Bureau's Higher Secondary (+2) Elements of Mathematics, Part-II, Published by Odisha

State Bureau of Text Book Preparation and Production, Bhubaneswar.

# MATHEMATICS

## (+2 First Year)

## UNIT - I : Sets and Functions

### 1. Sets

Sets and their representations. Empty set, Finite and Infinite sets, Equal sets, Subsets, Subsets of a set of real numbers especially intervals (with notations), Power set, Universal set, Venn diagrams, Union and Intersection of sets, Difference of sets, complement of a set, Properties of Complement of Sets, Practical Problems based on sets.

### 2. Relations & Functions

Ordered pairs, Cartesian product of sets. Number of elements in the Cartesian product of two finite sets. Cartesian product of the sets of real (up to  $\mathbb{R} \times \mathbb{R}$ ). Definition of relation, pictorial diagrams, domain, co-domain and range of a relation. Function as a special kind of relation from one set to another. Pictorial representation of a function, domain co-domain and range of a function. Real valued functions, domain and range of these functions: Constant, identity, polynomial, rational, modulus, signum, exponential, logarithmic and greatest integer function, with their graphs.

### 3. Trigonometric Functions

Positive and negative angles. Measuring angles in radians and in degrees and conversion of one into other. Definition of trigonometric functions with the help of unit circle. Truth of  $\sin^2 x + \cos^2 x = 1$ , for all  $x$ . Signs of trigonometric functions. Domain and range of trigonometric functions and their graphs. Expressing  $\sin(x \pm y)$  and  $\cos(x \pm y)$  in terms of  $\sin x$ ,  $\sin y$ ,  $\cos x$  &  $\cos y$  and their simple application. Deducing identities like the following :

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y}, \cot(x \pm y) = \frac{\cot x \cot y \mp 1}{\cot y \pm \cot x}$$

$$\sin x + \sin y = 2 \sin \frac{x+y}{2} \cos \frac{x-y}{2}, \cos x + \cos y = 2 \cos \frac{x+y}{2} \cos \frac{x-y}{2},$$

$$\sin x - \sin y = 2 \cos \frac{x+y}{2} \sin \frac{x-y}{2}, \cos x - \cos y = -2 \sin \frac{x+y}{2} \sin \frac{x-y}{2},$$

Identities related to  $\sin 2x$ ,  $\cos 2x$ ,  $\tan 2x$ ,  $\sin 3x$ ,  $\cos 3x$  and  $\tan 3x$ . Trigonometric equations  
Principal solution.

## **UNIT-II : Algebra**

### **1. Principle of Mathematical Induction**

Process of the proof by induction, motivation the application of the method by looking at natural numbers as the least inductive subset of real numbers. The principle of mathematical induction and simple applications.

### **2. Complex Numbers and Quadratic Equations**

Need for complex numbers, especially  $i$ , to be motivated by inability to solve some of the quadratic equations; Algebraic properties of complex numbers. Argand plane. Statement of Fundamental Theorem of Algebra, solution of quadratic equations in the complex system. cube roots of unity and its properties.

### **3. Linear Inequalities**

Linear inequalities. Algebraic solutions of linear inequalities in one variable and their representation on the number line. Graphical solution of linear inequalities in two variables. Graphical solution of system of linear inequalities in two variables.

### **4. Permutations and Combinations**

Fundamental principle of counting, factorial  $n$ . ( $n!$ ), Permutations and combinations, simple applications.

### **5. Binomial Theorem**

History, statement No problems on Binomial Theorem

### **6. Sequence and Series**

Sequence and Series, Arithmetic Progression (A.P.). Arithmetic Mean (A.M.) Geometric Progression (G.P.), general term of a G.P, sum of  $n$  terms of a G.P., Arithmetic and Geometric series, infinite G.P. and its sum, geometric mean (G.M.), Harmonic (mean) relation between A.M., GM. and H.M.,

## **UNIT - III : Co-ordinate Geometry**

### **1. Straight Lines**

Brief recall of two dimensional geometry from earlier classes. Slope of a line and angle between two lines. Various forms of equations of a line : parallel to axis, point-slope form, slope-intercept form, two-point form, intercept form and normal form. General equation of a line. Equation of family of lines passing through the point of intersection of two lines. Distance of a point from a line,.

### **2. Conic Sections**

Sections of a cone : circles, ellipse, parabola, hyperbola; Standard equations and simple properties of Circle, parabola, ellipse and hyperbola.

### **3. Introduction to Three-dimensional Geometry**

Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points and section formula.

## **UNIT-IV: Calculus**

### **1. Limits and Derivatives**

Derivative introduced as rate of change both as that of distance function and geometrically. Intuitive idea of limit. Limits of polynomials and rational functions,

trigonometric, exponential and logarithmic functions. Definition of derivative, relate it to slope of tangent of a curve, derivative of sum, difference, product and quotient of functions. The derivative of polynomial and trigonometric functions.

## **UNIT-V : Mathematical Reasoning**

### **1. Mathematical Reasoning**

Mathematically acceptable statements. Connecting words/phrases-consolidating the understanding of “if and only if (necessary and sufficient) condition,” “implies”, “and/or”, “implied by”, “and”, “or”, “there exists” and their use through variety of examples related to real life and Mathematics.

## **UNIT-VI : Statistics and Probability**

### **1. Statistics**

Measures of dispersion; Range, mean deviation, variance and standard deviation of ungrouped/grouped data.

Random experiments; outcomes, sample spaces (set representation). Events; occurrence of events, ‘not’, ‘and’ and ‘or’ events, exhaustive events, mutually exclusive events, Probability of an event. Probability of ‘not’, ‘and’ ‘or’ events.

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