MATHEMATICS

COURSE STRUCTURE

CLASS XI

One Paper **Time: 3 Hours** **Max Marks: 100**

Units:	**Title**	**Marks**
i.	SETS AND FUNCTIONS	29
ii.	ALGEBRA	37
iii.	GOORDINATE GEOMETRY	13
iv.	CALCULUS	06
v.	MATHEMATICAL REASONING	03
vi.	STATISTICS AND PROBABILITY	02
	TOTAL	**100**

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MATHEMATICS

CLASS - First Year PUC

Unit-1: Sets and functions

1. Sets:

Sets and their representations. Empty set. Finite & Infinite sets. Equal sets. Subsets. Subsets of the 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 sets.

2. Relations & Functions:

Ordered pairs, Cartesian product of sets. Number of elements in the cartestian product of two finite sets. Cartesian product of the reals with itself (upto RxR x R). Definition of relation, pictorial diagrams, domain. Codomain 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 & range of a function. Real valued function of the real variable, domain and range of these functions, constant, identity, polynomial, rational, modulus, signum and greatest integer functions with their graphs. Sum, difference, product and quotients of functions.

3. **Trigonometric Functions:**

Positive and negative angles. Measuring angles in radians and in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Truth of the identitiy, $\sin^2 x + \cos^2 x = 1$

For all x. Signs of trigonometric functions and sketch of their graphs.

Expressing sin$(x \pm y)$ and cos $(x \pm y)$ in terms of sin y, cos x & cos y. Deducing the identities like the following.

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

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

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

Identities related to sin2x, cos2x, tan 2x, sin3x, cos3x, tan3x. General solutions of trigonometric equations of the type $\sin\theta = \sin\alpha$, $\cos\theta = \cos\alpha$, $\tan\theta = \tan\alpha$ Proof and simple application of sine and cosine rules only.

Unit-II: ALGEBRA

1. **Principle of Mathematical Induction:**

Process of the proof by induction, motivating 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 $\sqrt{-1}$, to be motivated by inability to solve every quadratic equation brief description of algebraic properties of complex numbers. Argand's plane and polar representation of complex numbers Statement of fundamental theorem of algebra, solution of quadratic equations in the complex number system.

Square-root of a complex number, Cube roots of unity and their 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.

Solution of system of linear inequalities in two variables-graphically. Inequalities involving modulus function.

4. **Permutations & Combinations:**

Fundamental principle of counting. Factorial n. (n!) Permutations and combinations, derivation of formulae and their connections, simple applications.

5. **Binomial Theorem:**

History, statement and proof of the binomial theorem for positive integral indices. Pascal's triangle, General and middle term in binomial expansion, simple applications.

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., geometric mean (G.M.), relation between A.M and G.M. Arithmetic/geometric series, infinite G.P. and its sum, sum to n terms of the special series $\sum n, \sum n^2, \sum n^3$.

UNIT-III: CO-ORDINATE GEOMETRY

1. **Straight Lines:**

Brief recall of 2D from earlier classes. Shifting of origin. Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axes, point-slope form, slope-inercept form, two-point from, 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 Section:**

Sections of a cone: circle, ellipse, parabola, hyperbola, a point, a straight line and pair of intersecting lines as a degenerated case of a conic section. Standard equation of a circle; General equation of a circle; Standard equations and simple properties of parabola, ellipse and hyperbola. Introduction of directix of an ellipse and hyperbola.

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

Co-ordinate axes and co-ordinate planes in three dimensions. Co-ordinates 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. Definition of derivative, relate it to slope of tangent of the curve,

derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions.

UNIT-V: MATHEMATICAL REASONING

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. Validating the statements involving the connecting words difference between contradiction, converse and contrapositive.

UNIT – VI: STATISTICS AND PROBABILLITY

1. **Statistics:**

Measure of dispersion; mean deviation, variance and standard deviation of ungrouped/grouped data. Analysis of frequency distributions with equal means but different variances.

2. **Probability:**

Random experiments: Outcomes, sample spaces (set representation). Events: occurrence of events, 'not', 'and' and 'or' events, exhaustive events, mutually exclusive events axiomatic (set theoretic) probability connections with the theories of earlier classes. Probability of an event, probability of 'not', 'and' & 'or' events.

CLASS: Second Year PUC

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 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.

UNIT-II: ALGEBRA

1. **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 order2). 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:**

Determinant of a square matrix (up to 3 x 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 examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a-matrix. Cramer's Rule and its applications.

UNIT-III: CALCULUS:

1. **Continutity and Differentiability**

Continutity and differentiability, derivative of composite functions, chain rule, derivates of inverse trigonometric functions, derivate of implicit functions, concept of exponential and logarithmic functions to the base. Logarithmic functions as inverse of exponential functions.

$$\lim_{x\to 0} 1/x \;,\; \lim_{x\to\infty} 1/x \;,\; \lim_{x\to\infty}\left(1+1/x\right)^{x},\; \lim_{x\to 0}(1+x)^{1/x},\; \lim_{x\to 0}\frac{\log(1+x)}{x},\; \lim_{x\to 0}\frac{e^{x}-1}{x}$$

Derivatives of logarithmic and exponential functions.

Logarithmic differentiation, derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagranges's Mean value theorems (without proof) and their geometric interpretation and simple applications.

2. Applications of Derivatives:

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 principle understanding of the subject as well as real-life situations)

3. 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 to be evaluated.

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

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

$$\int \sqrt{ax^2+bx+c}\,dx, \int (px+q)\sqrt{ax^2+bx+c}\,dx, \int \frac{dx}{a+b\cos x}, \int \frac{dx}{a+b\sin x}$$

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:

Applications in finding the area under simple curves, especially lines, areas of circles/parabolas/ellipses (in standard form only), Area under the curve y=sin x, y=cos x, area between the two above said curves (the region should be clearly identifiable)

5. 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, and

$\frac{dx}{dy} + Px = Q$ Where p and q are functions of y

UNIT-IV: VECTORS AND THREE-DIMENSIONAL GEOMETRY

1. **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 vectors 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.

1. **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.

UNIT-V: LINEAR PROGRAMMING

1. **Linear Programming:**

Introduction, definition of related terminology such as constraints, objective function, optimization, different types of linear programming (LP) 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

1. **Probability:**

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

MATHEMATICS

COURSE STRUCTURE

CLASS XII

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

Units	Title	
i.	RELATIONS AND FUNCTIONS	10
ii.	ALGEBRA	13
iii.	CALCULUS	44
iv.	VECTORS AND THREE-DIMENSIONAL GEOMETRY	17
v.	LINEAR PROGRAMMING	06
vi.	PROBABILITY	10
	Total	**100**