

MATHEMATICS

Course Structure

Units	Topics	Marks
1	Sets and Functions	29
2	Algebra	37
3	Co-ordinate Geometry	13
4	Calculus	6
5	Mathematical Reasoning	3
6	Statistics and Probability	12
Total		100

Course Syllabus

Unit-I: Sets and Functions

Chapter 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 Sets

- Practical Problems based on sets

Chapter 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
 - 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
 - Greatest integer functions (with their graphs)
- Sum, difference, product and quotients of functions.

Chapter 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 the $\sin^2 x + \cos^2 x = 1$, 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
- Identities related to $\sin 2x$, $\cos 2x$, $\tan 2x$, $\sin 3x$, $\cos 3x$ and $\tan 3x$
- General solution of trigonometric equations of the type $\sin y = \sin a$, $\cos y = \cos a$ and $\tan y = \tan a$.

Unit-II: Algebra

Chapter 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

Chapter 2: Complex Numbers and Quadratic Equations

- Need for complex numbers, especially $\sqrt{-1}$, to be motivated by inability to solve some of the quadratic equations
- Algebraic properties of complex numbers
- Argand 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

Chapter 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

Chapter 4: Permutations and Combinations

- Fundamental principle of counting
- Factorial n
- $(n!)$ Permutations and combinations
- Derivation of formulae and their connections
- Simple applications.

Chapter 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

Chapter 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.)
- Relation between A.M. and G.M.

Unit-III: Coordinate Geometry

Chapter 1: Straight Lines

- Brief recall of two dimensional geometries from earlier classes
- Shifting of origin
- 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
 - 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

Chapter 2: Conic Sections

- Sections of a cone:
 - Circles
 - Ellipse
 - Parabola
 - Hyperbola: a point, a straight line and a pair of intersecting lines as a degenerated case of a conic section.
- Standard equations and simple properties of:

- Parabola
- Ellipse
- Hyperbola
- Standard equation of a circle

Chapter 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

Chapter 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

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

Unit-VI: Statistics and Probability

Chapter 1: Statistics

- Measures of dispersion:
 - Range
 - Mean deviation
 - Variance
 - Standard deviation of ungrouped/grouped data
- Analysis of frequency distributions with equal means but different variances.

Chapter 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' and 'or' events