

Part IV: Mathematics

1. Algebra

- 1.1 Complex numbers, addition, multiplication, conjugation, polar representation, properties of modulus and principal argument, triangle inequality, roots of complex numbers, geometric interpretations; Fundamental theorem of algebra.
 - 1.2 Theory of Quadratic equations, quadratic equations in real and complex number system and their solutions.
 - 1.3 Arithmetic and geometric progressions, arithmetic, geometric and arithmetico-geometric series, sums of finite arithmetic and geometric progressions, infinite geometric series, sums of squares and cubes of the first n natural numbers.
 - 1.4 Logarithms and their properties.
 - 1.5 Exponential series.
 - 1.6 Permutations and combinations, Permutations as an arrangement and combination as selection, simple applications.
 - 1.7 Binomial theorem for a positive integral index, properties of binomial coefficients, Pascal's triangle
 - 1.8 Matrices and determinants of order two or three, properties and evaluation of determinants, addition and multiplication of matrices, adjoint and inverse of matrices, Solutions of simultaneous linear
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- Equations in two or three variables, elementary row and column operations of matrices, Types of matrices, applications of determinants in finding the area of triangles.
- 1.9 Sets, Relations and Functions, algebra of sets applications, equivalence relations, mappings, one-one, into and onto mappings, composition of mappings, binary operation, inverse of function, functions of real variables like polynomial, modulus, signum and greatest integer.
- 1.10 Mathematical reasoning and methods of proofs , 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 through variety of examples related to real life and Mathematics. Validating the statements involving the connecting words – difference between contradiction, converse and contra positive., Mathematical induction
- 1.11 Linear Inequalities, solution of linear inequalities in one variable (Algebraic) and two variables (Graphical).

2. Trigonometry

- 2.1 Measurement of angles in radians and degrees, positive and negative angles, trigonometric ratios, functions with their graphs and identities.
- 2.2 Solution of trigonometric equations.
- 2.3 Inverse trigonometric functions

3. Two-dimensional Coordinate Geometry

- 3.1 Cartesian coordinates, distance between two points, section formulae, shift of origin.
- 3.2 Straight lines and pair of straight lines: Equation of straight lines in various forms, angle between two lines, distance of a point from a line, lines through the point of intersection of two given lines, equation of the bisector of the angle between two lines, concurrent lines.
- 3.3 Circles: Equation of circle in standard form, parametric equations of a circle.
- 3.4 Conic sections : parabola, ellipse and hyperbola their eccentricity, directrices & foci.

4. Three dimensional Coordinate Geometry

- 4.1 Co-ordinate axes and co-ordinate planes, distance between two points, section formula, direction cosines and direction ratios, equation of a straight line in space and skew lines.
- 4.2 Angle between two lines whose direction ratios are given, shortest distance between two lines.
- 4.3 Equation of a plane, distance of a point from a plane, condition for coplanarity of three lines, angles between two planes, angle between a line and a plane.

5. Differential calculus

- 5.1 Domain and range of a real valued function, Limits and Continuity of the sum, difference, product and quotient of two functions, Differentiability.
- 5.2 Derivative of different types of functions (polynomial, rational, trigonometric, inverse trigonometric, exponential, logarithmic, implicit functions), derivative of the sum, difference, product and quotient of two functions, chain rule, parametric form.
- 5.3 Geometric interpretation of derivative, Tangents and Normals.
- 5.4 Increasing and decreasing functions, Maxima and minima of a function.
- 5.5 Rolle's Theorem, Mean Value Theorem and Intermediate Value Theorem.

6. Integral calculus

- 6.1 Integration as the inverse process of differentiation, indefinite integrals of standard functions.
- 6.2 Methods of integration: Integration by substitution, Integration by parts, integration by partial fractions, and integration by trigonometric identities.

- 6.3 Definite integrals and their properties, Fundamental Theorem of Integral Calculus, applications in finding areas under simple curves.
- 6.4 Application of definite integrals to the determination of areas of regions bounded by simple curves.

7. Ordinary Differential Equations

- 7.1 Order and degree of a differential equation, formulation of a differential equation whose general solution is given, variables separable method.
- 7.2 Solution of homogeneous differential equations of first order and first degree
- 7.3 Linear first order differential equations

8. Probability

- 8.1 Various terminology in probability, axiomatic and other approaches of probability, addition and multiplication rules of probability.
- 8.2 Conditional probability, total probability and Baye's theorem
- 8.3 Independent events
- 8.4 Discrete random variables and distributions with mean and variance.

9. Vectors

- 9.1 Direction ratio/cosines of vectors, addition of vectors, scalar multiplication, position vector of a point dividing a line segment in a given ratio.
- 9.2 Dot and cross products of two vectors, projection of a vector on a line.
- 9.3 Scalar triple products and their geometrical interpretations.

10. Statistics

- 10.1 Measures of dispersion
- 10.2 Analysis of frequency distributions with equal means but different variances

11. Linear Programming

- 11.1 Various terminology and formulation of linear Programming
- 11.2 Solution of linear Programming using graphical method, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solutions (upto three nontrivial constraints)

12. Mathematical modelling

- 12.1 Formulation of simple real life problem, solution using matrices, calculus and linear programming.