

## **Mathematics**

### **Part – I (Senior Secondary Standard)**

- 1 **Sets, Relations and Functions** :Different kinds of sets and their basic properties, Relations, types of relations, Different types of real valued functions.
- 2 **Limit, Continuity and Differentiability** : Limit, continuity and differentiability of algebraic functions, trigonometric functions, exponential functions and logarithmic functions.
- 3 **Complex and Vector Algebra** : Complex numbers and their algebraic properties, polar representation, square root of a complex number, Vectors and scalars, types of vectors and their algebraic properties, scalar and vector product of two vectors, scalar triple product.
- 4 **Differential calculus** : Derivatives of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions. Derivatives of implicit and explicit functions. Increasing and decreasing functions. Concept of second order derivative.
- 5 **Integral calculus** : Integration of functions by the method of substitution, partial fraction and by parts. Basic properties of definite integrals and their uses to evaluate them.
- 6 **Differential equations** : Order and degree of a differential equation, solution of differential equations of first order and first degree.
- 7 **Permutations and combinations** : Derivation of formulae, their connections and simple applications.  
**Binomial theorem** : Binomial theorem for positive integral indices, general and middle terms in binomial expansion.
- 8 **Matrices** : Various types of matrices, their basic operations and properties. Invertible matrices and their inverse.  
**Determinant** : Determinant of a square matrix and their properties. Solution of system of linear equations in two or three variables using inverse of a matrix.
- 9 **Two dimensional geometry** : Straight line, standard equations and simple properties of circle, parabola, ellipse, hyperbola.
- 10 **Applications of derivatives and integrals** : Tangent and normals, maxima and minima of functions of one variable. Area under simple curves, area between the simple curves.
- 11 **Statistics** : Mean, Mode, Median for grouped data, measure of dispersion. Probability and their elementary laws, conditional probability.

### **Part – II (Graduation Standard)**

- 1 **Group Theory** : Groups and their simple properties, order of an element, order of a group, permutation groups, cyclic groups and their properties, subgroups and their basic algebraic properties, cosets and their properties.
- 2 **Normal subgroup and Rings** : Normal subgroups and quotient groups, theorems on homomorphism and isomorphism.  
Rings, ideals, integral domain and fields.
- 3 **Theory of equations** : Relation between the roots and coefficients of general polynomial equation in one variable. Transformation of equations. Descartes' rule of signs, solution of cubic equations by Cardon's method, Biquadratic equations by Ferari's method.
- 4 **Calculus** : Partial derivatives, curvature, asymptotes, envelopes and evolutes, maxima and minima of functions upto two variables, Beta and Gamma functions, double and triple integrals.
- 5 **Advanced Calculus** : Mean value theorems (Rolle's, Lagrange's, Taylor's theorems), sequence and series with convergence properties.

- 6 **Complex Analysis** : Continuity and differentiability of complex functions, Analytic functions, Cauchy – Riemann equation, Harmonic functions. Conformal mappings.
- 7 **Ordinary and Partial differential equations** : Linear differential equations of first order and higher degree, Clairaut’s form, Linear differential equations of constant coefficients, ordinary homogeneous differential equations, Linear differential equations of second order with variable coefficients. Partial differential equations of first order, solution by Lagrange’s method.
- 8 **Vector calculus** : Gradient, divergence and curl, identities related to them. Line, surface and volume integrals. Applications of Gauss, Stoke’s and Green’s theorems.
- 9 **Three dimensional geometry** : Direction ratios and cosines, straight line, plane, sphere, cone and cylinder.
- 10 **Statics** : Equilibrium of co-planar forces, moments, friction, virtual work catenary.
- 11 **Dynamics** : Velocities and acceleration along radial and transverse directions and along tangential and normal directions, simple harmonic motion, Rectilinear motion under variable laws, Hook’s law and problems, projectiles.

### **Part – III (Post Graduation Standard)**

- 1 **Linear Algebra and Metric Space** : Vector spaces, linear dependence and independence, bases, dimensions, linear transformations, matrix representation, algebra of matrices, characteristic roots and vectors, determinants, Cayley – Hamilton theorem.  
**Metric Spaces** : Bounded and unbounded metric spaces. Open and closed sets in a metric space, Cantor’s ternary set, closure, bases, product spaces.
- 2 **Integral transforms and special functions** : Hyper-geometric functions, Legendre’s polynomials, Bessel’s functions. Recurrence relations and orthogonal properties.  
Laplace transform, inverse Laplace transform. Fourier sine and cosine transforms. Convolution theorem.
- 3 **Differential Geometry and Tensors** : Curves in spaces, Curvature, Torsion, Skew curvature, Serret - Frenet formulae. Helices Osculating circle and sphere.  
Types of tensors and their algebraic properties. Christoffel’s symbols, covariant and contravariant differentiation, Geodesics.
- 4 **Numerical Analysis** : Newton’s formula for forward and backward interpolation for equal intervals, Divided difference, Newton’s Lagrange’s, Stirling’s and Bessel’s interpolation formulae.
- 5 **Optimization Technique’s** : Convex set and its properties. Solution of a L.P.P. by using Simplex methods. Duality, Assignment, Transportation and Game theory.

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