

# MATHEMATICS

CODE-16

## PAPER-I MATHEMATICS-PURE

The subjects included will be (1) Algebra, (2) Infinite sequences and series, (3) Trigonometry, (4) Theory of equations, (5) Analytic Geometry of two and three dimension, (6) Analysis, and (7) Differential equation.

**1. Algebra :-** Sets, union, Inter-section difference and complementation properties, Venn Diagram, Properties of natural numbers, Real numbers and their representation by decimals. Complex number Argand, Diagram, Cartesian Product Relation, mapping, Function as a mapping. Equivalence relation Groups Isomorphism groups, sub-groups normal sub-groups. Lagrange's theorem, Frobenius theorem.

The definitions and illustrations of rings and field divisions of zero and Homomorphisms Vector-spaces.

Determinants, addition, subtraction, multiplication and inversion of matrix, linear homogeneous and non-homogeneous equations, Cayley Hamilton theorem.

Elementary number theory Fundamental theorem of arithmetic, Congruences. Theorem of Fermat and Wilson, Inequalities, Arithmetical and Geometrical means. Inequalities of Cauchy, Hölder and Minkowski.

**2. Infinite sequences and series:-** Concept of limit infinite series. Convergent, divergent and oscillatory series, Cauchy's general principle of convergence. Comparison and ratio test, Gauss's test, Absolute convergence and rearrangement of series.

**3. Trigonometry:-** De Moivre's theorem for rational index and its applications. Inverse Circular and Hyperbolic functions. Expansions and summation of trigonometrical series. Expressions for sine and cosine in terms of infinite products.

**4. Theory of equations :-** General properties of polynomial equation. Transformation of equation. Nature of the roots of cubic and biquadratic, Cardan's solution of the cubic resolution of biquadratic into quadratic factors, Location of roots and Newton's method of divisors.

**5. Analytic Geometry of two and three dimensions :-** Straight line, pair of straight lines, circle, system of circle, Ellipse, Parabola, Hyperbola Reduction of second degree equation to a standard form. Plane straight lines, sphere cone, conoids their tangent and normal properties. (Vector methods will be permissible).

**6. Analysis :-** Concepts of limit, continuity, derivation, differentiability of function of one real variable. Properties of continuous functions. Characterisation of discontinuities. Mean value theorems. Evaluations of indeterminate forms. Taylor's and Maclaurin's theorems with Lagrange and Cauchy's form of remainders. Maxima and minima of function of one variable. Plane curves, singular points, curvature curve tracing Envelopes. Partial differentiation. Differentiability of function of more than one real variable. Standard methods of integration. Riemann's definition of definite-integral of continuous function. Fundamental theorem of integral calculus. First mean value theorem of integral calculus. Rectification, quadrature, volumes and surface of solids of revolution and their applications.

**7. Differential Equation** :- Formation of ordinary differential equation order and degree. Geometrical demonstration of the existing theorem for  $(x, y)$ . First order and linear and non linear equations. Singular points, Singular solution Linear differential equations and their important properties Linear Differential equations with constant Co-efficients Cauchy-Euler type of equations. Extract differential equation and equations admitting integrating factor. Second order equations. Changing of dependent and independent variables. Solution when integral is known variation of parametres.

## PAPER-II

### MATHEMATIC-APPLIED

The subjects included will be (1) Vector Analysis. (2) Statics. (3) Dynamics and (4) Hydrostatics.

1. Vector Analysis Vector Algebra Differentiation of vector function of a scalar variable. Gradient, divergence and curl in cartesian. Cylindrical and spherical co-ordinates and their physical interpretation. Higher order derivatives Vector identities and vector equations. Gauss and Stokes Theorems.

2. **Statics** :- Fundamental Law of Newtonian Mechanics. Theory of Dimension Plan statics Equilibrium of system of particles. Works and potential Energy, centre of mass and centre of gravity. Frictions common Catenary principle of virtual works. Stability of equilibrium. Equilibrium of forces in three dimensions. Attraction. Potential of rods, rectangular and circular discs, spherical, shell, spherical, equipotential surfaces and their properties, properties of potential. Green's equivalent stratum. Laplace's and Poisson's equations.

(3) **Dynamics** :- Velocity vector. Relative velocity, Acceleration. Angular velocity. Degree of freedom and constraints Rectilinear motions. Simple harmonic motion. Motion in a plane. Projectiles. Constrained motion. Works and energy. Motion under impulsive forces. Kepler's laws. Orbits under central forces. Motion of varying mass. Motion under resistance. Moments and products of inertia. Two dimensional motion of a rigid body under infinite and impulsive forces. Compound pendulum.

4. **Hydrostatics** :- Pressure of heavy fluids. Equilibrium of fluids under given system of forces. Centre of pressure. Trust of curved surfaces. Equilibrium of floating bodies. Stability of equilibrium. Pressure of gases and problems relating to atmosphere.