

MATHEMATICS (CODE NO. 07)

PAPER - I

1. Abstract Algebra

Group, Subgroup, cyclic group and their properties. Order of Elements of group Coset decomposition, Lagrange's theorem. Normal subgroup, Quotient Group, Homomorphism, Isomorphism, Automorphism of Groups. Permutation, Permutation Groups, Cayley's Theorem. Cauchy's Theorem and Sylow's Theorem for finite abelian and non abelian groups.

Ring Theory - Rings, Subrings, Ideals and quotient rings, Homomorphism & Isomorphism of rings, Integral domain, characteristic of an element. Polynomial rings, Field Polynomials over the rational fields. Unique factorization theorem.

2. Linear Algebra

Definition and examples of vector spaces, subspace, sum and direct sum of subspaces - Linear dependence and independence and their bases properties. Bases, Existence theorem for bases. Finite dimensional vector space. Dimension of a vector space. Dimension of sum of spaces. Quotient space and its dimension. Linear transformations and their representation as a matrix. The Algebra of Transformation. Rank Nullity Theorem. Eigen values and Eigen vectors of a linear transformation : Diagonalization of a matrix. Inner product space, Orthogonal vectors, orthogonal compliments. Orthonormal sets and bases. Bessel Inequality for finite dimensional space. Gram Schmidt's orthogonalization process.

3. Differential Calculus

Convergence of sequence and series, limit & continuity of function. Differentiability. Successive differentiation, Leibnitz's theorem. Applications of derivative, Tangent and normal, Asymptotes, Singular points, curve tracing. Mean value Theorem. Taylor's Theorem. Expansion in Taylor's and Maclaurin series. Maxima & minima of function of one variable.

4. Integral Calculus

Integration of rational, irrational and transcendental functions. Reduction formula. Definite integrals. Rectification quadrature, volume and surface of solid of revolution. Double & triple Integrals. Beta & Gamma functions, Change of order of Integration of double integral. Improper integrals and their convergence.

5. Differential Equation

Ordinary differential Equation of first order and higher degree. Homogeneous equation of first degree. Integrating factor. Linear Differential Equation with constant coefficients, Complementary functions and particular integrals. Linear Differential Equation with variable coefficients. Singular solutions linear Differential Equation and Equation reducible to linear form. Exact differential equation. method of variations of parameter. Simultaneous linear differential equations.

6. Vector Calculus

Differentiation of vector function, Gradient, divergence & curl in Cartesian, cylindrical & spherical coordinate, Higher order derivatives. Vector integration, Gauss's, Green's & Stoke's Theorem, and their applications.

7. Analytical Geometry

Cartesian and polar coordinates in two and three dimensions. Second degree equations in two and three dimensions, Reduction to canonical forms. Straight lines, Shortest distance between two skew lines, plane, Sphere, Cone, Cylinder, Paraboloid, Ellipsoid, Hyperboloids of one and two sheets and their properties.

8. Statistics

Measures of central tendency:- mean, mode, median, measures of dispersion, range, inter quartile range, mean deviation, standard deviation skewness and kurtosis.

Probability - Events, sample space, probability of an event, addition and multiplication Theorem, Baye's Theorem.

Theoretical Distributions - Binomial, Poisson, Normal distributions and their properties & use. Method of least square, curve fitting, correlation & regression. Partial & multiple correlation (up to three variables)

MATHEMATICS (CODE NO. 07)

PAPER - II

1. Real Analysis & Metric Space

Riemann Integral, Integrability of continuous and monotonic functions. The fundamental theorem on Integral calculus. Mean value theorem of Integral calculus. Partial derivatives and differentiability of real valued functions of two variables. Schwarz & Young's theorem, Implicit function theorem. Definition and example of metric spaces. Neighbourhood, Limit points, interior points, open and closed sets. Closure and interior, Boundary points. Subspace of a metric space. Cauchy's sequence, completeness. Cantor intersection Theorem. Contraction principle. Real number as a complete ordered field, Dense subsets Baire category Theorem, Separable, first countable and second countable space.

2. Complex Analysis

Continuity and differentiability of complex function. Analytic function, Cauchy - Riemann Equations, Cauchy's Theorem, Cauchy's Integral formula, Power series, Taylor's series, Laurent's series. Singularities, Cauchy's Residue Theorem, Contour Integration, Conformal mapping, Bilinear transformations.

3. Advance Calculus

Functions of several variables, Limit, continuity and differentiability of function of two variables. Partial derivative, Change of variables, Euler's Theorem on homogenous functions. Taylor's Theorem for function of two variables. Maxima & minima and saddle point of function of two variable, Lagrange's method of multipliers. Indeterminate form.

4. Partial Differential Equations

Curve and surfaces in three dimensions, formulation of partial differential equations. solutions of equation of the type $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. orthogonal trajectories. Pfaffian Differential equation, partial differential equation of first order, solution by Cauchy's method. Charpit method of solution. Linear partial differential equation of second order with constant coefficient.

5. Linear Programming

Linear programming problem, basic solution, basic feasible solution & optional solutions, graphical method & simplex method of solution. Duality, Transportation and assignment problems. Travelling sales man problems.

6. Numerical Analysis

Numerical methods, solution of algebraic and transcendental equation of one variable by bisection, Regula-Falsi and Newton Raphson method. Solution of linear Equations by Gaussian Elimination and Gauss Jordan (direct) method. Gauss seidel (Iterative). Method, Newtons (forward & backward) & Lagrange method of interpolation. Numerical Integration : Simpson's one third rule. Gaussian quadrature formula. Numerical solution of ordinary differential equations. Euler & Runge. Kutta Methods.

7. Boolean Algebra

Lattices and Algebraic structure. Duality Distributive and complementary lattice. Boolean lattices and Boolean algebras. Boolean functions & expressions. Propositional calculus. Design and implementation of Digital networks, switching circuits. graph, Paths & circuits, shortest paths - Eulerian paths & circuits. Application of graph for bridge problem, utility problem.

8. Mechanics

Statics - Analytical conditions of Equilibrium of coplanar forces. virtual works, catenary. Forces in three dimensions Poinsots Central axis. Stable & unstable equilibrium.

Dynamics - Velocities & acceleration along radial & transverse directions and along tangential and normal direction. Simple .Harmonic motions - Elastic strings.

Motion on smooth & rough plane curves. Motion in a resisting medium. Motion of a particle of varying mass.