

Course: M.A. / M.Sc. Mathematics

Semester I

Paper I: Algebra-I

Unit-1

Direct product of groups (External and Internal). Isomorphism theorems – Diamond isomorphism Theorem, Butterfly Lemma, Conjugate classes (Excluding p-groups). Sylow's

Theorem (Without Proof). Cauchy's theorem for finite abelian groups.

Unit-2

Commutators, Derived subgroups, Normal series and Solvable groups, Composition series, Refinement theorem and Jordan-Holder theorem for infinite groups.

Paper II: Real Analysis

Unit-1

Algebra and algebras of sets, Algebras generated by a class of subsets, Borel sets, Lebesgue measure of sets of real numbers, Measurability and Measure of a set, Existence of Non-measurable sets.

Unit-2

Measurable functions, Realization of non-negative measurable function as limit of an increasing sequence of simple functions, Structure of measurable functions, Convergence in measure, Egoroff's theorem.

Paper III: Differential Equations-I

Unit-1

Non-linear ordinary differential equations of particular forms. Riccati's equation – General solution and the solution when one, two or three particular solutions are known.

Unit-2

Total Differential equations. Forms and solutions, necessary and sufficient condition, Geometrical Meaning Equation containing three and four variables, total differential equations of second degree.

Paper IV: Differential Geometry

Unit-1

Space curves, Tangent, Contact of curve and surface, Osculating plane, Principal normal and Binormal, Curvature, Torsion, Serret-Frenet's formulae, Osculating circle and Osculating sphere, Existence and Uniqueness theorems, Bertrand curves, Involute and Evolutes.

Unit-2

Conoids, Inflexional tangents, Singular points, Indicatrix. Ruled surface, Developable surface, Tangent plane to a ruled surface. Necessary and sufficient condition that a surface $\zeta = f(\xi, \eta)$ should represent a developable surface. Metric of a surface, First, Second and Third fundamental forms. Fundamental magnitudes of some important surfaces, Orthogonal trajectories.

Paper V: Dynamics of Rigid Bodies

Unit-1

D'Alembert's principle, The general equations of motion of a rigid body, Motion of centre of inertia and motion relative to centre of inertia, Motion about a fixed axis.

Unit-2

The compound pendulum, Centre of percussion, Conservation of momentum (linear and angular) and energy for finite as well as impulsive forces.

Paper VI: Calculus of Variation and Special Function-I

Unit-3

Gauss hypergeometric function and its properties, Series solution of Gauss hypergeometric equation. Integral representation, Linear and quadratic transformation formulas, Contiguous function relations, Differentiation formulae, Linear relation between the solutions of Gauss hypergeometric equation, Kummer's confluent hypergeometric function and its properties, Integral representation, Kummer's first transformation.

Unit-4

Legendre polynomials and Series Solution of Legendre's equation and functions $P_n(x)$ and $Q_n(x)$.

Semester III

Paper I: Functional Analysis-I

Unit1:

Subspace of Metric space, product space, Continuous mapping, Sequence in a metric space, convergent, Cauchy sequence, Complete metric space.

Unit-2

Banach contraction theorem, Baire's category theorem, compact sets, compact spaces, separable metric space, and connected metric spaces.

Paper II: Viscous Fluid Dynamics-I

Unit-3

Exact solutions of Navier – Stokes equations, Velocity distribution for plane Couette flow, Plane

Poiseuille flow, Generalized plane Couette flow, Hagen-Poiseuille flow, Flow in tubes of uniform cross-sections.

Unit-4

Flow between two concentric rotating cylinders. Stagnation point flows: Hiemenz flow, Homann flow. Flow due to a rotating disc.

Paper III: Integral Transforms

Unit-1

Laplace transform– Definition and its properties. Rules of manipulation. Laplace transform of derivatives and integrals. Properties of inverse Laplace transform. Convolution theorem.

Unit-2

Fourier transform – Definition and properties of Fourier sine, cosine and complex transforms. Convolution theorem. Inversion theorems. Fourier transform of derivatives.

Paper IV: Mathematical Programming–I

Unit–1

Separating and supporting hyper plane theorems. Revised simplex method to solve Linear Programming problems, Bounded variable problems.

Unit-4

Dynamic programming: Introduction, Bellman principle of optimality, solution of problems with finite number stages, solution of L.P.P. by dynamic programming.

Paper V: Relativistic Mechanics

Unit–1

Relative Character of space and time, Principle of Relativity and its postulates, Derivation of special Lorentz transformation equations, Composition of Parallel velocities, Lorentz- Fitzgerald contraction formula, Time dilation.

Unit–2

Simultaneity, Relativistic transformation formulae for velocity, Lorentz contraction factor, Particle acceleration, Velocity of light as fundamental velocity, Relativistic aberration and its deduction to Newtonian theory.

Paper VI: Numerical Analysis–I

Unit–1

Iterative methods – Theory of iteration method, Acceleration of the convergence, Chebyshev method, Muler's method, Methods for multiple and complex roots.

Unit-2

Newton-Raphson method for simultaneous equations, Convergence of iteration process in the case of several unknowns. Solution of polynomial equations – Polynomial equation, Real and complex roots, Synthetic division, the Birge-Vieta, Bairstow and Graeffe's root squaring method.