

Mathematics (Optional) Test Series

Series-I (Before prelims)

S.No	Date	Syllabus
1	03/08/2023	ODE: 1. Formulation of differential equations 2. Equations of first order and first degree ✓ Variable separable method ✓ Homogeneous equations ✓ Linear differential equations ✓ Exact differential equations ✓ Integrating factor 3. Orthogonal trajectory PDE: 4. Formulation of partial differential equations ✓ Formulation of PDE by eliminating arbitrary constants ✓ Formulation of PDE by eliminating arbitrary functions 5. Linear partial differential equations of the first order ✓ Lagrange's method ✓ Lagrange's multiplier method
2	10/08/2023	ODE: 1. Equations of first order but not of first degree ✓ Equations solvable for p ✓ Equations solvable for x ✓ Equations solvable for y ✓ Clairaut's equation ✓ Singular solution (Equations solvable for p , x , y and Clairaut's equation) PDE: 2. General method of solving PDE of order one but of any degree – Charpit's method ✓ Equations of the form $f(p, q) = 0$ ✓ Clairaut's equation $z = px + qy + f(p, q)$ ✓ Equations of the form $f(p, q, z) = 0$ ✓ Equations of the form $f_1(x, p) = f_2(y, q)$
3	17/08/2023	ODE: 1. Second and higher order linear equations with constant coefficients ✓ Complementary function ✓ Particular integral

		<p>✓ General solution</p> <p>2. Second order linear equations with variable coefficients, Euler-Cauchy equation</p> <p>3. Method of variation of parameters</p> <p>PDE:</p> <p>4. Cauchy's method of characteristics</p> <p>5. Linear partial differential equations of the second order with constant coefficients</p>
4	24/08/2023	<p>ODE:</p> <p>1. Laplace and Inverse Laplace transforms</p> <p>PDE:</p> <p>2. Canonical form</p> <p>3. Equation of a vibrating string, heat equation, Laplace equation and their solutions.</p>
5	31/08/2023	ODE, PDE (Full Unit Test)
6	14/09/2023	<p>Analytical Geometry:</p> <p>1. Basics</p> <p>2. Plane</p> <p>3. Straight lines</p> <p>4. Shortest distance between two skew lines</p> <p>5. Sphere</p> <p>Vector Analysis:</p> <p>6. Scalar and vector fields</p> <p>7. Differentiation of vector field of a scalar variable</p> <p>8. Gradient, divergence and curl</p> <p>9. Vector identities and vector equations</p>
7	21/09/2023	<p>Analytical Geometry:</p> <p>1. Cone</p> <p>2. Cylinder</p> <p>3. Paraboloid</p> <p>4. Ellipsoid</p> <p>5. Hyperboloid of one and two sheets</p> <p>Vector Analysis:</p> <p>6. Curvature and torsion, Serret-Frenet's formulae.</p> <p>7. Gauss and Stokes' theorems</p> <p>8. Green's theorem</p>
8	28/09/2023	Analytical Geometry, Vector Analysis (Full Unit Test)
9	05/10/2023	<p>Calculus:</p> <p>1. Limits, continuity, differentiability</p> <p>2. Indeterminate forms</p> <p>3. Lagrange's mean value theorem</p> <p>4. Cauchy's mean value theorem</p> <p>5. Taylor's theorem with remainders</p> <p>✓ Schlomilch and Roche's form of remainders</p> <p>✓ Cauchy's form of remainders</p>

		✓ Lagrange's form of remainders
10	12/10/2023	Calculus: <ol style="list-style-type: none"> 1. Maxima and minima 2. Asymptotes 3. Curve tracing 4. Functions of two or three variables: <ul style="list-style-type: none"> ✓ Limits, continuity, partial derivatives ✓ Maxima and minima ✓ Lagrange's method of multipliers ✓ Jacobian
11	19/10/2023	Calculus: <ol style="list-style-type: none"> 1. Riemann's definition of definite integrals 2. Indefinite integrals; 3. Infinite and improper integrals 4. Double and triple integrals (evaluation techniques only). 5. Areas, surface and volumes.
12	26/10/2023	Calculus: (Full Unit Test)
13	09/11/2023	Real Analysis: <ol style="list-style-type: none"> 1. Real number system as an ordered field 2. Sequences <ul style="list-style-type: none"> ✓ Limit of a sequence ✓ Cauchy sequence Complex Analysis: <ol style="list-style-type: none"> 3. Analytic functions 4. Cauchy-Riemann equations 5. Cauchy's theorem
14	16/11/2023	Real Analysis: <ol style="list-style-type: none"> 1. Infinite series <ul style="list-style-type: none"> ✓ Comparison tests ✓ D'Alembert's ratio test ✓ Cauchy's n^{th} root test ✓ Raabe's test ✓ Logarithmic test ✓ Gauss test ✓ Cauchy's integral test ✓ Cauchy's condensation test ✓ Leibnitz test on alternating series 2. Absolute and conditional convergence of series Complex Analysis: <ol style="list-style-type: none"> 3. Cauchy's integral formula 4. Taylor's series 5. Laurent's series
15	23/11/2023	Real Analysis: <ol style="list-style-type: none"> 1. Properties of continuous functions on compact sets 2. Riemann integral, improper integrals



		<p>3. Sequences and series of functions</p> <ul style="list-style-type: none">✓ Uniform convergence <p>Complex Analysis:</p> <p>4. Singularities</p> <ul style="list-style-type: none">✓ Isolated and non-isolated singularities✓ Isolated essential singularities✓ Removable singularities✓ Poles <p>5. Cauchy's residue theorem</p> <p>6. Contour integration</p>
16	30/11/2023	Real Analysis, Complex Analysis (Full Unit Test)
17	07/12/2023	<p>Modern Algebra:</p> <ol style="list-style-type: none">1. Groups2. Subgroups3. Cyclic groups4. Permutation groups <p>Linear Algebra:</p> <ol style="list-style-type: none">5. Vector spaces over \mathbb{R} and \mathbb{C},6. Linear dependence and independence7. Subspaces8. Bases and dimension
18	14/12/2023	<p>Modern Algebra:</p> <ol style="list-style-type: none">1. Homomorphism and isomorphism of groups2. Cosets3. Lagrange's Theorem4. Normal subgroups5. Quotient groups <p>Linear Algebra:</p> <ol style="list-style-type: none">6. Linear transformations7. Rank and nullity8. Matrix of a linear transformation.9. Algebra of Matrices10. Row and column reduction11. Echelon form, congruence's and similarity12. Rank of a matrix
19	21/12/2023	<p>Modern Algebra</p> <ol style="list-style-type: none">1. Rings2. Subrings3. Integral domains4. Fields5. Quotient fields <p>Linear Algebra</p> <ol style="list-style-type: none">6. Inverse of a matrix7. Solution of system of linear equations8. Eigen values and eigenvectors

		9. Characteristic polynomial 10. Cayley-Hamilton theorem
20	28/12/2023	Modern Algebra 1. Ideals 2. Principal ideal domains 3. Euclidean domains and unique factorization domains 4. Homomorphisms of rings Linear Algebra 5. Symmetric, skew-symmetric 6. Hermitian, skew-Hermitian 7. Orthogonal and unitary matrices
21	04/01/2024	Modern Algebra, Linear Algebra (Full Unit Test)
22	11/01/2024	Linear Programming (Full Unit Test)
23	18/01/2024	Numerical Analysis and Computer programming (Full Unit Test)
24	25/01/2024	Statics: Equilibrium of a system of particles; Work and potential energy, friction; common catenary; Principle of virtual work; Stability of equilibrium, equilibrium of forces in three dimensions.
25	01/02/2024	Dynamics: Rectilinear motion, simple harmonic motion, motion in a plane, projectiles; constrained motion; Work and energy, conservation of energy; Kepler's laws, orbits under central forces.
26	08/02/2024	Mechanics: Generalized coordinates; D' Alembert's principle and Lagrange's equations; Hamilton equations; Moment of inertia; Motion of rigid bodies in two dimensions.
27	15/02/2024	Fluid Dynamics: Equation of continuity; Euler's equation of motion for inviscid flow; Stream-lines, path of a particle; Potential flow; Two-dimensional and axisymmetric motion; Sources and sinks, vortex motion; Navier-Stokes equation for a viscous fluid.

Series-II (After prelims)

S.No	Date	Syllabus	Duration	Marks
1	20/06/2024	Ordinary Differential Equations, Partial Differential Equations.	3 Hrs	250
2	27/06/2024	Analytic Geometry, Vector Analysis.	3 Hrs	250
3	04/07/2024	Linear Programming, Numerical Analysis and Computer programming.	3 Hrs	250
4	11/07/2024	Calculus, Real Analysis, Complex Analysis.	3 Hrs	250
5	18/07/2024	Modern Algebra, Linear Algebra.	3 Hrs	250
6	25/07/2024	Mechanics & Fluid Dynamics, Dynamics & Statics.	3 Hrs	250
7	08/08/2024	Paper – I: Linear Algebra, Calculus, Analytic Geometry, Ordinary Differential Equations, Vector Analysis, Dynamics & Statics.	3 Hrs	250
8	15/08/2024	Paper – II: Modern Algebra, Real Analysis, Complex Analysis, Linear Programming, Partial Differential Equations, Numerical Analysis and Computer programming, Mechanics & Fluid Dynamics.	3 Hrs	250
9	22/08/2024	Paper – I	3 Hrs	250
10	29/08/2024	Paper – II	3 Hrs	250