UPSC MATHS OPTIONAL SYLLABUS 2025 FOR MAINS PAPER 1 & 2, PDF DOWNLOAD

Overview of UPSC Maths Optional Syllabus 2025

The **UPSC Maths Optional Syllabus 2025** includes fundamental and advanced topics such as **linear algebra, calculus, analytical geometry, differential equations, real analysis, complex analysis, vector analysis, and mechanics.**

With two papers carrying 250 marks each, with a total 500 marks , the syllabus demands consistency and practice. Yet, its objective nature allows aspirants to score well with the right approach.

Overview of UPSC Maths Syllabus 2025

Sl. No.	UPSC IAS Mains Papers	Subject	Mark
1	Paper VI	Optional Subject Paper-I	250
2	Paper VII	Optional Subject Paper-II	250
Total			**500**
Time Duration			**3 hours**

UPSC Maths Optional Syllabus 2025 – Paper 1

Paper 1 carries a total of 250 marks and is divided into **Section A** and **Section B**

Section	Topics	Details
Section A	**Linear Algebra**	Vector spaces over R and C, linear dependence and independence, subspaces, bases, dimensions; Linear transformations, rank and nullity, matrix of a linear transformation; Algebra of matrices; Row and column reduction, echelon form, congruence and similarity; Rank of a matrix; Inverse of a matrix; Solution of system of linear equations; Eigenvalues and eigenvectors, characteristic polynomial, Cayley-Hamilton theorem; Symmetric, skew-symmetric, Hermitian, skew-Hermitian, orthogonal and unitary matrices and their eigenvalues.

UPSC MATHS OPTIONAL SYLLABUS 2025 FOR MAINS PAPER 1 & 2, PDF DOWNLOAD

Section	Topics	Details
	Calculus	Real numbers, functions of a real variable, limits, continuity, differentiability, mean-value theorem, Taylor's theorem with remainders, indeterminate forms, maxima and minima, asymptotes; Curve tracing; Functions of two or three variables, limits, continuity, partial derivatives, maxima and minima, Lagrange's method of multipliers, Jacobian; Riemann's definition of definite integrals; Indefinite integrals; Infinite and improper integrals; Double and triple integrals (evaluation techniques only); Areas, surfaces, and volumes.
	Analytic Geometry	Cartesian and polar coordinates in 3D; Second-degree equations in three variables, reduction to canonical forms; Straight lines, shortest distance between two skew lines, plane, sphere, cone, cylinder, paraboloid, ellipsoid, hyperboloid (one and two sheets) and their properties.
Section B	Ordinary Differential Equations	Formulation of differential equations; First-order and first-degree equations, integrating factor; Orthogonal trajectories; Equations of first order but not first degree, Clairaut's equation, singular solution; Second and higher-order linear equations with constant coefficients – complementary function, particular integral, general solution; Second-order equations with variable coefficients – Euler-Cauchy equation; Method of variation of parameters when one solution is known;

UPSC MATHS OPTIONAL SYLLABUS 2025 FOR MAINS PAPER 1 & 2, PDF DOWNLOAD

Section	Topics	Details
		Laplace and inverse Laplace transforms, properties, Laplace transforms of elementary functions; Application to initial value problems of second-order linear equations with constant coefficients.
	Vector Analysis	Scalar and vector fields; Differentiation of vector field of a scalar variable; Gradient, divergence, curl in Cartesian and cylindrical coordinates; Higher-order derivatives; Vector identities and equations; Applications to geometry – curves in space, curvature, torsion, Serret-Frenet's formulae; Green's theorem, Gauss' theorem, and Stokes' theorem.
	Dynamics and Statics	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; 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.

UPSC Maths Optional Syllabus 2025 – Paper 2

Paper 2, like Paper 1, carries 250 marks and is also divided into **Section A** and **Section B.**

UPSC MATHS OPTIONAL SYLLABUS 2025 FOR MAINS PAPER 1 & 2, PDF DOWNLOAD

Section	Topics	Details
Section A	**Modern Algebra**	Groups, subgroups, cyclic groups, cosets, Lagrange's theorem, normal subgroups, quotient groups, homomorphism of groups, basic isomorphism theorems, permutation groups, Cayley's theorem; Rings, subrings and ideals, homomorphisms of rings; Integral domains, principal ideal domains, Euclidean domains, unique factorization domains; Fields, quotient fields.
	Real Analysis	Real number system as an ordered field with least upper bound property; Sequences, limit of a sequence, Cauchy sequence, completeness of real line; Series and convergence – absolute and conditional, real and complex terms, rearrangement of series; Continuity and uniform continuity of functions, properties of continuous functions on compact sets; Riemann integral and improper integrals, fundamental theorems of integral calculus; Uniform convergence, continuity, differentiability, and integrability of sequences and series of functions; Partial derivatives of functions of several (two or three) variables, maxima and minima.
	Complex Analysis	Analytic function, Cauchy-Riemann equations, Cauchy's theorem, Cauchy's integral formula; Power series, representation of an analytic function, Taylor's series; Singularities, Laurent's series, Cauchy's residue theorem, contour integration.

UPSC MATHS OPTIONAL SYLLABUS 2025 FOR MAINS PAPER 1 & 2, PDF DOWNLOAD

Section	Topics	Details
Section B	Linear Programming	Linear programming problems, basic solution, basic feasible solution, optimal solution; Graphical method and simplex method of solutions; Duality theory; Transportation and assignment problems.
	Partial Differential Equations (PDEs)	Family of surfaces in 3D and formulation of partial differential equations; Solution of quasilinear PDEs of first order – Cauchy's method of characteristics; Linear PDEs of second order with constant coefficients, canonical form; Equation of vibrating string, heat equation, Laplace equation, and their solutions.
	Numerical Analysis & Computer Programming	**Numerical Methods:** Solution of algebraic and transcendental equations of one variable – Bisection, Regula-Falsi, Newton-Raphson methods; Solution of system of linear equations – Gaussian elimination, Gauss-Jordan (direct), Gauss-Seidel (iterative); Newton's interpolation (forward & backward), Lagrange's interpolation; Numerical integration – Trapezoidal rule, Simpson's rules, Gaussian quadrature; Numerical solution of ODEs – Euler and Runge-Kutta methods. **Computer Programming:** Binary system, arithmetic & logical operations on numbers; Octal & Hexadecimal systems, conversion to/from decimal; Algebra of binary

UPSC MATHS OPTIONAL SYLLABUS 2025 FOR MAINS PAPER 1 & 2, PDF DOWNLOAD

Section	Topics	Details
		numbers; Elements of computer systems, memory concepts; Basic logic gates & truth tables, Boolean algebra, normal forms; Representation of integers & reals (unsigned, signed, double precision, long integers); Algorithms & flowcharts for solving numerical analysis problems.
	Mechanics and Fluid Dynamics	**Mechanics:** Generalised coordinates, D'Alembert's principle, Lagrange's equations, Hamilton equations; Moment of inertia; Motion of rigid bodies in two dimensions.
		Fluid Dynamics: Equation of continuity; Euler's equation of motion for inviscid flow; Streamlines, particle path; Potential flow; 2D and axisymmetric motion; Sources and sinks, vortex motion; Navier-Stokes equation for a viscous fluid.