

# GATE 2014 Exam Syllabus for Mathematics

## General Aptitude (GA)-Multiple Choice Test

- **This Paper Consists of Verbal Ability:** English grammar, verbal analogies, instructions, critical reasoning and verbal deduction, Sentence completion, Word groups

## Mathematics-

- **Linear Algebra: It consists of vector spaces as well as linear mappings.** It include topics- Linear transformations; Finite dimensional vector spaces and their matrix representations, rank; systems of linear equations, eigen vectors and eigen values, minimal polynomial, Cayley-Hamilton Theorem, Hermitian, diagonalisation, Skew-Hermitian and unitary matrices; Gram-Schmidt orthonormalization process, Finite dimensional inner product spaces, self-adjoint operators.
- **Complex Analysis: Mathematical branch which investigates functions of complex numbers.** It include topics- Analytic functions, bilinear transformations; conformal mappings ;complex integration: Cauchy's integral theorem and formula; Liouville's theorem, maximum modulus principle; Laurent's and Taylor's series; residue theorem and applications for evaluating real integrals.
- **Real Analysis: Mathematical branch that deals with real numbers & the real valued functions of a real variable.** It include topics- Sequences and series of functions, power series, uniform convergence, Fourier series, functions of several variables, minima, maxima ; multiple integrals, Riemann integration, surface, line and volume integrals, theorems of Green, Gauss and Stokes; metric spaces, completeness, Weierstrass approximation theorem, Lebesgue measure, compactness; measurable functions, Fatou's lemma, Lebesgue integral, dominated convergence theorem.
- **Ordinary Differential Equations: Equation which contains a function of one independent variable and its derivatives.** It include topics- First order ordinary differential equations, existence and uniqueness theorems, linear ordinary differential equations of higher order with constant coefficients; systems of linear first order ordinary differential equations; linear second order ordinary differential equations with variable coefficients; method of Laplace transforms for solving ordinary differential equations, Legendre and Bessel functions and their orthogonality; series solutions.
- **Algebra: It goes together with number theory, geometry and analysis.** It include topics- Normal subgroups and automorphisms; homomorphism theorems ; Group actions, Sylow's theorems and their applications; Euclidean domains, unique

factorization domains and Principle ideal domains .Prime ideals and maximal ideals in commutative rings; finite fields, Fields

- **Functional Analysis:Detail study of vector spaces equipped with some kind of limit-related structure and the linear operators which act upon these spaces.**It include topics- Hahn-Banach extension theorem, Banach spaces ,open mapping and closed graph theorems, Hilbert spaces, principle of uniform boundedness ,orthonormal bases, Riesz representation theorem, bounded linear operators.

Gate mathematics syllabus

- **Numerical Analysis:Study of step by step approach which uses numerical approximation to deal with the difficulties of mathematical analysis.**It include topics- Numerical solution of algebraic and transcendental equations: secant method, bisection ,Newton-Raphson method, fixed point iteration; interpolation: Lagrange ;error of polynomial interpolation, Newton interpolations; numerical differentiation; numerical integration: Trapezoidal and Simpson rules, Gauss Legendre quadrature, least square polynomial approximation; method of undetermined parameters ;numerical solution of systems of linear equations: direct methods (LU decomposition ,Gauss elimination,); iterative methods ( Gauss-Seidel and Jacobi ); matrix eigen value problems: power method, numerical solution of ordinary differential equations: initial value problems: Euler's method, Runge-Kutta methods, Taylor series methods.
- **Partial Differential Equations: It contains unknown multivariable functions & partial derivatives.**It include topics- Linear and quasi linear first order partial differential equations, method of characteristics; second order linear equations in two variables and their classification; Dirichlet ,Cauchy and Neumann problems; solutions of Laplace, diffusion and wave equations in two variables; Fourier transform, Fourier series and Laplace transform methods of solutions for the above equations.
- **Mechanics: It uses physical reasoning to find answer to problems.**It include topics- Lagrange's equations for holonomic systems, Virtual work, Hamiltonian equations.
- **Topology:Study of shapes and spaces.**It include topics- Basic concepts of topology, connectedness, product topology, compactness, countability and separation axioms, Urysohn's Lemma.
- **Probability and Statistics: Probability is the way to roughly judge the occurrence of a thing or to what extent a statement is true.**It include topics- Probability space, Bayes theorem, conditional probability, independence, joint and conditional distributions, Random variables, standard probability distributions and their properties, conditional expectation, expectation,moments; strong and weak law of large numbers, Sampling distributions, central limit theorem ,UMVU estimators, maximum likelihood estimators, standard parametric tests based on normal, Testing of hypotheses,  $X^2$  , t,  $F$  – distributions; Linear regression; Interval estimation.
- **Linear programming:It is also referred as Linear optimization to find out the best result or outcome.** It include topics- Linear programming problem and its formulation, convex sets and their properties, basic feasible solution, graphical

method ,simplex method, big-M and two phase methods; unbounded LPP's and infeasible , alternate optima; Dual problem and duality theorems, dual simplex method and its application in post optimality analysis; unbalanced and balanced transportation problems, Hungarian method for solving assignment problems, u -u method for solving transportation problems.

- **Calculus of Variation and Integral Equations:**Field that deals with maximizing or minimizing functionals which are diagrammatically represented from a set of functions to the real numbers.It include topics- Variation problems with fixed boundaries; linear integral equations of Fredholm and Volterra type, their iterative solutions, sufficient conditions for extremum.

