

Linear Algebra: Vector spaces over \mathbb{R} and \mathbb{C} , linear dependence and independence, subspaces, bases, dimension; linear transformations, rank and nullity, matrix of a linear transformation. Algebra of Matrices; row and column reduction, echelon form, congruence and similarity; the rank of a matrix; the inverse of a matrix; solution of a 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.

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, surface and volumes.

Analytic Geometry: Cartesian and polar coordinates in three dimensions, second-degree equations in three variables, reduction to canonical forms, straight lines, the shortest distance between two skew lines; Plane, sphere, cone, cylinder, paraboloid, ellipsoid, hyperboloid of one and two sheets and their properties.