

Reference: <https://iitk.ac.in/math/index.php/2014-05-21-10-30-47/courses> ( MTH 201)

Syllabus: Pre-requisite: MTH102, None for M.Sc. 2yr

Matrices: Elementary matrices, invertible matrices, Gauss-Jordan method, determinant, Systems of linear equations and Cramer's Rule. Vector spaces: Fields, Vector spaces over a field, subspaces, Linear independence and dependence, existence of basis, coordinates, dimension. Linear Transformations: Rank Nullity Theorem, isomorphism, matrix representation of linear transformation, change of basis, similar matrices, linear functional and dual space. Inner product spaces: Cauchy-Schwarz's inequality, Gram-Schmidt orthonormalization, orthonormal basis, orthogonal projection, projection theorem, four fundamental subspaces and their relations (relation between null space and row space; relation between null space of the transpose and the column space). Diagonalization: Eigenvalues and eigenvectors, diagonalizability, Invariant subspaces, adjoint of an operator, normal, unitary and self adjoint operators, Schur's Lemma, diagonalization of normal matrices, spectral decompositions and spectral theorem, applications of spectral theorem, Cayley-Hamilton theorem, primary decomposition theorem, Jordan canonical form, minimal polynomials, Introduction to bilinear and Quadratic forms: Bilinear and quadratic forms, Sylvester's law of inertia. Some applications: Lagrange interpolation, LU,QR and SVD decompositions, least square solutions, least square fittings, pseudo inverses.

Reference materials:

1. Kenneth Hoffman and Ray Kunze: Linear Algebra, PHI publication.
2. Gilbert Strang: Linear Algebra and Its Applications, 4th edition.
3. Sheldon Axler: Linear Algebra Done Right, UTM, Springer.

Credits: 11