

Linear Algebra
Lecture Topics
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Lecture 1:

Vector spaces, subspaces, quotients, direct sums.
Linear transformations. Kernel, image, isomorphism theorem.
Bases, dimension, dimension formula.
Coordinates and matrix with respect to bases. Change of basis formula.
Gaussian elimination. Interpretation of reduced matrix.
Dual vector space, transpose of a linear transformation. Dual basis.
Canonical and non-canonical isomorphisms.

Lecture 2:

Eigenvalues and eigenvectors.
Diagonalization and bases of eigenvectors.
Impossibility of diagonalization in general. What is simplest triangular form?
Analysis of a Jordan block.
Statement of Jordan form.
Application of Jordan form.
Abstract Jordan form.

Lecture 3:

Bilinear pairing and forms.
Corresponding map from V to W^* . Non-degeneracy.
Matrix of a form and change of basis formula.
Symmetric, alternating, and Hermitian forms. Definiteness.
Gram-Schmidt and classification of forms over \mathbb{R} and \mathbb{C} .
Special operators: orthogonal and unitary, symmetric and hermitian, normal.
Spectral characterizations of special operators in inner product spaces