Linear Algebra - Video course

COURSE OUTLINE

Systems of linear equations, Matrices, Elementary row operations, Row-reduced echelon matrices. Vector spaces, Subspaces, Bases and dimension, Ordered bases and coordinates.

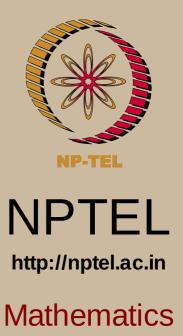
Linear transformations, Rank-nullity theorem, Algebra of linear transformations, Isomorphism, Matrix representation, Linear functionals, Annihilator, Double dual, Transpose of a linear transformation.

Characteristic values and characteristic vectors of linear transformations, Diagonalizability, Minimal polynomial of a linear transformation, Cayley-Hamilton theorem, Invariant subspaces, Direct-sum decompositions, Invariant direct sums, The primary decomposition theorem, Cyclic subspaces and annihilators, Cyclic decomposition, Rational, Jordan forms.

Inner product spaces, Orthonormal bases, Gram-Schmidt process.

COURSE DETAIL

Lectures	Торіс		
1	Introduction to the Course Contents.		
2	Linear Equations		
3a	Equivalent Systems of Linear Equations I: Inverses of Elementary Row-operations, Row-equivalent matrices		
3b	Equivalent Systems of Linear Equations II: Homogeneous Equations, Examples		
4	Row-reduced Echelon Matrices		
5	Row-reduced Echelon Matrices and Non- homogeneous Equations		



Additional Reading:

- 1. S. Axler, Linear Algebra Done Right, 2nd Edition, John-Wiley, 1999.
- 2. S. Lang, Linear Algebra, Springer UTM, 1997.
- S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice-Hall of India, 2004.

Coordinators:

Dr. K.C. Sivakumar Associate ProfessorDepartment of MathematicsIIT Madras

6	Elementary Matrices, Homogeneous Equations and Non-homogeneous Equations	
7	Invertible matrices, Homogeneous Equations Non- homogeneous Equations	
8	Vector spaces	
9	Elementary Properties in Vector Spaces. Subspaces	
10	Subspaces (continued), Spanning Sets, Linear Independence, Dependence	
11	Basis for a vector space	
12	Dimension of a vector space	
13	Dimensions of Sums of Subspaces	
14	Linear Transformations	
15	The Null Space and the Range Space of a Linear Transformation	
16	The Rank-Nullity-Dimension Theorem. Isomorphisms Between Vector Spaces	
17	Isomorphic Vector Spaces, Equality of the Row-rank and the Column-rank I.	
18	Equality of the Row-rank and the Column-rank II	
19	The Matrix of a Linear Transformation	
20	Matrix for the Composition and the Inverse. Similarity Transformation	
21	Linear Functionals. The Dual Space. Dual Basis I	
22	Dual Basis II. Subspace Annihilators I	
23	Subspace Annihilators II	
24	The Double Dual. The Double Annihilator	

25	The Transpose of a Linear Transformation. Matrices of a Linear Transformation and its Transpose	
26	Eigenvalues and Eigenvectors of Linear Operators	
27	Diagonalization of Linear Operators. A Characterization	
28	The Minimal Polynomial	
29	The Cayley-Hamilton Theorem	
30	Invariant Subspaces	
31	Triangulability, Diagonalization in Terms of the Minimal Polynomial	
32	Independent Subspaces and Projection Operators	
33	Direct Sum Decompositions and Projection Operators I	
34	Direct Sum Decomposition and Projection Operators	
35	The Primary Decomposition Theorem and Jordan Decomposition	
36	Cyclic Subspaces and Annihilators	
37	The Cyclic Decomposition Theorem I	
38	The Cyclic Decomposition Theorem II. The Rational Form	
39	Inner Product Spaces	
40	Norms on Vector spaces. The Gram-Schmidt Procedure I	
41	The Gram-Schmidt Procedure II. The QR Decomposition	
42	Bessel's Inequality, Parseval's Indentity, Best Approximation	
43	Best Approximation: Least Squares Solutions	
лл	Orthogonal Complementary Subspaces, Orthogonal	

44	Projections			
45	Projection Theorem. Linear Functionals			
46	The Adjoint Operator			
47	Properties of the Adjoint Operation. Inner Product Space Isomorphism			
48	Unitary Operators			
49	Unitary operators II. Self-Adjoint Operators I			
50	Self-Adjoint Operators II - Spectral Theorem			
51	Normal Operators - Spectral Theorem			
Referen	ces:			
1. K.Hoffman and R. Kunze, Linear Algebra, 2nd Edition, Prentice- Hall of India, 2005.				
2. M. Artin, Algebra, Prentice-Hall of India, 2005.				
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