



Linear Algebra

SWAYAM Prabha Course Code - S1

PROFESSOR'S NAME	Prof. Jugal Verma
DEPARTMENT	Mathematics
INSTITUTE	Indian Institute of Technology, Bombay
Course Outline	<p>Vectors in R^n , notion of linear independence and dependence, linear span of a set of vectors, vector subspaces of R^n , basis of a vector subspace. • Systems of linear equations, matrices and Gauss elimination, row space, null space, and column space, rank of a matrix. • Determinants and rank of a matrix in terms of determinants. • Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem. • Inner product spaces, Gram-Schmidt process, orthonormal bases, projections and least squares approximation. • Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special matrices (orthogonal, unitary, hermitian, symmetric, skewsymmetric, normal). algebraic and geometric multiplicity, diagonalization by similarity transformations, spectral theorem for real symmetric matrices, application to quadratic forms.</p>

COURSE DETAILS

S. No	Module ID/ Lecture ID	Lecture Title/Topic
1	L1	Notation for numbers and vectors
2	L2	Matrix Multiplication
3	L3	Gauss elimination method-II, Inverse of a matrix
4	L4	Inverse of matrices, determinant functions Determinant of matrices-I
5	L5	Solving linear equations using the REF
6	L6	Elementary matrices
7	L7	Finding the inverse of an invertible matrices
8	L8	Axioms for a determinant function
9	L9	Existence of determinant function
10	L10	Determinant of transpose of a matrix

11	L11	Cramer's Rule
12	L12	Vector spaces
13	L13	Subspace of a vector space
14	L14	L.D and L.I.Subsets
15	L15	Bases and Dimension
16	L16	Row and Column Spaces of Matrix
17	L17	Linear Transformation: Rank and Nullity
18	L18	Linear Transformation: Rank and Nullity
19	L19	Inner Product Spaces
20	L20	Pythagoras Theorem and Parallelogram Law
21	L21	The Gram-Schmidt orthogonalization
22	L22	Subspace and its orthogonal subspace
23	L23	Inner Product Spaces
24	L24	Least Squares Approximation
25	L25	The QR decomposition of a matrix
26	L26	Eigen values and Eigenvectors of matrices and Linear Transformations
27	L27	Eigen values and Eigenvectors of linear operators
28	L28	Algebraic and Geometric multiplicity of eigenvalues
29	L29	A criterion for diagonalizability
30	L30	Normal and Symmetric matrices
31	L31	Characterization of self-adjoint operators
32	L32	Spectral Theorem for self-adjoint operators
33	L33	Diagonalization of normal matrices
34	L34	A Hyperbola

References if Any: