Course Name: Linear Algebra   **Course Code: MT(N)-301**

Credit: 4

SYLLABUS

Vector Spaces

Vector spaces, linearly independent and dependent sets, vector subspace, bases and dimension of vector space.

Linear Transformation, Homomorphism and Dual space

Linear transformation, Linear functional, Dual spaces and second dual space, Transpose of linear transformation, Algebra of linear transformations, Isomorphism theorems.

Algebra of Polynomial and Canonical form

Algebras, The algebra of polynomials, Lagrange interpolation, Vandermonde matrix, Polynomial ideals, Taylor's formula, The prime factorization of a polynomial, Algebraically closed fields, Determinant functions, Characteristic values of a linear transformation, Cayley-Hamilton theorem for linear transformations, Annihilating polynomials, Invariant subspaces, Minimal and characteristic polynomials. Diagonalisability of linear transformations, Direct sum decomposition, Invariant direct sums, The primary decomposition theorem, Triangular form, Jordan canonical form, trace and transpose.

Inner Product Spaces

Definition and examples of inner product space, orthogonality, orthonormality, Cauchy-Schwarz inequality, Gram-Schmidt orthogonalisation, diagonalisation of symmetric matrices, Hermitian Operator, Unitary and normal operators.

UNIT SCHEDULE

BLOCK I: **VECTOR SPACE**

UNIT 1:   Vector Space

UNIT 2:   Subspace

UNIT 3:   Linear Dependence and Linear independence

UNIT 4:   Basis

BLOCK II: **LINEAR TRANSFORMATION, HOMOMORPHISM AND DUAL SPACE**

UNIT 5:   Linear transformation

UNIT 6:   Homomorphism and Isomorphism

UNIT 7:   Dual space

BLOCK III: ALGEBRA OF POLYNOMIAL AND CANONICAL FORM

UNIT 8:   Algebra of polynomial

UNIT 9:   Determinants

UNIT 10:   Elementary canonical form

BLOCK IV: INNER PRODUCT SPACE

UNIT 11:   Inner product space

UNIT 12:   Orthogonality and Orthonormality

UNIT 13:   Gram-Schmidt Orthogonalization process

UNIT 14:   Unitary and Normal operator

REFRENCE BOOKS

1. Gel′fand I.M. Lectures on linear algebra (1989), Courier Corporation.
2. Kenneth Hoffman & Ray Kunze, Linear Algebra (2nd edition)(2015), Prentice-Hall.
3. David C. Lay, Linear Algebra and its Application (3rd Edition) (2007) Pearson Education Asia, India Reprint.
4. Seymour Lipshutz and Marc Lipson, Schaum's outlines "Linear Algebra" (3rd Edition)(2012), Mc Graw Hill Education.

SUGGESTED READINGS

1. Minking Eie & Shou-Te Chang (2020), A First Course In Linear Algebra, World Scientific.
2. Axler, Sheldon (2015), Linear algebra done right. Springer.
3. .https://nptel.ac.in/courses/111106051
4. https://archive.nptel.ac.in/courses/111/104/111104137