

B.Sc. (Mathematics) (Part III) (Semester – VI)
Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)
Syllabus to be implemented from Academic Year 2024-25

Course code	:	DSE – F10
Title of course	:	Linear Algebra
Theory	:	32 Hrs. (40 lecturers of 48 min.)
Marks	:	50 (Credit: 02)

Course Learning Outcomes: This course will enable the students to:

CO1: understand the fundamental concepts in linear algebra, enabling them to analyze and manipulate vector spaces, linear transformations.

CO2: relate matrices and linear transformations

CO3: acquire skills to perform computations related to inner product and orthogonalization techniques.

CO4: compute Eigen values and Eigen vectors of a linear transformations.

Unit 1: Vector Spaces and Linear Transformations

(20 Lect.)

Vector space, Subspace, Sum of subspaces, direct sum, Quotient space, Homomorphism or Linear transformation, Kernel and Range of homomorphism, Fundamental Theorem of homomorphism, Isomorphism theorems, Linear Span, Finite dimensional vector space, Linear dependence and independence, basis, dimension of vector space and subspaces.

One-one and onto Linear Transformations, rank and nullity of a linear transformation, Sylvester's Law, Algebra of Linear Transformations - Sum and scalar multiple of Linear Transformation, The vector space $\text{Hom}(V, W)$, Product (composition) of Linear Transformations, Linear operator, Linear functional, Invertible and non-singular Linear Transformation, Matrix of Linear Transformation and its examples.

Unit 2: Inner Product Spaces, Eigen values and Eigen vectors

(20 Lect.)

Inner product space, norm of a vector, Cauchy- Schwarz inequality, Orthogonality, Generalized Pythagoras Theorem, orthonormal set, Gram-Schmidt orthogonalisation process,

Eigen values and Eigen vectors, Eigen space, Characteristic Polynomial of a matrix and remarks on it, similar matrices, Characteristic Polynomial of a Linear operator, Examples on eigen values and eigen vectors of matrices, Cayley Hamilton theorem (without proof), Applications of Cayley Hamilton theorem (Examples).

RECOMMENDED BOOKS

1. Khanna V. K. and Bhambri S. K., **A Course in Abstract Algebra**, Vikas Publishing House PVT Ltd., New Delhi, 2016, 5th edition, [Scope: Chaper-10,11,12 & 13]
2. Grewal, B.S., **Higher Engineering Mathematics**, 42nd Edition, Khanna Publishers, New Delhi, 2012. [Scope: Chaper-2: Art. 2.15]

REFERENCE BOOKS

1. **Elementary Linear Algebra** (with Supplemental Applications), H. Anton & C. Rorres; 11th Edition, Wiley India Pvt. Ltd (Wiley Student Edition), New Delhi, 2016.
2. **Linear Algebra**, S. Friedberg, A. Insel, L. Spence; 4th Edition, Prentice Hall of India, 2014.
3. **Linear Algebra**, Holfman K. and Kunze R.; Prentice Hall of India, 1978.
4. **Linear Algebra**, Lipschutz' S; Schaum's Outline Series, McGraw Hill, Singapore, 1981.