

Mathematics

**LINEAR
ALGEBRA**

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Unit-I**Chapter 1. Vector Spaces.**

- 1.1. Introduction and definitions
- 1.2. Vector space
- 1.3. General properties of vector spaces
- 1.4. Vector subspaces
- 1.5. Criterion for a subspace
- 1.6. Algebra of subspaces
- 1.7. Linear combination of vectors
- 1.8. Linear span of a set
- 1.9. Finite dimensional vector space
- 1.10. Linear sum of two subspaces
- 1.11. Quotient space
- 1.12. Direct sum of vector sub-spaces
- 1.13. Linearly dependent and linearly independent vectors
- 1.14. Deductions
- 1.15. Some theorems on linear dependence and linear independence
- 1.16. Basis of a vector space
- 1.17. Existence of basis of a finite dimensional vector space
- 1.18. Dimension of a finitely generated vector space
- 1.19. Some properties of finite dimensional vector spaces
- 1.20. Co-ordinate representation of a vector

Unit -II**Chapter 2. Linear Mapping**

- 2.1. Linear mapping or vector space homomorphism
- 2.2. Properties of linear mappings
- 2.3. Isomorphism of vector spaces
- 2.4. Some theorems
- 2.5. Some important theorems
- 2.6. Application to ordinary differential equations

Chapter 3. Rank and Nullity of a Linear Transformation

- 3.1. Rank of a linear transformation
- 3.2. Product of linear transformations
- 3.3. Invertible linear transformations

- 3.4. Singular and non-singular linear transformations
- 3.5. Sum of two linear maps
- 3.6. Scalar multiple of a linear map

Chapter 4. Matrix Representation of Linear Maps

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- 4.1. Matrix representation of linear maps
- 4.2. Some theorems

Unit-III

Chapter 5. Eigen Values and Eigen Vectors

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- 5.1. Eigen values and eigen vectors of a linear map
- 5.2. Certain relation between eigen values and eigen vectors
- 5.3. Nature of the eigen values of special types of matrices
- 5.4. The process of finding the eigen values and the eigen vectors of a matrix
- 5.5. Characteristic (Eigen) subspaces of a matrix
- 5.6. Cayley-Hamilton theorem

Chapter 6. Diagonalization of Matrices

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- 6.1. Similarity
- 6.2. Diagonalization of matrices
- 6.3. Diagonalization of a matrix with repeated eigen values

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Chapter 7. Inner Product

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- 7.1. Inner product
- 7.2. Properties of inner product
- 7.3. Norm or length of a vector in an inner product space
- 7.4. Orthogonalization of a base
- 7.5. Bessel's inequality

Chapter 8. Quadratic Forms and their Reduction to Canonical Forms

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- 8.1. Some definitions
- 8.2. Types of bilinear forms
- 8.3. Quadratic form
- 8.4. Linear transformation of a quadratic form
- 8.5. Reduction of quadratic forms to canonical forms
- 8.6. Elementary transformation
- 8.7. Canonical or normal form of a real quadratic form

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