

## Module M31 Linear Algebra

1. Vector (Linear) space over a field. Subspaces. Linear combinations. Linear dependence and independence of a set of vectors. Linear span. Finite dimensional vector space.

Basis. Dimension. Replacement Theorem. Extension theorem. Deletion theorem.

2. Row Space and Column Space of a Matrix. Rank of a matrix.  $\text{Rank}(AB) \leq \min(\text{Rank}A, \text{Rank}B)$ .

3. System of Linear homogeneous equations: Solution space of a homogeneous system and its dimension.

System of linear non-homogeneous equations: Necessary and sufficient condition for the consistency of the system. Method of solution of the system of equations.

4. Linear Transformation (L.T.) on Vector Spaces: Null space. Range space. Rank and Nullity, Sylvester's law of Nullity. Inverse of Linear Transformation. Non-singular Linear Transformation. Change of basis by Linear Transformation. Vector spaces of Linear Transformation.

5. Linear Transformation (L.T.) and Matrices: Matrix of a linear transformation relative to ordered bases of finite-dimensional vector spaces. Rank of L.T. = Rank of the corresponding matrix.

6. Characteristic equation of a square matrix. Eigen-value and Eigen-vector. Invariant subspace. Cayley- Hamilton Theorem. Simple properties of Eigen value and Eigen vector.