CURRICULUM TRANSACTIONAL STRATEGY

MMT-C201: Linear Algebra

Prerequisites: Elementary Linear Algebra

COURSE OBJECTIVES

- To get an idea of system of equations and to study different methods of solving such types of equations.
- To understand the concept of vector spaces and subspaces and to obtain criteria for a non-empty subset of a vector space V to be a subspace.
- To understand the definitions of Bases and Dimensions of a vector space and to study when a non- empty subset S of a vector space V forms its Bases.
- To understand the concept of Linear Transformations from a vector space V to a vector space U.
- To understand how to write the matrix of a Linear Transformation with respect to given Bases .
- To understand and get an idea of Linear Functionals and Transpose of a linear transformation.
- To understand the concept of Eigen values and the corresponding Eigen vectors of a matrix and understand the geometrical interpretation of Eigen values.
- To understand the minimal and characteristic polynomial of a matrix and find the relation between the two.
- To understand the concept of diagonalizability and Criterion for diagonalizability.
- To understand the concept of modules, submodules and quotient modules.
- To get an idea of Module homomorphism and understand various isomorphism theorems on modules.
- To understand the concept of torsion and torsion-free modules, direct product, sum of modules, free modules, generated and free modules and rank of a module.
- To get an idea of Modules over a Principle Ideal Domain and properties of R[X] over a field K.
- To understand the Structure theorem for finitely generated module over a PID.
- To understand rational and Jordan canonical form and illustrate it by means of various examples.

COURSE OUTLINE

UNIT I

- The definition vector spaces and subspaces illustrate with examples.
- The idea of a Bases and Dimension of vector spaces.
- The Algebra of Linear Transformations.
- Matrix of a linear transformation with respect to various Bases.
- Linear Functionals and Transpose of a linear transformation.

UNIT II

- Definition of Eigen values and eigen vectors with examples.
- Definition of minimial and characteristic polynomial of a matrix and relation between the two,
- Definition of Invariance and Invariant subspaces.
- The Diagonalizability and Criterion for diagonalizability of a linear transformation.
- Diagonalizability of normal operators on a finite dimensional inner product space.
- Bilinear forms.

UNIT III

- Basic Concept of Modules, submodules, quotient modules.
- Module homomorphisim and Isomorphism theorems on Modules.
- Definition of torsion and torsion-free modules.
- Direct product of modules and sum of modules.
- Free modules, finitely generated and free modules.
- Rank of module and related results.

UNIT IV

- Modules over PID and related results.
- Properties of K[X] over a field K.
- Structure theorem for finitely generated module over a PID.
- Rational and Jordan canonical form illustrate with examples.

Classroom Transaction

Unit	Topic	Activity	No. of Tutorials	No. of lectures
I	Definition of vector spaces and subspaces illustrate with examples.	Assignment	02	02
	The Bases and Dimension of vector spaces and related results.	Assignment	03	02
	The Algebra of Linear Transformations.	Assignment	02	04

	Matrix of a linear transformation and related theorems.	Assignment	03	02
	Linear Functionals and Transpose of a linear transformation.	Assignment and Presentation	04	03

Unit	Topic	Activity	No. of Tutorials	No. of lectures
II	Definition of Eigen values and Eigen vectors with examples.	Assignment	02	01
	Definition of Minimal and Characteristic polynomial of a matrix and relation between the two.	Assignment and Presentation	02	02
	Definition of Invariance and Invariant subspaces.	Assignment	02	03
	The Diagonalizability and Criterion for diagonalizability of a linear transformation.	Assignment	01	01
	Diagonalizability of normal operators on a finite dimensional inner product space.	Assignment and Presentation	01	03

Unit	Topic	Activity	No. of Tutorials	No. of lectures
III	Basic Concept of Modules, submodules, quotient modules.	Assignment	02	01
	Module homomorphisim and Isomorphism theorems on Modules.	Assignment	02	01
	Definition of torsion and torsion-free modules.	Assignment and Presentation	02	03
	Direct product of modules and sum of modules.	Assignment	02	01
	Free modules, finitely generated and free modules.	Assignment	01	02
	Rank of module and related results.	Assignment and Presentation	01	02

Unit	Topic	Activity	No. of Tutorials	No. of lectures
IV	Modules over PID and related results.	Assignment	01	01
	Properties of K[X] over a field K.	Assignment	01	02
	Structure theorem for finitely generated module over a PID.	Assignment	01	01
	Rational and Jordan canonical form illustrate with examples.	Assignment --	01	01
	Modules over PID and related results.	Assignment and Presentation	03	03

Reference books:

1. K. Hoffman and R. Kunze, Linear Algebra.
2. D. S. Dummit and R. M. Foote, Abstract Algebra.
3. N.S. Gopalakrishnan, University Algebra.