Version No:
Approval Date:

Linear Algebra

Programme(s) in which it is offered: B.Sc.B.Ed. Mathematics

Course Category: Core	**Schedule of Offering**: Even
Course Credit Structure: 4	**Course Code:** EG417
Total Number of Hours: 5	**Contact Hours Per Week:** 5
Lecture: 3, 3	**Tutorial:** 1, 2
Practical: 0, 0	**Medium of Instruction:** English
Date of Revision:	**Skill Focus:** Others
Short Name of the Course: Linear Algebra	**Course Stream**
Grading Method: Regular	**Repeatable:** Credit
Course Level: Beginner	

Course Description

This course is a core course for B.Sc. B.Ed. Mathematics students. This course discusses the fundamental theory of linear algebra.

Course Introduction

This course is an introductory course in linear algebra – a study of vector (linear) spaces. The course discusses the theory of vector spaces, linear transformations and their significance. The course also to a certain extent relates branches of mathematics like Euclidean geometry, Matrix algebra and abstract algebra.

Course Objective

The objectives of the course are:

1. To discuss the fundamental concepts of linear algebra
2. To expose the students to various tools of linear algebra
3. To study linear maps, their properties and applications
4. To study inner product spaces as generalisation of Euclidean spaces

Course Outcome

At the end of the course students will be able to

1. Find the bases for a given vector space and vice versa
2. Determine the matrix of a given linear map and vice versa
3. Prove and apply the properties of linear maps
4. Apply the diagonalization process on suitable linear maps
5. Generalise certain properties of Euclidean geometry to inner product spaces

PO-CO Mapping

<This should explain how the Course Outcomes (CO) are mapped with the Programme Outcomes (PO). All programmes to have two generic POs which can map to all minors/proficiency courses and foundation/self-immersion courses. Please tick the respective cells only; leave the other cells blank.>

PO-CO Mapping Matrix

CO/PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6
CO1						
CO2						
CO3						
CO4						
CO5						

Prerequisites and other constraints

This course is offered to all students of B.Sc.B.Ed. Mathematics. There is no prerequisite course.

Pedagogy

The teaching-learning of the course is organized through lectures, problem-solving sessions and student presentations.

Suggested Reading:

1. Hoffmann and Kunze (1998). Linear Algebra, Second Ed. Prentice Hall of India New Delhi.
2. Kumaresan (1999). Linear Algebra: A Geometric Approach. Prentice Hall of India, New Delhi.
3. Herstein (2006). Topics in Algebra. Wiley.
4. Lang (1986). Introduction to Linear Algebra, Second Ed. Springer-Verlag. New York.

5. Friedberg, Insel, and Spence (2009). Linear Algebra, Fourth Edition. PHI.

Evaluation Pattern

Evaluation Matrix

	Component Type	Weightage Percentage	Total Marks	Tentative Dates	Course Outcome Mapping
Continuous Internal Assessment (CIA) Components*	Mid-semester exam	50% of CIA	30	Around 9th week	1, 2, 3
	Assignment	25% of CIA	15	End of each module	1, 2, 3, 4, 5
	Quizzes/Problem Solving	17% of CIA	10	Every two weeks	1, 2, 3, 4
	Presentations	8% of CIA	5	End of two modules	1, 2, 3, 4, 5
	CIA Marks	**100% of CIA**	**60**		
ESE		40%	**100**	End of the semester	1, 2, 3, 4, 5

Module Sessions

Module 1: Vector Spaces (20 hours)

Vector spaces, Subspaces, Linear Combinations, Linear span, Linear dependence and Linear independence of vectors, Basis and Dimension, Finite dimensional vector space – some properties. Quotient spaces, Direct sums.

Reading:

1. Kumaresan
2. Friedberg
3. Hoffman

Activities:

a. Quiz
b. Assignment

Module 2: Linear Maps - I **(18 Hours)**

Linear maps, Matrices of Linear maps, Change of basis and the effect on associated matrices, Kernel and Image of a linear transformation, Rank-Nullity theorem and applications.

Reading:

1. Friedberg
2. Kumaresan

Activities:

a. Quiz
b. Assignment
c. Presentation

Module 3: Linear Maps - II **(17 Hours)**

Singular and non-singular linear transformations, Elementary matrices and transformations, Similarity, Eigen values and Eigen vectors, Diagonalisation, Characteristic polynomial, Cayley - Hamilton Theorem, Minimal Polynomial.

Reading:

1. Friedberg
2. Hoffman
3. Kumaresan

Activities:

a. Quiz
b. Assignment

Module 4: Inner-product Spaces **(20 Hours)**

Inner product spaces, Euclidean spaces, Distance, Length, Properties, Parallelogram Law, Cauchy-Schwarz inequality, Orthogonal and Orthonormal vectors, Gram-Schmidt Orthogonalisation Process, Orthogonal complement.

Reading:

1. Kumaresan
2. Friedberg

Activities:

a. Quiz
b. Assignment
c. Presentation