Course Code	Course Title	L	P	T
MA505	Linear Algebra – I	4	0	4

Objectives of the course :

The aim of this course is to learn the concept of basic matrix algebra, vector spaces. Further we study the eigenvalues and eigenvectors of a matrix.

Objective 1 : Students will learn the fundamentals of basic matrix algebra.

Objective 2 : Students will study the concept of vector spaces and its basis and dimension.

Objective 3 : Students will derive and characterize the eigenvalues and eigenvectors of a matrix.

Course learning outcome: Upon completion of this course, the student will be able to:

1. Understand basic concepts of matrix algebra, elementary row operations, rank of a matrix, invertible matrices.
2. Characterize the solutions of a system of linear equations using Gaussian elimination and Gauss – Jordan method.
3. Know the properties of a vector space, linearly independent subset, basis and dimension of a vector space and subspaces of a vector space.
4. Classify eigenvalues and eigenvectors of a matrix and apply Cayley – Hamilton theorem to solve several problems.
5. Derive the minimal polynomial of a matrix.

Mapping of Course Outcome(s):

PO/ CO		Program Outcomes						
		PO1	PO2	PO3	PO4	PO5	PO6	PO7
Course Outcomes	CO1	S			M			M
	CO2	S			M			M
	CO3	M			S			S
	CO4	M			S			S
	CO5	M			M			M

L-Low, M-Medium, S-Strong

Text Books	**T1**	S. Axeler, Linear Algebra Done Right, 2nd edition, Springer
Reference books	**R1**	K. Hoffman and R. Kunze, Linear Algebra, 2nd edition, Prentice-hall INC.

Course Contents

Unit I : Basic matrix algebra, elementary row operations, rank of a matrix, invertible matrices. **(12 hours).**

Unit II : Solution of a system of linear equations, Gaussian elimination and Gauss-Jordan Method. **(5 hours).**

Unit III : Vector space, Sum and Direct sum of vector spaces, linearly independent subset, basis, dimension, subspaces of a vector space. **(20 hours).**

Unit IV : Characteristic polynomial, Cayley Hamilton Theorem and its applications. **(13 hours).**

Unit V :. Annihilating polynomials, derivation of minimal polynomial of a matrix, properties of minimal polynomial. **(6 hours).**

LECTURE-WISE PLAN

Lecture No.	Learning outcomes	Topics to be covered	Books
1-2	Understand basic concepts of matrix algebra, elementary row operations, rank of a matrix, invertible matrices.	Basic matrix algebra	R1
3		Elementary row operations	R1
4		Row echelon form	R1
5		Reduced row echelon form	R1
6		Rank of a matrix	R1
7		Elementary matrices	R1
8-10		Invertible matrices and its properties	R1
11-12		Problems on basic matrix algebra	R1
13	Characterize the solutions of a system of linear equations using Gaussian elimination and Gauss – Jordan method.	System of linear equations and its solution	R1
14		Gaussian Elimination	R1
15		Gauss Jordan method	R1
16-17		Problems on system of linear equations	R1

Lecture No.	Learning outcomes	Topics to be covered	Books
18-19	Know the properties of a vector space, linearly independent subset, basis and dimension of a vector space and subspaces of a vector space.	Definition and example of a vector space	T1
20-22		Properties of a vector space	T1
23		Sum of vector spaces	T1
24-25		Direct sum of vector spaces	T1
26		Linear span	T1
27-28		Linearly independent subset	T1
29-30		Basis	T1
32		Dimension	T1
32		Definition and examples of subspaces	T1
33-34		Properties of a subspace of a vector space	T1
35-37		Problems on vector space and subspaces	T1
38	Classify eigenvalues and eigenvectors of a matrix and apply Cayley – Hamilton theorem to solve several problems.	Characteristic polynomial	R1
39-41		Derivation of eigenvalues and eigenvectors of a matrix	R1
42		Cayley – Hamilton Theorem	R1
43-45		Application of Cayley – Hamilton Theorem	R1
46-50		Problems on eigenvalues and Cayley-Hamilton Theorem	R1
51-52	Derive the minimal polynomial of a matrix.	Annihilating polynomials	R1
53		Minimal polynomial of a matrix	R1
54-56		Properties of minimal polynomial	R1
57-60		Problems on minimal polynomials	R1

: Evaluation Scheme :

Component	Duration	Marks	Remarks
Internal I		25	
Mid Term Examination	2 hours	20	Closed Book
Internal II		25	
Comprehensive Examination	3 hours	30	Closed Book

1. **Attendance Policy :** A student must normally maintain a minimum of **75% attendance** in the course without which he/she will be disqualified from appearing in the respective examination.

2. **Make-up Policy :** A student, who misses any component of evolution for genuine reasons, must immediately approach the instructor with a request for make-up examination. **The decision of the instructor in all matters of make-up will be final.**

3. **Chamber Consultation Hours :** During the chamber consultation hours, the student can consult the respective faculty in his or her chamber without any prior appointment.