20MSM503T					Linear Algebra					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs. / Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To understand the need of introducing vector spaces and to be able to apply various operations therein.
- To be able to associate matrices to linear transformation, verify Rank-Nullity theorem.
- To understand the concept of inner product spaces, apply Orthogonalization and Spectral theorem.
- To be able to apply diagonalization, singular value decomposition and solve ordinary differential equations.

UNIT 1 VECTOR SPACES **09 Hrs.**

Introduction to Matrices, Determinants and systems of linear algebraic equations, Vector spaces, Subspaces, Linear Dependence and Independence, Basis and Dimension, Range and Null space, Rank-Nullity theorem, Linear span, Change of basis, Row column space, Direct sum and complement, least squares, orthogonal subspaces.

UNIT 2 LINEAR TRANSFORMATIONS **09 Hrs.**

Introduction to linear transformation, Algebra, Isomorphism, Representation by matrices, Change of basis, Diagonal Forms, Triangular Forms, Jordan Forms, Inverse of a linear transformation, Linear Functional.

UNIT 3 INNER PRODUCT AND ORTHOGONALITY **10 Hrs.**

Metric and Normed spaces, Inner Product Spaces, Orthogonality, Orthonormal Basis, Gram-Schmidt Orthogonalization process, Expansion, Orthogonal and Unitary Matrices, Orthogonal projections, Adjoints, Hermitian, self adjoint, Unitary and Normal operators, Spectral Theorem for normal operators, Rayleigh quotient, Min-Max Principle.

UNIT 4 EIGEN VALUES AND VECTORS WITH APPLICATIONS **12 Hrs.**

Modal matrix and Diagonalization, Similarity Transformation, Powers and functions of matrices, Eigen systems of real symmetric, orthogonal, Hermitian and Unitary matrices, Quadratic forms, Positive definite matrices, Computation of eigen values, Singular value decomposition (Principal Component Analysis), Norm of a matrix, Condition number, Applications to solving ordinary differential equations and image processing.

40 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Recall the concept of vector spaces and find basis and dimension.
CO2 – Associate the linear transformations with matrices.
CO3 – Apply appropriate tool/method to extract the solutions of practical problems.
CO4 – Analyze the obtained solution in context with theory.
CO5 – Appraise practical problems in terms of vectors and arrays and solve them using algebraic methods.
CO6 – Create various patterns of image processing through singular value decomposition.

TEXT/REFERENCE BOOKS

1. Hoffman K. & Kunze R., Linear Algebra, Pearson Education (India), 2008.
2. Strang, G., Linear Algebra and its applications, 3rd ed .,Thomson, 1998.
3. Anton, H. & Rorres C., Elementary linear algebra, 9th ed., Wiley India, 2005.
4. David C. Lay, Steven C. Lay, Judi J. McDonald, Linear Algebra and its applications, 5th ed., Pearson, 2015.