OLMDS501	Linear Algebra	L	T	P	C
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Pre-Requisite	**NIL**	**Syllabus Version**			
		1.0			

Course Objectives:

1. Understand the basic concepts of matrix algebra and its applications.
2. Solving computational problems of linear algebra.

Course Outcomes:

At the end of the course students will be able to:

1. Understand basic matrix properties like rank, determinant, inverse and a special types of matrices
2. Comprehend Gaussian / Gauss-Jordan elimination methods, LU factorisation technique
3. Use computational techniques for singular value decomposition (Computational and Algebraic Skills).
4. Understand the concepts of vector spaces and subspaces.
5. Find the matrix representation of a linear transformation given bases of the relevant vector spaces.
6. Compute inner products on a real vector space and compute angle and orthogonality in inner product spaces.
7. Understand the use of linear algebra and matrices in several important, modern applications of research and industrial problems involving statistics.

Module: 1	**Matrix theory change to Introduction to Matrices**
Algebra of Matrices, Square vs Rectangular matrices, Trace and Rank of a Matrix and their properties, Determinants, singular/nonsingular matrices, Inverse, Eigen values and Eigen vectors, symmetric, orthogonal and idempotent matrices and their properties, Sparse matrices.	
Module:2	**Matrix Factorisation change to Systems of Linear Equations**
Row canonical form, Echlon form, Gaussian elimination, diagonal form, Gauss-Jordan method, solving systems of linear equations, ill-conditioned systems.	
Module:3	**Decomposition of Matrices**
Triangular reduction -LU decomposition, Cholesky decomposition of symmetric matrices, QR factorisation, singular value decomposition (SVD), Spectral decomposition.	
Module:4	**Vector Spaces**
Vector Spaces, Subspaces, Basis and dimension of a vector space, linear dependence and independence, spanning set.	
Module:5	**Linear transformations**
Linear transformation, kernels, range, Matrix Representation of a linear transformation, rank-nullity theorem, change of basis and similar matrices.	
Module:6	**Inner product spaces**
Inner-product spaces, orthogonal sets and bases, Orthogonal Projection, Gram-Schmidt orthogonalization process.	
Module:7	**Applications in Statistics**
Generalized inverses (g-inverses), Methods of constructing g-inverses, general solution to a system of linear equations. Linear Discriminant Analysis and Canonical Correlation Analysis, Quadratic forms, definiteness and related results with proofs.	
	Total Lecture hours:	**120 hours**
Tutorial	• A minimum of 5 problems to be worked out by student in every tutorial class. .	

Text Book(s)

1. 1.Gilbert Strang, *Introduction to linear algebra, 5/e.*, Wellesley-Cambridge, 2016.

2. 2. David C. Lay, Linear Algebra and Its Applications, Pearson, 5/e 2019.			
Reference Book(s)			
1. 1.G. Allaire and S. M. Kaber. Numerical Linear Algebra, Texts in Applied Mathematics, Springer, 2008. 2. 2.,L. Hogben, Handbook of Linear Algebra, CRC Press/Taylor & Francis Group, 2014. 3. Friedberg, S., Insel, A., and Spence, L., Linear Algebra, 5/e, Pearson, 2019. 4. 4. Nick Fieller, Basics of Matrix Algebra for Statistics with R, CRC Press, 2015.			
Mode of Evaluation: Quiz, Assignment, Mid-Term and FAT.			
Recommended by Board of Studies	28-10-2021		
Approved by Academic Council	No.65	Date	17-03-2022