Course Title	**Linear Algebra**		
Course Code	**MS-252**		
Credit Hours	3 (3,0)		
Category	Mathematics & supporting		
Prerequisite	None		
Co-Requisite	None		
Follow-up	None		
Course Learning Outcomes (CLOs)	At the end of the course, the students will be able to:	**BT**	**PLO**
	CLO1: Know the concept and application of leaner algebra.	C1 (Know)	1
	CLO2: Describe geometry of vector spaces and optimization.	C2 (Describe)	1
	CLO3: Perform matrix algebra.	C3 (Apply)	1,3
Course Description	**Linear Equations in Linear Algebra:** Systems of Linear Equations, Row Reduction and Echelon Forms, Vector Equations, The Matrix Equation Ax = b, Solution Sets of Linear Systems, Applications of Linear Systems, Linear Independence, Introduction to Linear Transformations, The Matrix of a Linear Transformation, Linear Models in Business, Science, and Engineering. **Matrix Algebra:** Matrix Operations, The Inverse of a Matrix, Characterizations of Invertible Matrices, Partitioned Matrices, Matrix Factorizations, Applications to Computer Graphics, Subspaces of R^n, Dimension and Rank. **Determinants:** Introduction to Determinants, Properties of Determinants, Cramer's Rule, Volume, and Linear Transformations. Vector Spaces: Vector Spaces and Subspaces, Null Spaces, Column Spaces, and Linear Transformations, Linearly Independent Sets; Bases, Coordinate Systems, The Dimension of a Vector Space, Rank, Change of Basis. **Eigenvalues and Eigenvectors:** Eigenvectors and Eigenvalues, The Characteristic Equation, Diagonalization, Eigenvectors and Linear Transformations, Complex Eigenvalues, Discrete Dynamical Systems. **Orthogonality and Least Squares:** Inner Product, Length, and Orthogonality, Orthogonal Sets, Orthogonal Projections, The Gram–Schmidt Process, Least-Squares Problems, Applications to Linear Models, Inner Product Spaces, Applications of Inner Product Spaces. **Symmetric Matrices and Quadratic Forms:** Diagonalization of Symmetric Matrices, Quadratic Forms, Constrained Optimization, The Singular Value Decomposition, Applications to Image Processing and Statistics. **The Geometry of Vector Spaces:** Affine Combinations, Affine Independence, Convex Combinations, Hyperplanes. **Optimization:** Matrix Games, Linear Programming—Geometric Method, Linear Programming—Simplex Method, Duality.		
Text Book(s)	1. David C. Lay, Steven R. Lay, Judi J. McDonald, Linear Algebra and Its Applications, 5th Edition, Pearson, 2015, ISBN-13: 978-0321982384, ISBN-10: 032198238X. 2. Gilbert Strang, Introduction to Linear Algebra, 5th Edition, Wellesley-Cambridge Press, 2016, ISBN-13: 978-0980232776, ISBN-10: 0980232775. 3. Howard Anton, Elementary Linear Algebra, 11th Edition, Wiley, 2013, ISBN-13: 978-0470458211, ISBN-10: 0470458216.		
Reference Material	1. Philip N. Klein, Coding the Matrix: Linear Algebra through Applications to Computer Science, 1st Edition, Newtonian Press, 2013, ISBN-13: 978-0615880990, ISBN-10: 0615880991. 2. David Hill, David Zitarelli, Linear Algebra Labs with MATLAB, 3rd Edition, Pearson, 2003, ISBN-13: 978-0131432741, ISBN-10: 0131432745.		