

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 linear algebra.	C1 (Know)	1
	CLO2: Describe geometry of vector spaces and optimization.	C2 (Describe)	1
	CLO3: Perform matrix algebra.	C3 (Apply)	1,3
Syllabus	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 $\mathbb{R}^n$, 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.		
Suggested Instructional/ Reading Material	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. 4. 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. 5. David Hill, David Zitarella, Linear Algebra Labs with MATLAB, 3rd Edition, Pearson, 2003, ISBN-13: 978-0131432741, ISBN-10: 0131432745.		