



DEPARTMENT OF MATHEMATICS AND COMPUTER & INFORMATION SCIENCE

LINEAR ALGEBRA MA3160

Departmental Syllabus

TEXTBOOK: Elementary Linear Algebra, 11th Edition, by Howard Anton, published by Wiley,
ISBN-13: **9781118473504**

Prerequisite: Grade of C or higher in Calculus I-MA2310

COURSE DESCRIPTION: This course discusses the main concepts and terminology of linear algebra. Some of the topics included are systems of linear equations, matrices and determinants, vectors in 2-space and 3-space, Euclidean vector spaces, general vector spaces, subspaces, linear independence, bases and dimension, eigenvectors and eigenvalues, diagonalization, and linear transformations.

COURSE OBJECTIVES: Upon successful completion of this course students should: be able to solve systems of linear equations using a variety of methods; carry out the basic operations of matrix algebra; interpret the geometric properties of vectors in Euclidean n -space; define linear transformation and represent by matrices; comfortable with the axiomatic definitions of general vector spaces; determine whether a specified set of vectors forms a subspace; understand the notion of span and basis; calculate eigenvalues and eigenvectors of a square matrix; determine when a matrix is diagonalizable; write proofs of statements involving vector spaces, subspaces, linear independency, basis, and linear transformation.

COURSE EVALUATION & GRADING: Course grade will be based on quizzes, class work, homework, Midterm Exams, and Final Exam. The Final exam is **cumulative** and it counts at least **30%** of the course grade.

A = [94, 100] A ⁻ = [90, 93]	B ⁺ = [87, 89]	C ⁺ = [77, 79]	D ⁺ = [67, 69]	F = [0, 59]
	B = [84, 86]	C = [74, 76]	D = [64, 66]	
	B ⁻ = [80, 83]	C ⁻ = [70, 73]	D ⁻ = [60, 63]	

TUTORIAL: Drop-in tutorial is available in the Mathematics Learning Center.

TOPICS TO BE COVERED

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1. SYSTEMS OF LINEAR EQUATIONS AND MATRICES

- 1.1 Introduction to Systems of Linear Equations
- 1.2 Gaussian Elimination
- 1.3 Matrices and Matrix Operations
- 1.4 Inverses; Algebraic Properties of Matrices
- 1.5 Elementary Matrices and a Method for Finding A^{-1}
- 1.6 More on Linear Systems and Invertible Matrices
- 1.7 Diagonal, Triangular, and Symmetric Matrices
- 1.8 Matrix Transformations

2. DETERMINANTS

- 2.1 Determinants by Cofactor Expansion
- 2.2 Evaluating Determinants by Row Reduction
- 2.3 Properties of Determinants; Cramer's Rule

3. EUCLIDEAN VECTOR SPACES

- 3.1 Vectors in 2-Space, 3-Space, and n-Space
- 3.2 Norm, Dot Product, and Distance in R^n
- 3.3 Orthogonality
- 3.4 The Geometry of Linear Systems
- 3.5 Cross Product

4. GENERAL VECTOR SPACES

- 4.1 Real Vector Spaces
- 4.2 Subspaces
- 4.3 Linear Independence
- 4.4 Coordinates and Basis
- 4.5 Dimension
- 4.6 Change of Basis
- 4.7 Row Space, Column Space, and Null Space
- 4.8 Rank, Nullity, and the Fundamental Matrix Spaces
- 4.9 Basic Matrix Transformations in R^2 and R^3
- 4.10 Properties of Matrix Transformations

5. EIGENVALUES AND EIGENVECTORS

- 5.1 Eigenvalues and Eigenvectors
- 5.2 Diagonalization

6. INNER PRODUCT SPACES

- 6.1 *Inner Products
- 6.3 *Gram-Schmidt Process; QR-Decomposition
- 8.1 *General Linear Transformation

* - Optional