

Computational and Applied Mathematics 3301 - Linear Algebra

Student Learning Outcomes

- 1. Students will demonstrate factual knowledge including the mathematical notation and terminology used in this course.** Students will learn the vocabulary, symbolism and basic definitions used in linear algebra, including vectors, matrices, vector spaces, subspaces, linear independence, span, basis, dimension, linear transformation, inner product, eigenvalue and eigenvector.
- 2. Students will describe the fundamental principles including the laws and theorems arising from concepts covered in this course.** Students will become familiar with the theorems about and the characteristics of linear spaces and linear transformations. Students will determine bases, compute dimensions, evaluate linear transformations, solve systems of linear equations and find determinants.
- 3. Students will apply course material along with procedures and techniques covered in this course to solve problems.** Students will apply properties and theorems about linear spaces to specific mathematical structures that satisfy the linear space axioms.
- 4. Students will develop specific skills, competencies, and thought processes sufficient to support further study or work in this field or related fields.** Students will acquire a level of proficiency in the fundamental concepts and applications necessary for further study in academic areas requiring linear algebra as a prerequisite or for work in occupational fields requiring a background in linear algebra. These fields might include the physical sciences and engineering as well as mathematics.

Course Content

Textbook: *Elementary Linear Algebra*, Tenth Edition, by Howard Anton, ISBN: 978-0-55991-8 (Binder Version). The following chapters are covered. (See textbook "Contents")

- 1. Systems of Linear Equations and Matrices:** Introduction, Gaussian elimination, matrices, special matrices, inverses and solutions of linear systems.
- 2. Determinants:** Definition, row reduction, properties of determinants, cofactor expansion, Cramer's Rule.
- 3. Euclidean Vector Spaces:** Vectors in 2-space, 3-space, and n-space, norms, dot products, distance, orthogonality, geometry of linear systems.
- 4. General Vector Spaces:** Real vector spaces, subspaces, linear independence, coordinates and bases, dimension, change of basis, row space, column space, null space, rank, nullity, matrix transformations and properties.
- 5. Eigenvalues and Eigenvectors:** Definition and properties.
- 6. Linear Transformations:** General linear transformations, isomorphism, composition and inverse transformations.

Additional topics to be covered as time permits: inner products, orthonormal bases, Gram-Schmidt process, applications.