

Computational and Applied Mathematics 3301 - Linear Algebra

Student Learning Outcomes

- 1. The students will demonstrate factual knowledge including the mathematical notation and terminology used in this course.** Students will read, interpret, and use 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. The students will describe the fundamental principles including the laws and theorems arising from the concepts covered in this course.** Students will identify and apply the theorems about and the characteristics of linear spaces and linear transformations, determine bases, compute dimensions, evaluate linear transformations, solve systems of linear equations and find determinants.
- 3. The students will apply course material along with techniques and procedures 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. The students will develop specific skills, competencies and thought processes sufficient to support further study or work in this 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* (with WileyPLUS), Tenth Edition, by Howard Anton, ISBN: 978-0-470-56007-5. The following chapters are covered. (See textbook "Contents")

- 1. Systems of Linear Equations and Matrices:** Gaussian elimination, matrices, inverses, special matrices.
- 2. Determinants:** Row reduction, properties of determinants, cofactor expansion, Cramer's rule.
- 3. Euclidean Vector Spaces:** Vectors in 2-space, 3-space, and n-space, vector norm, dot product, distance, orthogonality, lines and planes in 3-space, cross product.
- 4. General Vector Spaces:** Real vector spaces, subspaces, linear independence, coordinates and basis, dimension, change of basis, row space, column space, null space, rank, nullity, matrix transformations and properties.
- 5. Eigenvalues and Eigenvectors:** Definition, properties, diagonalization.
- 8. Linear Transformations:** General linear transformations, isomorphism, composition and inverse transformations, matrices for general linear transformations, similarity.

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