

University of Arkansas – Fort Smith
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General Syllabus

MATH 41073 Advanced Linear Algebra

Credit Hours: 3

Lecture Hours: 3

Laboratory Hours: 0

Prerequisite: MATH 30803 Applied Linear Algebra

Effective Catalog: 2018~2019

I. Course Information

A. Catalog Description

Topics include general vector spaces, linear transformations, inner products, matrices and matrix algebra, eigenvalues, eigenvectors, bilinear forms, orthogonal and unitary transformations, systems of linear equations, and determinants.

B. Additional Information - None

II. Student Learning Outcomes

A. Subject Matter

Upon completion of this course, the student will be able to:

1. Determine the linear dependence or independence of a set of vectors in $\mathbb{R}^n$.
2. Determine a basis for a subspace of $\mathbb{R}^n$.
3. Write a square matrix for a change of basis.
4. Determine the rank and nullity of a matrix.
5. Prove whether a given abelian group and scalar multiplication from a given field forms a vector space.
6. Determine whether a given function between vector spaces is a linear transformation.
7. Write the matrix representation of a linear transformation on a given vector space.
8. In a given inner product space,
 - a. determine the magnitude of a vector.
 - b. determine the angle between two vectors.
9. Find the eigenvalues and eigenvectors of a matrix.
10. Use linear programming techniques to obtain optimal solutions.

B. University Learning Outcomes

This course enhances student abilities in the following areas:

Analytical Skills

Critical Thinking Skills: Students will use concepts of linear algebra to solve application problems in multiple disciplines.

Communication Skills (written and oral)

Students will compose coherent documents describing real-world linear algebra problems and solution strategies.

Ethical Decision Making

Students will identify ethical dilemmas wherever present in real-world linear algebra applications and apply ethical frameworks to resolve such dilemmas.

Global and Cultural Perspectives

Students will reflect on the areas where linear algebra is used and identify notable differences.

III Major Course Topics

- A. Matrix operations
 - 1. Matrix notation
 - 2. Matrix multiplication
 - 3. Triangular factors
 - 4. Row exchanges
- B. Determinants and inverse matrices
 - 1. Determine
 - 2. Transposes
 - 3. Inverses
- C. Systems of equation
 - 1. Cramer's rule
 - 2. Gaussian Elimination
- D. $\mathbb{R}^n$
 - 1. Vector spaces
 - 2. Coordinatization of vectors
 - 3. Inner-product spaces
- E. General vector spaces
 - 1. Vector space and subspaces
 - 2. Linear independence, basis, and dimension
- F. Linear transformations
 - 1. Coordinatization and change of basis
 - 2. Matrix representations and similarity
- G. Eigenvalues and eigenvectors
 - 1. Eigenvalues and eigenvectors
 - 2. Diagonalization

H. Linear Programming