MAS2103: LINEAR ALGEBRA

Effective Term

Fall 2025

Academic Level

Associate

Course Tags

Course Tag(s)
A.A. Elective

Requirements

Are there pre- or co-requisites?

Yes

Requisites

Course	Minumum Grade	Requisite Type
MAC2311	C	Pre-Requisite

Course Description

A first course in linear algebra, emphasizing the algebra of matrices and vector spaces. Recommended for students majoring in mathematics or related areas.

Learning Outcomes

Autonumber

1

Unit Title

Matrices and Systems of Equations

General Outcome

1.0 Use matrix operations and other procedures in finding the solutions of homogeneous and nonhomogeneous systems of linear equations and apply these procedures to the study of vector spaces.

Specific Outcomes

1. Solve systems of homogeneous and nonhomogeneous linear equations by the reduction of the augmented matrix of the system, illustrating the similarity with the elimination method.
2. Determine criteria for the existence and uniqueness of solutions.
3. Perform vector operations and apply vector methods to the solution of problems.
4. Evaluate the determinant of a matrix.
5. Perform matrix operations, find the inverse of a square matrix when the inverse exists and solve matrix equations.

Autonumber

2

Unit Title

Vector Spaces

General Outcome

2.0 Develop an understanding of the concept of a vector space, prove that a mathematical system is a vector space, and determine its dimension.

Specific Outcomes

1. Define a vector space.
2. Determine whether a particular set is linearly independent.
3. Determine whether a subset of a vector space spans the vector space.

4. Determine whether a subset of a vector space is a basis for the vector space.
5. Determine the coordinates of a vector with respect to a basis.
6. Identify subspaces of a vector space.
7. Determine the dimension of a vector space and of its subspaces.
8. Find the rank and nullity of a matrix.
9. Find the dot product of two vectors.
10. Define orthogonal and orthonormal sets and find orthogonal bases for vector spaces.
11. Apply these concepts in the solution of problems.

Autonumber

3

Unit Title

Transformations and Matrices

General Outcome

3.0 Demonstrate an understanding of the definition of linear transformation, identify linear transformations, and apply matrix methods to linear transformations.

Specific Outcomes

1. Define a linear transformation.
2. Identify projections, rotations, and reflections.
3. Find the matrix of a linear transformation.
4. Find product transformations.
5. Apply the rules of transformation multiplication.
6. Make use of the relationship between a matrix and a transformation.
7. Apply these concepts to geometric situations.

Autonumber

4

Unit Title

The Inverse of a Linear Transformation

General Outcome

4.0 Determine when a linear transformation is invertible, how to find the inverse, and how to relate the theory of invertibility to coordinate changes.

Specific Outcomes

1. Determine if the inverse of a matrix exists.
2. Find the inverse of a matrix using row reduction.
3. Find the inverse of a product of matrices.
4. Find the transpose of a matrix.
5. Determine if a matrix is orthogonal.
6. Find the inverse of a linear transformation.
7. Describe transformations of rotations, reflections, and projections.
8. Use an invertible matrix to find the coordinates of a vector relative to a basis when given the coordinates of the vector relative to a different basis.
9. State and use the properties of determinants to evaluate large (m x m) determinants.
10. State the relationships between the inverse of a matrix and its determinant.
11. Find the adjoint of a matrix.
12. Find the inverse of a matrix using the determinant and the adjoint.

Autonumber

5

Unit Title

Representations of Linear Transformations

General Outcome

5.0 Find the matrix for a linear transformation relative to any arbitrary basis, and find a basis and a diagonal matrix such that the diagonal matrix is the matrix for a given linear transformation relative to the basis when such a diagonal matrix exists.

Specific Outcomes

1. Find the matrix for a linear transformation relative to any arbitrary basis.
2. Explain how changing the basis will affect the matrix of a linear transformation.
3. Find the eigenvalues and corresponding eigenvectors for a given matrix.
4. Find a basis consisting of eigenvectors of a linear transformation when such a basis exists.
5. Find a basis and a diagonal matrix such that the diagonal matrix is the matrix for a given linear transformation relative to the basis when such a diagonal matrix exists.
6. Determine when a matrix is similar to a diagonal matrix.
7. Find a diagonal matrix similar to a symmetric matrix.

Hours and Units

Instructional Format

Lecture

Lecture Hours

48.00

Total Contact Hours

48

Variable Contact Hours

48.00

Unit Type

Credits

Minimum Units

3

Maximum Units

3

Faculty Load Hours

48.00

Repeatable for Additional Credit

No

Reviewer Comments

Marc Webb (mwebb) (Thu, 24 Apr 2025 20:54:53 GMT): Recommended for approval by the Curriculum Committee at 4/21/2025 meeting