C-ID Descriptor
Introduction to Linear Algebra

Descriptor Details

- **Descriptor Title**: Introduction to Linear Algebra
- **C-ID Number**: 250
- **Units**: 3.0
- **Date of Last Revision**: 10/12/2017 11:43:58 PM GMT+0000

General Description

This course develops the techniques and theory needed to solve and classify systems of linear equations. Solution techniques include row operations, Gaussian elimination, and matrix algebra. Investigates the properties of vectors in two and three dimensions, leading to the notion of an abstract vector space. Vector space and matrix theory are presented including topics such as inner products, norms, orthogonality, eigenvalues, eigenspaces, and linear transformations. Selected applications of linear algebra are included.

Prerequisites

Calculus I (C-ID MATH 210, MATH 211 OR MATH 900S)

Corequisites

None

Advisories

A year of college calculus. Prior or concurrent course work with vector calculus or vector-intensive physics would be helpful.

Content

1. Techniques for solving systems of linear equations including Gaussian and Gauss-Jordan elimination and inverse matrices;
2. Matrix algebra, invertibility, and the transpose;
3. Relationship between coefficient matrix invertibility and solutions to a system of linear equations and the inverse matrices;
4. Special matrices: diagonal, triangular, and symmetric;
5. Determinants and their properties;
6. Vector algebra for $\mathbf{R}^n$;
7. Real vector space and subspaces;
8. Linear independence and dependence;
9. Basis and dimension of a vector space;
10. Matrix-generated spaces: row space, column space, null space, rank, nullity;
11. Change of basis;
12. Linear transformations, kernel and range, and inverse linear transformations;
13. Matrices of general linear transformations;
14. Eigenvalues, eigenvectors, eigenspace;
15. Diagonalization including orthogonal diagonalization of symmetric matrices;
16. Inner products on a real vector space;
17. Dot product, norm of a vector, angle between vectors, orthogonality of two vectors in $\mathbf{R}^n$;
18. Angle and orthogonality in inner product spaces; and
19. Orthogonal and orthonormal bases: Gram-Schmidt process.

Lab Activities

No information provided

Objectives

Upon successful completion of the course, students will be able to:

1. Find solutions of systems of equations using various methods appropriate to lower division linear algebra;
2. Use bases and orthonormal bases to solve problems in linear algebra;
3. Find the dimension of spaces such as those associated with matrices and linear transformations;

4. Find eigenvalues and eigenvectors and use them in applications; and
5. Prove basic results in linear algebra using appropriate proof-writing techniques such as linear independence of vectors; properties of subspaces; linearity, injectivity and surjectivity of functions; and properties of eigenvectors and eigenvalues.

Evaluation Methods

Tests, examinations, homework or projects where students demonstrate their mastery of the learning objectives and their ability to devise, organize and present complete solutions to problems and proofs.

Textbooks

A college level textbook designed for science, technology, engineering and math majors, and supporting the learning objectives of this course.