MATH 5 Course Outline as of Fall 2021

CATALOG INFORMATION

Dept and Nbr: MATH 5 Title: INTRO TO LINEAR ALGEBRA
Full Title: Introduction to Linear Algebra
Last Reviewed: 2/8/2021

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	4.00	Lecture Scheduled	4.00	17.5	Lecture Scheduled	70.00
Minimum	4.00	Lab Scheduled	0	17.5	Lab Scheduled	0
		Contact DHR	0		Contact DHR	0
		Contact Total	4.00		Contact Total	70.00
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 140.00 Total Student Learning Hours: 210.00

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	

Catalog Description:
An introduction to linear algebra including the theory of matrices, determinants, vector spaces, linear transformations, eigenvectors, eigenvalues and applications.

Prerequisites/Corequisites:
Completion of MATH 1B or higher (MATH)

Recommended Preparation:
Concurrent enrollment in MATH 1C or MATH 2

Limits on Enrollment:

Schedule of Classes Information:
Description: An introduction to linear algebra including the theory of matrices, determinants, vector spaces, linear transformations, eigenvectors, eigenvalues and applications. (Grade Only)
Prerequisites/Corequisites: Completion of MATH 1B or higher (MATH)
Recommended: Concurrent enrollment in MATH 1C or MATH 2
Limits on Enrollment:
Transfer Credit: CSU;UC.
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**	Effective:	Inactive:
CSU GE:	**Transfer Area**	Effective:	Inactive:
IGETC:	**Transfer Area**	Effective:	Inactive:

CSU Transfer:	Transferable	Effective:	Spring 1989	Inactive:	
UC Transfer:	Transferable	Effective:	Spring 1989	Inactive:	

CID:
CID Descriptor: MATH 250 Introduction to Linear Algebra
SRJC Equivalent Course(s): MATH5

Certificate/Major Applicable:
Major Applicable Course

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Determine the dimensions of a variety of vector spaces.
2. Find eigenvalues, eigenvectors and eigenspaces of matrices and linear transformations.
3. Determine matrix representations of linear transformations and linear operators.

Objectives:
At the conclusion of this course, the student should be able to:
1. Solve systems of linear equations using Gauss-Jordan elimination, matrix inverses and Cramer's rule.
2. Define matrix operations, invertibility, elementary matrices and orthogonal matrices.
3. Use properties of determinants including row reduction to evaluate determinants.
4. Invert matrices using adjoints and cofactors.
5. Define vector spaces, subspaces, span, linear independence, bases, dimension, inner product spaces, and orthonormal bases.
6. Determine the nullspace or kernel and range of a matrix and linear transformation.
7. Determine the injectivity and surjectivity of linear transformations and linear operators.
8. Define and determine dimension, rank and nullity of a matrix.
9. Determine the matrix representation of a linear transformation using different bases and using change of basis.
10. Determine eigenvalues, eigenvectors and eigenspaces of matrices and linear transformations.
11. Apply proof writing techniques to prove basic results in linear algebra.
12. Utilize methods of linear algebra to solve application problems selected from science, engineering, and related fields.

Topics and Scope:

I. Vectors
   A. Review of vectors in 2- and 3-dimensional real space
   B. Vectors in n-dimensional real space

- C. Properties of vectors in n-dimensional real space, including dot product, norm of a vector, angle between vectors, and vector orthogonality

II. Matrices
- A. Systems of linear equations
- B. Gauss-Jordan elimination
- C. Operations on matrices, including the transpose
- D. Invertibility
- E. Triangular matrices
- F. Elementary matrices
- G. Orthogonal matrices

III. Determinants
- A. Properties
- B. Evaluation by row reduction
- C. Cofactors and adjoints
- D. Formula for inverse of a matrix
- E. Cramer's rule

IV. Real Vector Spaces
- A. Defining properties
- B. Subspace
- C. Span
- D. Linear independence
- E. Basis
- F. Dimension
- G. Rank
- H. Solution space of a system of linear equations
- I. Inner product spaces
- J. Orthonormal bases
- K. Gram-Schmidt process

V. Linear Transformations
- A. Kernel
- B. Range
- C. Rank and nullity
- D. Matrix representation of linear transformation
- E. Similarity
- F. Change of basis
- G. One-to-one and onto

VI. Eigenvectors and Eigenvalues
- A. Characteristic equations
- B. Eigenspaces
    1. Diagonalization of matrices
    2. Orthogonal diagonalization of symmetric matrices

VII. Proofs applied to:
- A. Linear independence of vectors
- B. Properties of subspaces
- C. Linearity, injectivity and surjectivity of transformations
- D. Properties of eigenvectors and eigenvalues
- E. Vector spaces and subspaces

VIII. Applications including at least two of the following:
- A. Differential equations
- B. Fourier series
- C. Quadratic forms
- D. Gauss-Seidel method

E. Partial pivoting
F. Eigenvalues, eigenvalue approximations and eigenvectors
G. Markov chains
H. Computer graphics
I. Graph theory networks
J. Dynamical systems
K. Cryptography
L. Least squares techniques
M. Recurrence relations
N. Balancing chemical equations
O. Leontief input-output model
P. QR decomposition
Q. Rotated conic sections

IX. Technology - Computer Algebra Systems

Assignment:

1. Reading outside of class (5-50 pages per week)
2. Problem sets (15-30)
3. Midterm exams (2-5), quiz(zes) (0-20) and final exam
4. Project(s) (0-5), such as: computer labs, term projects, group projects

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments are more appropriate for this course.	Writing 0 - 0%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Problem sets	Problem solving 5 - 20%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None	Skill Demonstrations 0 - 0%

Exams: All forms of formal testing, other than skill performance exams.

Exams and quizzes	Exams 80 - 95%

Other: Includes any assessment tools that do not logically fit into the above categories.

Project(s)	Other Category 0 - 10%

Representative Textbooks and Materials:
Elementary Linear Algebra. 12th ed. Anton, Howard. Wiley. 2018
Linear Algebra and Its Applications. 5th ed. Lay, David C. Pearson. 2016 (classic)