**MATH 5 Course Outline as of Fall 2015**

# 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 | 3.00 | Lecture Scheduled | 3.00 | 17.5 | Lecture Scheduled | 52.50 |
| Minimum | 3.00 | Lab Scheduled | 0 | 17.5 | Lab Scheduled | 0 |
| | | Contact DHR | 0 | | Contact DHR | 0 |
| | | Contact Total | 3.00 | | Contact Total | 52.50 |
| | | Non-contact DHR | 0 | | Non-contact DHR | 0 |

Total Out of Class Hours: 105.00 Total Student Learning Hours: 157.50

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| 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 (VF)

**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 (VF)
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:

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

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|---|---|---|---|---|---|
| **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

**Outcomes and Objectives:**
Upon successful completion of the course, students will be able to:
1. Solve systems of linear equations using Gauss-Jordan elimination, matrix inverses and Cramer's rule.
2. Define operations on matrices, invertibility, elementary matrices, 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.

**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, & 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, subjectivity & surjectivity of functions
D. Properties of Eigenvectors and Eigenvalues

VIII. Applications may include:
A. Differential equations
B. Fourier series
C. Quadratic forms
D. Gauss-Seidel method
E. Partial pivoting
F. Eigenvalues, Eigenvalue approximations & Eigenvectors

**Assignment:**

1. Reading outside of class (0-50 pages per week)
2. Problem sets (15-30)
3. Midterm exams (2-5), quizzes (0-20) and final exam

**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.

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| 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<br>0 - 0% |

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

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| Problem sets | Problem solving<br>5 - 20% |

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

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| None | Skill Demonstrations<br>0 - 0% |

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

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| Exams and quizzes (free response, multiple choice, true/false) | Exams<br>80 - 95% |

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

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| None | Other Category<br>0 - 0% |

**Representative Textbooks and Materials:**
Elementary Linear Algebra (11th). Anton, Howard. Wiley: 2014
Linear Algebra and Its Applications (4th). Lay,  David C. Pearson: 2012