COURSE OUTLINE OF RECORD

Number: MATH A235 **TITLE:** Applied Linear Algebra

ORIGINATOR: Tab Livingston **EFF TERM:** Fall 2015

FORMERLY KNOWN AS: **DATE OF OUTLINE/REVIEW:** 03-02-2016

CROSS LISTED COURSE: **TOP NO:** 1701.00

CID:

SEMESTER UNITS: 3.0

HRS LEC: 54.0 **HRS LAB:** 0.0 **HRS OTHER:** 0.0

CONTACT HRS TOTAL: 54.0

STUDY/NON-CONTACT HRS RECOMMENDED: 108.0

CATALOG DESCRIPTION:

Introduction to linear algebra, classical linear algebra problems, and applications to computer science and related technologies including matrices, determinants, linear spaces, linear transformations, and eigenvalues. May be taken for grades or on a pass-no pass basis. Transfer Credit: CSU; UC.

JUSTIFICATION FOR COURSE:

Comparable to UC and CSU courses.

PREREQUISITES:

- MATH A185: Calculus 2 with a minimum grade of C or better
  or
- MATH A185H: Calculus 2 Honors with a minimum grade of C or better
  or
- MATH A182H: Calculus 1 and 2 Honors with a minimum grade of C or better

COREQUISITES:

ADVISORIES:

ASSIGNED DISCIPLINES:

Mathematics

MATERIAL FEE: Yes [ ] No [X] Amount: $0.00

CREDIT STATUS: Noncredit [ ] Credit - Degree Applicable [X] Credit - Not Degree Applicable [ ]

GRADING POLICY: Pass/No Pass [X] Standard Letter [X] Not Graded [ ]

OPEN ENTRY/OPEN EXIT: Yes [ ] No [X]

TRANSFER STATUS: CSU Transferable[ ] UC/CSU Transferable[X] Not Transferable[ ]

BASIC SKILLS STATUS: Yes [ ] No [X] **LEVELS BELOW TRANSFER:** Not Applicable

CALIFORNIA CLASSIFICATION CODES: Y - Not Applicable

NON CREDIT COURSE CATEGORY: Y - Not applicable, Credit Course

OCCUPATIONAL (SAM) CODE: E

REPEATABLE ACCORDING TO STATE GUIDELINES: No [X] Yes [ ] NUMBER REPEATS:

REQUIRED FOR DEGREE OR CERTIFICATE: No [ ] Yes [X]
COMPUTER PROGRAMMING(Certificate of Achievement)
COMPUTER PROGRAMMING(Associate in Science)

GE AND TRANSFER REQUIREMENTS MET:

IGETC Area 2: Mathematical Concepts and Quantitative Reasoning

2A: Mathematic

CSU GE Area B: Scientific Inquiry and Quantitative Reasoning

B4 - Mathematics/Quantitative Thinking

OCC AA Gen Ed

AREA A2: LANGUAGE AND RATIONALITY - Communication and Analytical Thinking

OCC AS Gen Ed

AREA A2 – ENGLISH COMMUNICATION - Communication and Analytical Thinking

COURSE LEVEL STUDENT LEARNING OUTCOME(S) Supported by this course:

1. Apply the theory and techniques of linear algebra in applications from physics, operations research and other scientific disciplines.
2. Solve linear systems, including under- and over-determined systems.
3. Relate linear transformations to their matrices with respect to given bases.
4. Describe linear transformations as functions mapping an n-dimensional space to an m-dimensional space.

COURSE OBJECTIVES:

1. Apply matrix methods to systems of linear equations.
2. Apply determinant methods to matrices and systems of equations.
3. Describe the properties of Rn.
4. Apply eigenvalues and eigenvectors to matrices.
5. Demonstrate use and understanding of eigenvalues and eigenvectors.
6. Apply orthogonality to matrices.
7. Use linear algebra techniques and theory to solve selected applications.

COURSE CONTENT:

LECTURE CONTENT:

It is imperative that instructors cover all topics in the outline. The instructor may determine the order of topics.

A. Perform matrix addition and multiplication
    1. matrix operations and their properties
    2. operations with partitioned matrices
B. Apply matrix methods to systems of linear equations.
    1. Gaussian elimination echelon and reduced echelon form
    2. row reduction as
        a. elementary matrices
        b. interpreted as an LU-factorization
    3. solution theory, rank + nullity = number of columns
C. Apply determinant methods to matrices and systems of equations.
    1. elementary properties
    2. cofactor expansion
    3. determinants and row operations
    4. det AB = (det A) (det B)
    5. Cramer's rule
D. Describe the properties of Rn
    1. linear combinations: linear dependence and independence
    2. bases of Rn
    3. subspaces of Rn
        a. spanning set
        b. basis
        c. dimension
        d. row space and column space

e. null space
4. matrices as linear transformations
5. dim (range) +dim (kernel) = dim (domain)
6. rank
a. row rank = column rank
b. products
7. inner product
a. length and orthogonality
b. orthogonal/orthonormal sets and bases
c. orthogonal matrices

E. Apply eigenvalues and eigenvectors to matrices.
1. the equation Ax = λx
2. the characteristic polynomial
a. identification of some of its coefficients (trace, determinant)
b. algebraic multiplicity of eigenvalues
3. eigenspaces, geometric multiplicity
4. similarity: distinct eigenvalues and diagonalization
5. symmetric matrices: orthogonal diagonalization.

F. Apply orthogonality to matrices.
1. strong geometric emphasis: orthogonal projections onto a subspace
2. Gram-Schmidt orthogonalization and interpretation as a QR factorization

G. Apply linear algebra concepts to advanced topics.
1. abstract vector spaces
2. non-matrix linear transformations
3. positive definite matrices

H. Solve applications to linear differential equations and systems of linear differential equations.

I. Solve other applications selected by the instructor from the following list:
1. network analysis
2. stochastic matrices
3. least squares regression analysis
4. quadratic forms
5. Gaussian elimination with pivoting

J. Apply computers and calculators to homework, projects and class demonstrations if time permits.

LABORATORY CONTENT:

METHODS OF INSTRUCTION:

A. Lecture:
B. Independent Study:

INSTRUCTIONAL TECHNIQUES:

Lecture, discussion, written homework.

COURSE ASSIGNMENTS:

Reading Assignments

As assigned from text. 1 hour

Out-of-class Assignments

As assigned by instructor. 4 hour

Writing Assignments

Writing is encouraged throughout the course but is not necessarily a part of the grading or exams. 1 hour

METHODS OF STUDENT EVALUATION:
Midterm Exam
Final Exam
Short Quizzes
Written Assignments

Demonstration of Critical Thinking:

Several written tests and a comprehensive final.

Required Writing, Problem Solving, Skills Demonstration:

Several written tests and a comprehensive final.

TEXTS, READINGS, AND RESOURCES:

TextBooks:

1. Larson, Ron. . *Elementary Linear Algebra.* , ed. Boston: Houghton Mifflin, 2012
2. Williams, Gareth. *Linear Algebra with Applications*, ed. Boston: Jones and Bartlett, 2012

Other:

1. Other appropriate textbook as chosen by faculty.

LIBRARY:

Adequate library resources include: Print Materials
Non-Print Materials
Online Materials
Services

Comments:

Attachments:

Attached Files