Number: MATH G235

TITLE: Applied Linear Algebra

ORIGINATOR: Pete Bouzar

EFF TERM: Fall 2016

FORMERLY KNOWN AS: Math 290

DATE OF OUTLINE/REVIEW: 03-01-2016

CROSS LISTED COURSE:

TOP NO: 1701.00

CID: MATH 250

SEMESTER UNITS: 4.0

HRS LEC: 72.0

HRS LAB: 0.0

HRS OTHER: 0.0

CONTACT HRS TOTAL: 72.0

STUDY NON-CONTACT HRS RECOMMENDED: 144.0

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.

JUSTIFICATION FOR COURSE:

PREREQUISITES:
- MATH G185: Calculus 2 with a minimum grade of C or better
- MATH A185: Calculus 2 with a minimum grade of C or better
- MATH A185H: Calculus 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 [ ] Standard Letter [X] Not Graded [ ] Satisfactory Progress [ ]

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

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

BASIC SKILLS STATUS: Yes [ ] No [X]

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]

Liberal Arts: Emphasis in Mathematics(Associate in Arts)
Mathematics(Associate in Science for Transfer)
Mathematics(Associate in Arts)

GE AND TRANSFER REQUIREMENTS MET:

IGETC Area 2: Mathematical Concepts and Quantitative Reasoning
- 2A: Mathematics
CSU GE Area B: Scientific Inquiry and Quantitative Reasoning
   B4 - Mathematics/Quantitative Thinking

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

1. Determine the rank and basis for the row and column space of a given matrix.
2. Apply the Gram-Schmidt process to transform a basis into an orthonormal basis.
3. Apply the definition of a vector space to prove that a given set with defined operations of vector addition and scalar multiplication is or is not a vector space.

COURSE OBJECTIVES:

1. Perform matrix operations, understand their properties and applications.
2. Evaluate determinants, understand their properties and applications.
3. Solve linear systems of equations and their applications using several computational techniques.
4. Develop an understanding of vector spaces: basis, dimension, linear independence, subspaces, change of basis, inner product spaces, orthonormal basis, and the applications of these concepts.
5. Find the dimension of spaces such as those associated with matrices and linear transformations.
6. Perform eigenvalue and eigenvector computations and applications.
7. Write proofs using appropriate proof-writing techniques such as linear independence of vectors; properties of subspaces; linearity, injectivity and surjectivity of functions; and properties of eigenvalues and eigenvectors.

COURSE CONTENT:

LECTURE CONTENT:

1. Systems of Linear Equations
   a. Matrix representation
   b. Gaussian and Gauss-Jordan elimination
   c. Applications

2. Matrix Algebra
   a. Basic matrix operations (addition, subtraction, multiplication, transposition) and their properties.
   b. Special matrices: diagonal, triangular, and symmetric
   c. Methods of matrix inversion
   d. Relationship between coefficient matrix invertibility and solutions to a system of linear equations.
   e. Using the inverse of the coefficient matrix to solve systems of linear equations

3. Determinants
   a. Evaluating determinants
   b. Properties of determinants
   c. Cramer's Rule
   d. Applications
4. Vector Spaces
   a. Basic definitions and terminology
   b. Vectors algebra in \( \mathbb{R}^n \)
   c. Linear dependence and linear independence
   d. Linear combinations and Span
   e. Basis and dimension
   f. Subspaces
   g. matrix-generated spaces: row space, column space, null space, rank and nullity
   h. Change of basis
   i. Applications

5. Inner Product Spaces
   a. Basic definitions and terminology
   b. The dot product, cross product, norm of a vector, angle between two vectors, and orthogonality of two vectors in \( \mathbb{R}^n \)
   c. Angle and orthogonality in inner product spaces
   d. Inner products on a real vector space
   e. Orthogonal and Orthonormal bases: the Gram-Schmidt process
   f. Applications

6. Linear Transformations
   a. Basic definitions and terminology
   b. Kernel, Range, and Isomorphisms
   c. Correspondence between linear transformations and matrices of general linear transformations
   d. Inverse of linear transformations
   e. Change of basis problem
   f. Similarity classes
   g. Applications

7. Theory of Eigenvectors and Eigenvalues
   a. Basic definitions and terminology
   b. Finding eigenvalues, eigenvectors, and eigenspaces
   c. Diagonalization including orthogonal diagonalization of symmetric matrices
d. Applications

METHODS OF INSTRUCTION:

A. Lecture:
B. Tutoring – noncredit:
C. Direct Study/IS:
D. Dist. Ed – Delayed Interaction:
E. Video One Way – Audio Two Way:
F. Two-way interactive audio only:
G. Other simultaneous interactive:
H. Audio – One Way:
  I. Other passive medium:
J. Online:
K. Independent Study:

INSTRUCTIONAL TECHNIQUES:

COURSE ASSIGNMENTS:

Reading Assignments

A. Required Reading such as:
   Linear algebra textbook.

Out-of-class Assignments

Computer assignments

Writing Assignments

1. Tests and quizzes.
2. Homework assignments consisting mainly of problems from the textbook.
3. Group projects

METHODS OF STUDENT EVALUATION:

Midterm Exam
Final Exam
Short Quizzes
Written Assignments
Essay Examinations
Objective Examinations
Projects (ind/group)
Problem Solving Exercises

   Demonstration of Critical Thinking:
   Each homework set, quiz, exam and computer assignment requires critical thinking and problem solving

   Required Writing, Problem Solving, Skills Demonstration:
   1. Tests and quizzes. 2. Homework assignments consisting mainly of problems from the textbook. 3. Group projects

TEXTS, READINGS, AND RESOURCES:

TextBooks:

Other:
1. Supplemental handouts and assignments
2. Computer assignments.

LIBRARY:
Adequate library resources include:

Comments:

Attachments:

Attached Files