MATH 332 – Elementary Linear Algebra

Course Description from Bulletin: Systems of linear equations; matrix algebra, inverses, determinants, eigenvalues and eigenvectors, diagonalization; vector spaces, basis, dimension, rank and nullity; inner product spaces, orthonormal bases; quadratic forms. (3-0-3)

Enrollment: Required for AM majors, elective for other majors

Textbook(s): Anton, *Elementary Linear Algebra*, 10^{th} ed., John Wiley and Sons

Other required material: None

Prerequisites: MATH 251

Objectives:
1. Students will learn how to solve systems of equations through various techniques, especially through row reduction of matrices.
2. Students will learn properties of matrices, especially invertibility, and matrix algebra.
3. Students will learn general vector spaces and linear transformations. The primary vector spaces studied are Euclidean, matrix and polynomial spaces. Topics include linear independence, column and row spaces, nullspace, basis and dimension (including rank and nullity).
4. Students will explore eigenvectors and eigenvalues and learn how to diagonalize a matrix.
5. Students will learn about inner product spaces and orthogonailty. Topics include orthonormal bases, the Gram-Schmidt process, best approximation, and their applications to QR-decomposition and least squares-fitting.
6. Students will learn about applications of linear systems in sciences and engineering.

Lecture schedule: Three 50 minute (or two 75 minute) lectures per week

Course Outline:	Hours
1. Linear Systems and Matrices: Elementary row operations, Gaussian elimination, elementary matrices and LU decomposition, matrix inverse and invertibility, determinant, applications in electrical circuits or chemical reactions.	7
2. Euclidean Vector Spaces: Vector algebra in R^n, dot product and orthogonality, linear transformations and geometric operators.	3
3. General Vector Spaces: Examples, including R^n, P_n, and M_{mn}, and non-examples, subspaces and spanning sets, linear independence, basis and dimension, null, row and column spaces of a matrix, application to Markov chains.	8
4. Eigenvalues and Eigenvectors: Eigenvalues, eigenvectors, eigenspaces, and diagonalization, application to Markov chains (contd.)	3

5. Inner Product Spaces: 7

   Inner products – examples, non-examples, and properties, orthonormal basis, Gram-Schmidt process and application to QR-decomposition, best Approximation and least squares problem, application to least squares fitting.

6. Orthogonal Matrices and Quadratic Forms: 4

   Orthogonal matrices. Orthogonal decomposition, quadratic forms and positive/negative definite matrices, application to optimization.

7. Exams and overflow 3

Assessment:

	Homework	20-30%
	Quizzes/Exams	40-50%
	Final Exam	20-30%

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