

NOTE: This document is published only as an indication of what is typically taught in this course. Instructors have the responsibility of deciding on topics to be omitted, additional topics to be included, and the emphasis, ordering, and pacing of presentation of topics.

Course Number: **MTH 309**

Course Title: **Introduction to Linear Algebra**

Credit Hours: **4.0**

Textbook(s): **David Lay, Linear Algebra and its Applications, 3th ed.**, Addison Wesley.
(UB custom edition is identical to standard edition.)

Description: Linear equations, linear transformations, matrices, determinants, vector spaces, eigenvalues and eigenvectors, inner products, orthogonality, quadratic forms.

Prerequisite: MTH 142 (Calculus 2), or MTH 192 [or CSE 192] (Discrete Math II).

Clientèle: Core course required for all Math majors. Majors in course as of 2003: approx 40% Engineering, 30% Computer Science, 10% Math, 20% other.

Notes: The core syllabus is 12 weeks of lecture material. The remaining 2 weeks of a 14-week semester can be devoted to review, exams, and optional topics at the discretion of the instructor.

Technology: Instructors are encouraged to demonstrate the usefulness of technology (Maple) for applying the concepts of the course to nontrivial examples, including a selection of exercises marked [M] where technology is necessary. An instructor's technology guide for Maple is available from the publisher (ISBN 0-321-122-19-4).

Syllabus: Chapters 1-7 should be covered as specified below.

# of 50-minute lectures	Sections	Title	Topics
7	1.1 - 1.8	Linear Equations in Linear Algebra	Systems of linear equations. Row reduction and echelon forms. Vector equations. $Ax=b$. Solution sets of linear systems. Applications of linear systems. Linear independence. Linear transformations.
5	2.1 - 2.3 2.8 - 2.9	Matrix Algebra	Matrix operations. Inverse of a matrix. Characterizations of invertible matrices. Subspaces of R^n . Dimension and rank.
2	3.1 - 3.2	Determinants	Introduction to determinants. Properties of determinants.
10	4.1 - 4.6	Vector Spaces	Vector spaces and subspaces. Null spaces, column spaces, and linear transformations. Linearly independent sets, bases. Coordinate systems. Dimension of a vector space. Rank.
5	5.1 - 5.5	Eigenvalues and Eigenvectors	Eigenvectors and eigenvalues. Characteristic equation. Diagonalization. Eigenvectors and linear transformations. Complex eigenvalues.
5	6.1 - 6.5	Orthogonality and Least Squares	Inner product, length, orthogonality. Orthogonal sets. Orthogonal projections. Gram-Schmidt process. Least squares problem.
2	7.1 - 7.2	Symmetric Matrices and Quadratic Forms	Diagonalization of symmetric matrices. Quadratic forms.

Note: Instructors are encouraged to keep notes regarding pacing and other issues that will assist them in making detailed suggestions for adjustments and improvements in the Instructor Questionnaire at the end of the semester.

The MTH 309 syllabus for Spring 2005 has been adjusted to take into account the responses to the Fall 2004 Instructor Questionnaire. One of the F04 instructors had the following additional detailed comment:

Some homework problems are of value dealing with fundamental material ...
for the most part I taught these as an integral part of the lecture:

Section	Problem numbers
1.5	25,39,40
1.8	39,40
1.9	35,36
(2.1)	At least one of 22 thru 25
2.3	35, 36, 39
2.9	27, 28
4.2	35, 36
4.3	24, 29, 30, 31, 32
4.4	23, 24, 25, 26
4.5	31, 32, 33
4 Supp	10, 11
5.5	23, 24
6.1	29, 30
6.3	24
6.4	22
6 Supp	2, 3, 8