

# SYLLABUS

## MA242 Linear Algebra

Fall 2009

**Professor:** Steve Rosenberg

**Office:** MCS 248; phone 3-9556

**Office Hours:** MF 10-11, W 11-12 or by appointment

**Course Hours:** MWF 1-2 in MCS 148; discussion W 2-3 in MCS 148

**Text:** Lay, *Linear Algebra and its Applications*, 3rd edition, updated

**Website:** math.bu.edu/people/sr

**Email:** sr@math.bu.edu

**Material:** The course will cover the basic concepts of systems of linear equations and their solutions. The first half of the course will emphasize calculational techniques, with applications to physics, applied mathematics, economics and engineering. The second half of the course will cover matrices as linear transformations on vector spaces. We will cover Chapters 1-5 and further topics if time permits.

**Grading:** There will be two in-class exams and a final. There will be a brief quiz at the beginning of each discussion section. The in-class exams each count for 20% of the grade, the final counts for 20%, the quizzes count for 10%, and homework counts for 30%. The only acceptable excuses for missing an exam, quiz or homework due date are legal reasons such as jury duty, substantiated illness, family emergency or religious reasons. Unacceptable excuses include oversleeping an exam or having non-refundable plane tickets for the day of an exam. Make-up exams for in-class exams are not given. If you miss an in-class exam for an acceptable reason, your remaining in-class exam will count for 40% of your grade.

**Homework:** The homework assignments are listed below. Homework will be due one week after it is assigned. Late homework will not be accepted. Since the answers to the odd-numbered problems are in the back of the book, you must give complete answers on all problems to receive credit. I cannot emphasize enough the importance of doing the homework problems—I think it is impossible to do well in the course without keeping up with the homework. You are welcome to work with others on your homework.

**Computer packages:** Use either the book's CD or go to the book's website at [www.laylinalg.com](http://www.laylinalg.com) to find introductions to computer algebra packages such as Maple, Mathematica and Matlab. (Warning: don't go to [ww.laylinearalgebra.com](http://ww.laylinearalgebra.com), a commercial site.) These programs are available on the main BU server. Some homework problems will involve computer calculations; you can use another system (such as TI-86, TI-85, etc.) if you prefer. You can access the BU server from a PC/Mac using the Terminal program and the command `ssh <login name>@acs.bu.edu`, or via programs such as Putty or XWin32, available for download at <http://www.bu.edu/pcsc/unix/configure>.

**Cheating:** Boston University's policies on cheating and plagiarism are spelled out in the CAS Academic Conduct Code, available at CAS 105, and will be followed in this class.

### Outline of Contents

#### Chapter 1. Linear Equations in Linear Algebra

- 1.1 Systems of Linear Equations Hwk: #1,5,8,9,14,19,30,33,34
- 1.2 Row Reduction and Echelon Forms Hwk: #1,6,9,16,25,26,33,34
- 1.3 Vector Equations Hwk: #1,4,5,8,9,12,27,28,29
- 1.4 The Matrix Equation  $Ax = b$  Hwk: #1,5,7,10,12,13,17,20,26,31,35
- 1.5 Solution Sets of Linear Systems Hwk: #1,5,8,11,13,16,18,36,38
- 1.6 Applications of Linear Systems Hwk: #3, 4, 12, 14
- 1.7 Linear Independence Hwk: #1,6,19,20,31,32,40
- 1.8 Intro to Linear Transformations Hwk: #1,4,9,11,14,16,19,22,23,25,29
- 1.9 The Matrix of a Linear Transformation Hwk: #1,6,7, 24
- 1.10 Business, Science, Engineering Applications Hwk: #1,2,11, 12

## Chapter 2. Matrix Algebra

- 2.1 Matrix Operations Hwk: #1,4,5,13,23,24,28,30,31,33
- 2.2 Inverse Matrix Hwk: #1,5,7,10bc,12,21,22, 39, 40
- 2.3 Characterizations of Invertible Matrices Hwk: #1,5,10,16,26,32
- 2.7 Computer Graphics Hwk: #1,3,4,5,8,11,15,16,17,18,21

## Chapter 3. Determinants

- 3.1 Introduction to Determinants Hwk: #1,2,9,10,15,16,38, 41
- 3.2 Properties of Determinants Hwk: #5,11,15,17,19,28, 29
- 3.3 Cramer's rule, etc. Hwk: #19,21,23,32

### Test 1

## Chapter 4. Vector Spaces

- 4.1 Vector Spaces and Subspaces Hwk: #1,3,4,5,6,9,11,14,16,19,20,21,27
- 4.2 Null spaces, etc. Hwk: #1,5,6,7,16,29,31,33,34,38,39
- 4.3 Bases Hwk: #1,8,11,14,33
- 4.4 Coordinate Systems Hwk: #1,8,9,12,13,17,21,28,36
- 4.5 Dimension of a Vector Space Hwk: #1,8,9,12,13,20,21,24,27,29,34
- 4.7 Change of Basis Hwk: #1,4,6,9,13,14,15,17,18
- 4.9 Applications to Markov Chains Hwk: #1,4,5,7,15

## Chapter 5. Eigenvalues and Eigenvectors

- 5.1 Eigenvectors and Eigenvalues Hwk: #1,6,11,22abd,31,33,37
- 5.2 The Characteristic Equation Hwk: #1,10,13,20,21,24 31
- 5.3 Diagonalization Hwk: #1,6,11,22,23,28,31,33
- 5.4 Eigenvectors and Linear Transformations Hwk: #1,4,5,8,9,12,13,19,28
- 5.5 Complex Eigenvalues Hwk: #1, 7, 8, 13, 21
- 5.6 Discrete Dynamical Systems Hwk: #1,3,4,5,9,10,16

### Test 2

## Chapter 6. Orthogonality and Least Squares

- 6.1 Inner Product, etc. Hwk: #1,4,7,11,14,17,20,26,30
- 6.2 Orthogonal Sets Hwk: #1,8,11,14,17,24,26,28
- 6.3 Orthogonal Projections Hwk: #1,4,7,11,14,17,25
- 6.4 Gram-Schmidt Hwk: #1,9,22
- 6.5 Least-Squares Problems Hwk: #1,3,5,7,10
- 6.6 Applications to Linear Models Hwk: #1,7,8,10,11

Final Exam: Monday, December 21, 12:30 – 2:30.

**Warning:** The dates of the in-class exams may be changed.