640:250:C Linear Algebra (MATLAB Sections)

General Information

Lecturer: Chris Woodward, Asst Prof in Mathematics
Office and telephone number: Hill 336, 5-2466
Office Hours: MW 3:00- 4:00 Hill 336 or by appt. Feel free to e-mail questions to me. If I think that other people might have the same question, I will forward the message and my response to everyone, unless you ask me not to in the message.

Text: Gilbert Strang, *Introduction to Linear Algebra*, 2rd ed.,
ISBN # 0-9614088-5-5, Wellesley-Cambridge Press, Box 812060, Wellesley MA 02482

Computer/Calculator: The MATLAB software package (version 5.3) is installed on PC's in all the Rutgers public computer labs (in ARC, Loree, College Avenue, Livingston). Students in the School of Engineering can also use MATLAB in the DSV Lab (Eng B-125/127) on Sun Ultra 10 workstations.

If you want to install MATLAB on your personal computer, the Student edition (for Windows 95/98, Linux or Macintosh) can be purchased directly from the publisher, MathWorks, Inc. (go to their website: `www.mathworks.com`. The student edition includes documentation and tutorials.

Although MATLAB is the preferred computational environment in this course (and is required for the Lab assignments), any graphing calculator will do matrix algebra. More powerful ones (such as the TI-85 or TI-86) also do Row reduction (LU decomposition) and eigenvalues/eigenvectors. You may find a calculator useful for some homework problems, but it is not required. Calculators will NOT be allowed on exams.

Exams, Homework, and Grades: There will be two midterm exams and a final exam. There will be several MATLAB assignments, and short quizzes based on the assigned homework problems will be given in class. The weightings to determine course grade will be as follows:
each midterm exam = 20%
graded homework, MATLAB labs, and quizzes = 20%
final exam = 40%
There will also be two extra-credit optional Applied Linear Algebra projects (requiring some MATLAB). Successful completion of the projects can add up to 20 points to each midterm exam grade.

Roster: Bring a photocopy (with recognizable photo) of your Rutgers I.D., to turn in for a quiz on 9/11. It will count for credit. List on the sheet your e-mail address/possible major.

Attendance is required. After the first two absences, prior written excuses will be required. More than two inexcused absences may count against your grade.

Academic Honesty: The work you submit should be your own; do not copy other students assignments and exams, or allow your assignments/exams to be copied by others. The MATLAB assignments contain random matrices; submissions with identical matrices will both be given zero credit. Students taking make-up exams are responsible for not looking at exams other students have taken, even if they are different versions. Evidence that students have obtained previous versions of the exam will lead to a grade of zero. Formula sheets are not allowed in exams.
Working together on assignments is fine (even encouraged!), as long as (1) the answers are not copied; this means there should be (at least small) differences in the assignment (2) the names of the collaborators are listed.

Course Website: This document, other course materials, information about the course, and links to relevant web sites are posted on the Mathematics Department web site (`http://www.math.rutgers.edu`) Click on `course materials` and then `Math 250 Linear Algebra`. Follow the indicated links from there.

Course Syllabus

Lecture	Reading	Topics
9/6	1.1-1.2	Vectors, Lengths and Dot Products
	2.1	Vectors and Linear equations
	MATLAB Lab #1 – Introduction to MATLAB	
9/11	2.2, 2.3	The Idea of Elimination, Elimination using Matrices
9/13	2.4, 2.5	Rules for Matrix Operations; Inverse Matrices
9/18	2.6	Elimination by $A = LU$ Factorization
	MATLAB Lab #2 – $A = LU$ Factorization	
9/25	2.7	Transposes and Permutations, $PA = LU$ Factorization
	Extra-Credit Project #1 – Graphs and Matrices	
9/27	3.1	Spaces of Vectors
10/2	3.2	Nullspace of A
10/4	3.3	Rank; Echelon Matrices and Row Reduced Form
10/9	3.4	Complete Solution to $Ax = b$
	MATLAB Lab #3 – Solving $A\mathbf{x} = \mathbf{b}$	
10/11	3.5	Independence, Basis, and Dimension
10/16	3.6	Dimensions of the Four Subspaces
10/18	**Midterm Exam #1**	
10/23	4.1	Orthogonality of the Four Subspaces
10/25	4.2, 4.3	Projections; Least Squares Approximate Solution to $A\mathbf{x} = \mathbf{b}$
	MATLAB Lab #4 – Vector Spaces and Approximate Solutions to $A\mathbf{x} = \mathbf{b}$	
10/30	4.4	Orthogonal Bases, Gram-Schmidt Algorithm, $A = QR$ Factorization
11/1	5.1	Determinant Function and its Properties
11/6	5.2	Permutations and Cofactors
11/8	5.3	Cramer's Rule, Inverses
	MATLAB Lab #5 – QR Factorization, Determinants and Eigenvalues	
11/13	6.1	Introduction to Eigenvalues and Eigenvectors
	10.1	Review of complex numbers
11/15	6.2	Diagonalizing a Matrix
	Extra-Credit Project #2 – Graphs and Markov Processes	
11/20	6.3	Applications to Differential Equations
11/22		Friday schedule - No class!
11/27	6.4	Eigenvalues and Eigenvectors of Symmetric Matrices
	MATLAB Lab #6 – Symmetric Matrices, Positive-Definite Matrices, SVD	
11/29	6.5	Positive Definite Matrices
12/4	**Midterm Exam # 2**	
12/6	6.7	Singular Value Decomposition (SVD)
12/11	7.1, 7.2	Linear Transformations and their Matrices
12/13	7.3, 7.4	Change of Basis; Dual Basis
		Geometric meaning of SVD, Solving $Ax = b$ by pseudo inverse
12/15, 12pm	**Final Exam** (closed book)	