MATH 526 – Numerical Linear Algebra

Instructor Professor Doug Meade
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Course Website http://www.math.sc.edu/~meade/math526/

Meeting Times Lecture: MWF 10:10AM–11:00AM, LC 405
Lab: §001 T 9:30AM–10:20AM, LC 303A
§002 T 11:00AM–11:50AM, LC 303A

Text Brenner and Sung, *Numerical Linear Algebra*, draft, 1999.
Note: The USC SIAM Student Chapter photocopies and distributes the course notes. Full sets of notes will be available before class on August 26 and 29. The price is $25, payable in cash only.

Prerequisite Completion of Math 241 with a grade of C or better.

Course Content Linear algebra is the area of mathematics that looks at properties of systems of linear equations. In many realistic cases, these systems contain thousands, if not millions, of equations and unknowns. It is customary to formulate these problems in terms of matrices and vectors. This course is an introduction to the subject of linear algebra with attention given to numerical computations.

A linear system of equations in two dimensions corresponds to a collection of lines; in three dimensions to a collection of planes. Visualization in higher dimensions is not possible, but the same structure and general methods of analysis apply.

A fundamental question in linear algebra is finding solutions to a linear system: knowing when a solution exists, how many solutions there are, and finding all solutions in a systematic manner. A second fundamental question is the eigenvalue problem: find all non-zero vectors, $\mathbf{x}$, with the property that $A\mathbf{x} = \lambda\mathbf{x}$ for some constant λ. We will discuss both the computation of λ and $\mathbf{x}$ and the significance and application of eigenvalues.

Some of the specific topics that will be covered while we learn about these two problem include:

- Properties of Matrices
- Gaussian Elimination (including Pivoting)
- Ill-Conditioned Matrices
- Iterative Solution Methods
- Eigenvalue Decomposition of a Matrix
- Linear Independence of Vectors
- Overdetermined Systems

Study Hints Reading the material **in advance** of the lecture is strongly encouraged. Benefits of this preparation include obtaining a familiarity with the terminology and concepts that will be encountered (so you can distinguish major points from side issues), being able to formulate questions about the parts of the presentation that you do not understand, and having a chance to review the skills and techniques that will be needed to apply the new concepts.

Grading Your grade in this course will be based on your performance on (weekly) homework, (weekly) labs, two (2) mid-term exams, and a final exam. The weights assigned to each of these components will be:

Homework	15%(highest 10 scores)
Labs	15%(highest 10 scores)
Mid-term exams (2)	40%
Final exam	30%

Course grades will be determined according to the following scale:

A	90 –100
B	80 – 89
C	70 – 79
D	60 – 69
F	0 – 59

The deadline to drop this course with a grade of W is Thursday, September 29, 2005.

Exams *Tentative* dates for the mid-term exams are:

Friday, September 16	Chapters 0– 6
Wednesday, October 26	Chapters 7–12

Make-up exams will be given only for documented reasons of illness, family emergency or participation in a University sponsored event. Excuses such as oversleeping, forgetting the time or location of the exam, and lack of studying are explicitly noted as unacceptable grounds for a make-up exam.
A comprehensive final will be given at 9:00A.M. on Friday, December 9, 2005.

Homework Problems will be assigned for each chapter. You are expected to work all of these problems and turn in your solutions at the beginning of class on Fridays (generally). Some assignments might be accepted electronically. Details about this will be given at an appropriate time.
Your homework grade will be based on your ten (10) highest homework scores.

Labs This course includes a weekly one-hour computer lab. The purposes of this lab are (i) to introduce you to `MATLAB`, a powerful and popular software package for matrix computations and (ii) to provide hands-on experience with some of the topics discussed in the lectures.

Each lab consists of two parts. Part I contains some instruction in `MATLAB`. Part II contains questions that are to be answered using `MATLAB`. The work associated with Part II is due at the beginning of the next class meeting.
Your lab grade will be based on your ten (10) highest homework scores.

Graduate Credit Graduate students enrolled in this course will be expected to work additional problems assigned throughout the semester. Students taking the course for undergraduate credit can work these problems for extra credit.

Attendance Attendance at every class meeting is important – and expected. Students missing more than 10% of the class meetings (4 days) can have their grade lowered.

Academic Honesty Cheating and plagiarism will not be tolerated. You may discuss homework problems with others, but do not copy work from another student or from a book. Violations of this policy will be dealt with according to University guidelines.