Syllabus
Math 630, Section 101: Matrix Analysis
Spring 2008, MW 4:00–5:15 pm, MP 012

Instructor: Dr. Minkoff
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Office Hours: W 2:30–3:30 pm or by appointment.

Prerequisite: A working knowledge of a high-level programming language such as C or Fortran, or Matlab. Note that we will be using Matlab exclusively in this course. Even if you have not had exposure to Matlab previously, you will have time to master the basics of the language by working on the homework assignments.

Texts — Required: *Fundamentals of Matrix Computations*, 2nd Edition, by Watkins. Publisher: Wiley-Interscience, 2002.
Recommended: *Mastering MATLAB* , by Hanselman and Littlefield. Publisher: Prentice Hall, Inc.
Additional References: (1) *Numerical Linear Algebra* by Trefethen and Bau. Publisher: SIAM, 1997. (2)*Matrix Computations* by Golub and Van Loan. Publisher: The Johns Hopkins University Press.

Grades:

Homework	35%
Midterm Exam	30%
Final Exam	35%
Total	100%

Homework and computer assignments: There will be one homework (which may include paper and pencil and/or computer work) due every week on Wednesdays. Homework is to be turned in at the START of class on Wednesday or can be slipped under my office door *prior* to class on Wednesday if you must miss class for some reason. *Late homework will not be accepted.*

Please note that the homework constitutes a substantial portion of your overall grade. In order to learn the concepts and be able to apply them to solving problems on exams, etc., you are strongly encouraged to devote as much time as possible to working the homework problems. I encourage you to discuss the homework assignments with other students in the class. However, I expect the homework you submit for grading to be written up by you alone (this includes computer programs which must not be duplicates of programs other students turn in).

Tests: No make-up exams will be given except *possibly* in the case of a serious emergency. In such a case I *must* be notified *in advance*. There will be no exceptions to taking the final exam at the date, time, and place specified by the University. (Monday 5/19/08 from 3:30–5:30 pm in MP 012). The final exam will be comprehensive although material covered after the midterm will be emphasized.

Learning Goals and Course Motivation: Matrix Analysis (otherwise known as Numerical Linear Algebra) is a graduate course intended to teach you how best to solve large linear systems and to find eigenvalues of those systems. At least one major reason solving large matrix systems is important is that most physical systems are modeled by differential equations. These differential equations usually cannot be solved by hand, and hence must be discretized and solved approximately on a computer. The resulting algebraic system involves solving a large matrix equation or eigenvalue equation. The small problems one studies in undergraduate linear algebra (which can be solved using paper and pencil) are usually not what scientists working on real problems encounter.

In this course you will:

1. Refresh your memory on fundamental concepts in linear algebra.
2. Learn about roundoff error that arises when solving problems on finite precision machines (i.e., computers).
3. Generalize your understanding of concepts like matrix norms.
4. Learn direct and iterative techniques for solving linear systems and when to choose a direct method vs an iterative method.
5. Understand how accurate these techniques are and in what situations you should apply one method vs. another.
6. Be introduced to the ideas of convergence and rate of convergence and learn when you can expect the different methods to converge.
7. Learn how to solve rectangular (rather than square) matrix systems.
8. Learn multiple ways to estimate parameters via least squares.
9. Understand the accuracy and efficiency and cost issues involved in using numerical techniques to estimate eigenvalues.
10. Learn how to estimate the cost of classical algorithms for solving linear systems and finding eigenvalues.
11. Refine your skills with Matlab.

12. Improve your skills manipulating matrices (block matrix manipulations, etc) especially in the context of proving results.

13. Understand the important role numerical linear algebra plays in numerical modeling applications.

Academic Conduct:
I take academic dishonesty *very seriously* and will not tolerate it in this class in any form. Academic misconduct includes willfully cheating on or giving aid during an exam or copying homework assignments (computer or paper and pencil). Blatant copying on an exam, homework assignment, or computer assignment will result in a grade of zero for that work.

The university now stipulates that the following be included in all class syllabi:

By enrolling in this course, each student assumes the responsibility of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal.

To read the full Student Academic Conduct Policy, consult the *UMBC Student Handbook*, the *Faculty Handbook*, or the UMBC Policies section of the *UMBC Directory*.

Class Attendance: I expect students to attend class and to turn up **on time**. Rarely do students do well in classes which they do not attend, and I will be less likely to give outside assistance to students who regularly miss class. Further, students arriving late for class disrupt the entire class. Students who consistently turn up more than a few minutes late for class or who regularly miss class may be docked points from their final grade.

Email: I am happy to answer questions about the class via email. However, I will not respond to email which does not include the name of the sender.

Important Dates:

Date	Notes
1/28/08	First day of class
2/8/08	Last day to register and last day for graduate students to drop class (without "W" on transcript)
3/16–3/23/08	Spring Break
3/12/08	Midterm Exam
4/14/08	**Absolute Last day to drop class**
5/13/08	Last day of classes
5/19/08	Final Exam