Math 611, Spring 2009
Applied Analysis

Instructor: John Zweck
Office: MP 424
Email: zweck@umbc.edu
Webpage: I will maintain a web page for the course, linked from my web page www.math.umbc.edu/~zweck. I will also communicate with you using a class email list.
Phone: (410) 455 2424 Do not leave a message. Email me instead.
Fax: (410) 455 1066
Lectures: Tu Th, 4:00-5:15pm (MP401)
Prerequisites: Official: Math 600 or permission of instructor. Unofficial: I will assume you have taken Math 302/401 or an equivalent course on metric spaces and the analysis of functions. In addition, the mathematical maturity gained in Math 601 will be extremely helpful.
Office Hours: M 2:30-3:30, Tu 1:30-2:25 and by appointment. If you cannot come to my office hours please contact me in class or by email to set up a time to meet. Also, you are encouraged to ask me questions by email. I rarely check my phone messages.

References
The text for the course is “Foundations of Modern Analysis”, by Avner Friedman, Dover, 1982, (Chapters 4,5,6). However, lectures will be based on a variety of sources. The following texts on Functional Analysis are all highly recommended and represent a wide range of perspectives and levels of sophistication. My lectures will be drawn from the first seven books.

[Y] “An Introduction to Hilbert Space” by N. Young
[T] “Functional Analysis” by Gerald Teschl, Faculty of Mathematics University of Vienna. (Online text linked from course web page.)
[D] “History of Functional Analysis” by J. Dieudonnéd
Course Summary and Learning Goals

The course will be focused on the fundamentals of the analysis of linear functionals. Although the material will be motivated by applications there will only be time for a brief discussion of a few applications, mostly those to ordinary and partial differential equations. Topics to be covered include

1. Normed linear spaces, subspaces, finite dimensional normed linear spaces.

2. Bounded linear transformations, The principle of uniform boundedness, open mapping and closed graph theorems.


4. Weak and weak* topologies, Banach-Alaoglu theorem.

5. Completely continuous (compact) operators, Fredholm theory, elements of spectral theory.


7. Orthonormal sets, Bessel’s inequality, Parseval’s identity.

8. Adjoint of an operator, self-adjoint, normal, and projection operators, invertibility and spectrum, spectra of special operators.


The goal of the course is to prepare students for the Applied Mathematics Qualifying Exam in Analysis as well as for subsequent courses in optimization, partial differential equations, and numerical techniques such as the finite element method.
**Academic Misconduct**

I will not tolerate cheating in any form. All instances of cheating I discover will be reported to UMBC’s academic integrity committee. (See http://www.umbc.edu/integrity/) In particular, in this course, giving or receiving aid on exams will result in a grade of zero for that exam. Copying of homework solutions from other students in the class, from students who have previously taken this or an equivalent course, from a solutions manual, or from the web will treated as a serious offense. At a minimum this will result in a grade of zero for that homework (which will not be counted as one of the two lowest homeworks I drop when calculating your overall homework grade). For flagrant cheating on homework I reserve the right to give a grade of zero for the homework on which the students was found to have cheated as well as on all homeworks that were turned in prior to the discovery of the offense. Also see comments below in the subsection on Homework.

Here is a summary of UMBC’s official policy on academic misconduct, which I fully endorse:

By enrolling in this course, each student assumes the responsibilities 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.

**Grading**

**Grades:** Homework 35%, Midterm Exam 30%, Final 35%

**Homework:** The homework problems will be posted on the course web page each week. Problems assigned for the week are due at the start of class on the Thursday of the following week. At least some of them will be graded. Make sure your homework paper is stapled. No late homework will be accepted! Your lowest two homework grades will be dropped. You may ask me questions about the homework and you may discuss homework problems with another student in the class. To ensure that you struggle and learn the material for yourself attempt the homework problems for yourself, then meet with another student to discuss your solutions at a blackboard without showing each other your written solutions. Finally, after your discussion revise your solutions. The final write up must be your own – two (almost) identical solutions will both be given zero. I do not encourage groups of more than two people to work together on homework. Do not miss class to complete a homework. I will not accept homework that is handed in after the first few minutes of class. You may redo up to four of your graded homework assignments. Each must be resubmitted no more than one week after the original homework was handed back to you. These will be graded and the
higher of the two grades will count towards your final homework grade.

Midterm Exam: Thursday March 26th.
Final Exam: Tuesday May 19th 3:30-5:30. (Comprehensive)

How I assign final grades

For each exam I work out how many points I expect a student who has a solid understanding of the material to get. I tend to put the bottom B near this score. Then I work out where to place the bottom A,C,D using the grade distribution and by looking at individual exams. I also work out the bottom A,B,C,D for the homework. Then I take an imaginary student who got the bottom B (say) for each component of the course and calculate their score. If your score is higher than the imaginary student’s you get a B. If it is a little less than the imaginary student’s score I look carefully at your work to decide whether you deserve a B or a C. Most importantly I look at your final exam. In particular, students on the borderline between two grades and who show mastery of the material on the final are more likely to receive the higher grade. However, students who do very poorly on the final might find that their course grade is lower than they had expected! In short I reward “strong finishers” who can show me they have a solid understanding of the entire course.