

Mathematics 5440-1
Fall 2010

Class Time and Place: M, W, F, 10:45-11:35, LCB 222

Class website <http://www.math.utah.edu/~korevaar/5440fall10>

Instructor: Professor Nick Korevaar 581-7318
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Office Hours: M, W 2:20-3:00; Th 9:30-10:30, and by appointment

Problem Session: Th 12:30-2:00, LCB 215.

Text: *A First Course in Partial Differential Equations, with Complex Variables and Transform Methods*, by H.F. Weinberger ISBN 0-486-68640-X

Prerequisites: Math 3210-3220 or equivalent; we will use concepts from single and differential and integral multivariable analysis such as continuity, differentiability, inverse function theorem, function convergence theorems and the vector calculus theorems. Although the formal prerequisite requirement is a grade of at least *C* in 3220, you will probably have difficulty with the 5440 course material if you don't understand the analysis material at an *A* or *B* level. You will be expected to learn the key theorems and derivations in this course, and your homework will include theoretical problems along with computations and applications.

Course Description: This course is an introduction to the methods used to study of partial differential equations. PDEs and systems of PDEs arise in diverse areas of science and mathematics, and can have quite different characteristic behaviors, as you would expect by the diversity of dynamical and static systems they can be used to model. The core of the 5440 course material is Chapters 1-7 of the Weinberger text, i.e. a rigorous study of the basic partial differential equations of classical physics and mathematics: the wave, heat and Laplace equations. We will study derivations of these equations, along with the classical methods for solving and estimating the solutions to the associated natural initial and/or boundary value problems. These methods include the method of characteristics, integral forms of solution including Green's functions, maximum principles, Fourier series solutions and generalizations. As appropriate I will provide supplementary material from other texts or on-line resources, in order to fit this core material into the larger context of the more general study of PDEs. There is currently a wealth of interesting material easily available on-line.

I will pass a sheet around on the first day of class so that you may each pick a 20 minute interval to visit me in my office and get acquainted. I'm interested in knowing your backgrounds and expectations for this course, and in answering questions you may have about it.

Grading: There will be two midterms, a comprehensive final examination, and homework. Each midterm will count for 20% of your grade, homework will count for 30%, and the final exam will make up the remaining 30%. All exams will be given in our classroom. The midterm exam dates are **Monday October 4** and **Monday November 15**. The final exam is at the University time and date of **Tuesday December 14, 10:30-12:30**.

You may opt out of the final exam by completing an individual or 2-person group project on some application or extension of the course material. Each project shall consist of a 5-10 page expository paper, and a presentation to the class of at least 20 minutes in length,

but possibly longer. I will be available for pre-presentation consultation and practice. Project groups and topics must be approved by me, **by Friday November 5**.

Although I don't recommend it, some graduate students from departments other than Math may need to enroll in the parallel course to this one, Math 6850. If you are one of these students you will be required to complete both a project (at an appropriately advanced level) and the in class final exam. Luckily, since PDEs arise in so many areas of research, there may be a topic which ties in very nicely with your graduate interests.

Homework assigned at successive FMW lectures will be collected on the immediately following Friday, and will be graded. Note that in addition to office hours you may attend the weekly problem/discussion session. Work individually and collaboratively, but each student is responsible for handing in original (non-copied) work.