

Introduction to PDE

Math 557

INSTRUCTOR INFORMATION:

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Office hours: Monday 1:30-2:30, Wednesday 9:15-10:15 or by appointment.

This is the first course of a three quarter introduction to Partial Differential Equations. The course will start with a motivation from Calculus of Variations. This would allow us to introduce the notion of Euler-Lagrange equation and variational derivative. We will briefly review some elements of Fourier analysis, distribution theory and the notion of weak derivatives. We will study in detail the existence and regularity of solutions to the Laplace and the heat equations. We will spend time learning about Sobolev spaces, elliptic regularity and boundary value problems.

The study of the wave and Schrodinger equations is postponed to the second quarter. Other topics for the second and third quarter may include: Cauchy-Kowalewsky theorem, first order equations, initial value problems, introduction to microlocal analysis, Lax parametrix construction, Schauder estimates, Calderon-Zygmund theory, energy methods, boundary regularity on rough domains. The precise selection of topics will be left to the instructor's discretion.

During the Fall, we will follow G.B. Folland's *Real Analysis* and *Introduction to Partial Differential Equations* for the review of Fourier analysis and distribution theory. Both of these books are in reserve in the library. The main textbook for the class is L.C. Evans' book *Partial Differential Equations*. It will be as a guideline for most of the other topics.

RESERVE LIST:

- Partial Differential Equations, L.C. Evans, AMS, Graduate Texts In Math (recommended textbook).
- Elliptic Partial Differential Equations of Second Order, D. Gilbarg and N. Trudinger.
- Real Analysis, G.B. Folland.
- Introduction to Partial Differential Equations, G.B. Folland.

REMARKS:

- Homework will be due on October 27th, November 24th and on December 14rd, 2010.
- Students are expected to be familiar with the topics treated in the Appendices of Evans' book.