Department of Mathematics – UNL
Fall 2007

Math 914 – Partial Differential Equations

Schedule: TuTh 12:30 – 1:45 Military and Naval Building B6

Instructor: Petronela Radu, Avery Hall 239, 472-9130, pradu@math.unl.edu

Textbook: Partial Differential Equations by Lawrence Craig Evans (Graduate Studies in Mathematics, V. 19) published by AMS 1998

Course information: This graduate course offers an introduction to modern methods used in the study of partial differential equations; we will cover topics such as distributions, weak solutions, Sobolev spaces, and obtaining estimates of solutions to PDEs. The material will deal with the main linear PDEs (the transport, Laplace, heat, and wave equations) and the nonlinear PDEs associated with them. The main problem for every PDE is to establish its well posedness, i.e. existence, uniqueness, and continuity of solutions with respect to initial data; we will see that each of these questions can be answered in more than one way depending on the topology in which we are working.

The course will cover (most of) Chapters 1- 5 from the textbook and some additional topics (e.g. distributions, some aspects from nonlinear PDEs).

The prerequisites are Real Analysis, a good understanding of Measure Theory, Lebesgue Integration, and Functional Analysis. Please contact the instructor if you have not had one of these courses.

Evaluation: The grade is computed with the following formula:
30% Homework
30% Midsemeter Exam
40% Final Exam
Bonus points can be obtained by

1. **regularly** attending and participating in the PDE seminar (Wed 2:30-3:20 Avery 351) – 5 points

2. giving a one-hour presentation of a short article or theorem (check with instructor first) – 5 points

Additional resources:

1. Partial Differential Equations by F. John

2. An Introduction to Partial Differential Equations by M. Renardy and R. Rogers

3. Lecture notes written by L. Tartar available at http://www.math.cmu.edu/cna/publications.html

Syllabus – Schedule

- 08/28 – 09/01 Introduction to PDEs: classification, examples, difficulties.
- 09/03 – 09/07 The transport equation. Laplace's Equation
- 09/10 – 09/14 Properties of harmonic functions. Green's function. Energy methods.
- 09/17 – 09/21 Heat Equation
- 09/25 – 09/28 Wave Equation
- 10/01 – 10/05
- 10/08 – 10/12
- 10/15 – 10/19
- 10/22 – 10/26
- 10/29 – 11/02
- 11/05 – 11/09
- 11/12 –11/16
- 11/19 – 11/23
- 11/26 –11/30
- 12/03 – 12/07