FALL 2013
COURSE ANNOUNCEMENT

Math 8583: THEORY OF PARTIAL DIFFERENTIAL EQUATIONS
MW 11:15 AM - 12:30 PM, VinH 207

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Office Hours: MW 10:00 AM - 11:00 AM, or by appointment

We plan to cover the basic properties of different types of equations, with a more detailed account on second order elliptic and parabolic equations.

Our main tools are the classical maximum (or comparison) principle and energy estimates. These estimates are very useful in combination with local smoothness of harmonic functions or solutions to the heat equation. They allow us to prove the existence of classical solutions to different boundary value problems for elliptic and parabolic equations with Hölder coefficients without using representations of solutions in terms of solid and layer potentials. This approach works for nonlinear equations as well, when there are no explicit representations of solutions available.

We will also treat in details the qualitative properties of solutions to elliptic and parabolic equations, which do not depend on smoothness of coefficients (Hölder regularity of solutions, Harnack inequalities, etc). These properties have important applications to the study of behavior of solutions near the boundary and at infinity, and to various free boundary problems.

Lecture notes will be provided for the main part of the course.

PREREQUISITES: Some knowledge of Real and Functional Analysis (Lebesgue integral, Banach and Hilbert spaces).

For supplementary reading, one can use the books:

L. C. Evans, *Partial Differential Equations*, Graduate Studies in Mathematics, Vol. 19, 1998.

N. V. Krylov, *Lectures on Elliptic and Parabolic Equations in Hölder spaces*, Graduate Studies in Mathematics, Vol. 12, 1996.

D. Gilbarg and N.S. Trudinger, *Elliptic Partial Differential Equations of Second Order*, Springer, 2nd Edition, 1983 (or more recent 3rd Edition).

EVALUATION. In Fall semester, the grade will be based on 3 best (out of 4) homeworks (30%), an in-class open book Midterm exam (30%), and a take-home Final exam (40%).