2013/2014, Term 1. MATH 516:101 Partial Differential Equations I: Introduction to Elliptic and Parabolic PDE

This course is an introduction to the qualitative theory of partial differential equations, emphasizing elliptic and parabolic problems. It should be useful to students with interests in applied mathematics, differential geometry, mathematical physics, probability, harmonic analysis, dynamical systems, and other areas, as well as to PDEfocused students.

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Class hours: Tue Thu 9:30-11:00 Maths Annex 1102

Tentative Course Outline:

- Classical linear equations: Laplace, heat, and wave equations, and their fundamental solutions; properties of solutions of the Laplace/Poisson and heat equations: mean value properties, regularity, maximum principles, uniqueness for boundary (and initial) value problems.
- Second-order elliptic equations: weak solutions; regularity; maximum principles; method of sub- and supersolutions; application to semilinear elliptic problems
- Second-order parabolic equations: weak solutions; regularity; maximum principles; method of sub- and supersolutions; semigroup theory; application to semilinear parabolic equations
- Further developments: L^p theory: Calderon-Zygmund inequality; Schauder theory: Holder estimates, method of continuity, Perrons subsolution method; DeGiorgi-Nash-Moser theory: application to quasilinear elliptic problems
- Analytical tools we will review/expose along the way as needed: some functional analysis, L^p and Sobolev spaces, Fourier transform, weak convergence etc.

Pre/co-requisites: Basic analysis, such as Math 400/421 (or equivalent) would be helpful, as would some previous exposure to PDE.

References: A number of books will prove useful, but our basic reference is

Partial Differential Equations, by Lawrence C. Evans, AMS, 1998.

Course homepage: http://www.math.ubc.ca/~dli/m516PDE1/m516.html **Grading**: is based on homework assignments and class participation.