An Introduction to Partial Differential Equations
Spring 2008
Course Document

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Textbooks: G.B. Folland, *Introduction to Partial Differential Equations*, Chapters 0, 2 & 6; L.C. Evans, *Partial Differential Equations*, Chapter 5

Course Summary: The aim of this course is to study some classical methods in partial differential equations which are particularly useful in modern research. The principal goal is to understand boundary value problems for the Laplacian via layer potentials, while acquiring useful tools along the way.

Syllabus: The following is the approximate content of each lecture.

1. Convolutions and the Fourier transform
2. Distributions and Compact operators
3. The Laplace operator; Green's identities, symmetry and mean value properties
4. The maximum principle and Louisville's theorem
5. The fundamental solution and applications
6. Dirichlet and Neumann problems; Green's function
7. Dirichlet's principle and the Dirichlet problem for a half-space
8. The reflection principle and the Kelvin transform
9. Solving the Dirichlet and Neumann problems via layer potentials; definitions and motivation
10. Properties of integral operators
11. Properties of the double layer potential
12. Properties of the single layer potential
13. Solutions to the boundary value problems
14. Sobolev spaces; extensions and traces
15. Sobolev inequalities; Poincaré's inequality

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