Partial Differential Equations
Math 85500, Fall 2009

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Class Schedule: This class will meet on M&F, 10:00am - 11:30am.

Overview:
The aim will be to study important classes of partial equations, that arise in physics and differential geometry. Existence of solutions using variational and topological methods will be the main objective.

1. Basic examples. Classification of second order PDEs, heat, Laplace and wave equations. Harmonic functions, mean-value property. Poisson kernel.
2. Distribution Theory, Sobolev spaces, Embeddings Theorem.
3. Lax-Milgram Theorem, Direct method in the calculus of variations, topological degree, introduction to Morse Theory. Application to linear and nonlinear PDEs.
4. Eigenvalues of the Laplacian, Isoperimetric inequality and Faber-Krahn inequality.
5. Interior L^2-regularity. Nash-Moser Theorem.
6. Laplacian on manifolds. Problem of prescribing the scalar curvature on a compact manifold.
7. Theory for parabolic equations. Mean curvature flow.

References

[1] L. Evans, Partial Differential Equations, AMS Graduate studies in Mathematics **19**, Providence, 1998.

[2] D. Gilbarg, N. S. Trudinger, Elliptic Partial Differential Equations of Second Order, Springer Verlag, Berlin-Heidelberg-New York-Tokyo, 1983.

[3] M. Struwe, Variational methods. Applications to nonlinear partial differential equations and Hamiltonian systems. Springer-Verlag, Berlin, 1990.