MAT : Differential Equations in Mathematical Physics Annuncement of First Midterm Test

When and where?

Wednesday, November 7 2016, in-class
Closed books, closed notes.

Topics

The test will cover Chapters 1-4 of Strauss, Assignments 1-7, and lectures up to Friday, November 4. Specifically:

- *What is a PDE?* What is a solution? Linear and nonlinear equations. Linear differential operators and superposition. Initial and boundary values. Well-posed problems. Exact vector fields and the divergence theorem.

- *First-order linear equations.* The method of characteristics. Existence and uniqueness. The transversality condition.

- The method of characteristics for scalar conservation laws in one dimension. Burger's equation. Shocks and the Rankine-Hugoniot condition. Lax's entropy condition. The graphical method for constructing entropy solutions.

- *The wave equation on the real line.* The general form of the solution; D'Alembert's formula. Causality and energy; finite speed of propagation, the light cone, domain of dependence, domain of influence.

- *The heat equation on the real line.* The fundamental solution. Maximum principle and energy methods. Infinite speed of propagation.

- *Reflections and sources.* Solving boundary-value problems by even and odd reflection.

- *Inhomogeneous equations.* Duhamel's principle.

- *Separation of variables.* Boundary-value problems for the wave and heat equation. Dirichlet, Neumann, periodic, and Robin boundary conditions. Eigenvalues and eigenfunctions.