MATH/AMSC 674 CLASSICAL METHODS IN PDE, SPRING 2012

Corrected syllabus

Instructor: Matei Machedon
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Texts: Evans, Partial Differential Equations **second edition**
Hörmander, The analysis of linear partial differential operators, I, second edition (will be used in the second half of the semester). We will cover: Evans Chapter 5 :all sections. Chapter 6: 6.1 to 6.3 and 6.5. These are standard qualifying exam topics.

After that, we will study distribution theory from Hörmander's book. If there is time, we will also cover Strichartz estimates.

Grading: 30 % homework, 40% mid-term exam on chapters 5 and 6, 30% final exam. Tentative date for the in-class exam: Tuesday April 3.

Problem set 1, due in late February, at a date to be determined.
Evans, Chapter 5: 1, 6 (you can assume 5), 7, 8(an example of such a U is sufficient), 9, 11, 13, 14, 15, 16, 21.

Written exams:
August 2010, 4
August 2009, 6
August 2008, 5
August 2006, 4

Problem set 2, due Tuesday, March 13
Written exams:
January 2011: 5 (this looks clearer if you use complex numbers)
August 2010 : 5
August 2008: 6
January 2006: 4
August 2005: 2

Problem set 3, due Thursday April 26.

1) Let B be the ball of radius π centered at 0 in $\mathbb{R}^3$. Prove that the space of solutions to

$$\begin{aligned} u + \Delta u &= 0 \,\text{in}\; B \\ u &= 0 \,\text{on}\; \partial B \end{aligned}$$

is one dimensional. CORRECTED HINT: Prove that the eigenspace corresponding to the lowest eigenvalue of $-\Delta$ in B with 0 Dirichlet boundary conditions contain a spherically symmetric eigenfunction.

2) Find the solution to $-u'' + u = \delta(x)$, $u(x) \to 0$ as $x \to \pm\infty$.

3) Compute $x\delta'(x)$ and find all solutions $u \in \mathcal{D}'(\mathbb{R})$ to $xu' = \delta$.

4) Let B be the unit ball in $\mathbb{R}^2$. Compute $x\frac{\partial}{\partial x}\chi_B + y\frac{\partial}{\partial y}\chi_B$ as well as $y\frac{\partial}{\partial x}\chi_B - x\frac{\partial}{\partial y}\chi_B$.