Partial Differential Equations for Finance
G63.2706, Spring 2003
Mondays 7:10-9pm
Silver Center 207

Instructor: Robert V. Kohn. Office: 612 Warren Weaver Hall. Phone: 212-998-3217. Email: kohn@cims.nyu.edu. Web: www.math.nyu.edu/faculty/kohn. Office hours: Tuesday 4-5 and by appointment.

Teaching Assistant: Fan-fu Feng. Office: 1309. Phone: 212-998-3329.
Email: fffeng@cims.nyu.edu. Office hours: Tuesday 12-1 and Thursday 5-6. Room 613 has been reserved for the Thursday timeslot.

Special Dates: First lecture Jan. 27. No lecture Feb. 17 (Presidents' Day) and March 17 (spring break). Last lecture May 5. Final exam: May 12.

Content: An introduction to those aspects of partial differential equations and optimal control most relevant to finance. PDE's naturally associated to diffusion processes: the forward and backward Kolmogorov equations and their applications. Linear parabolic equations: fundamental solution, boundary value problems, maximum principle, transform methods. Dynamic programming and optimal control: Hamilton-Jacobi-Bellman equation, verification arguments, optimal stopping. Applications to finance will be distributed throughout the course, including: barrier, Asian, and other exotic options; pricing and hedging in incomplete markets; options on an underlying that can jump; American options, portfolio optimization, and other examples of optimal decision-making.

Prerequisites: Working knowledge of stochastic calculus, and some familiarity with financial models. The fall semester course Stochastic Calculus (G63.2902) is ideal; actually I'll assume somewhat less, roughly the material covered by Chapters 9, 10, and 11 of S. Neftci's book. See my handout "Stochastic Calculus Review" for a quick refresher.

In addition to stochastic calculus, students also need considerable scientific maturity, at a level typically obtained through an undergraduate math or science major.

Course requirements: There will be several homework sets, one every couple of weeks, probably 6 in all. Collaboration on homework is encouraged (homeworks are not exams) but registered students must write up and turn in their solutions individually. There will be one in-class final exam.

Lecture notes: Lecture notes and homework sets will be handed out, and also posted on my web-site as they become available.

Text: There is no textbook for this course – the right book just doesn't exist. Lectures will draw from many sources, including recent articles from the quantitative finance literature. See the separate handout "Library Reserve" for a list of some books that may be useful. I may from time to time make use of articles that are not easily downloaded electronically; if so then I'll place copies in the "Green Box" associated with my name, which you can request from the CIMS library staff.