

# **PDE for Mathematical Finance.**

**Spring, 2004.**

## **Course Outline.**

**Lecture 1.** Ordinary differential equations, first order partial differential equations and the method of characteristics.

**Lecture 2.** Markov Chains on a finite state space. Semigroups, and Generators. Feynman-Kac formula.

**Lecture 3.** Brownian Motion, the Laplace operator and the Heat equation.

**Lecture 4.** Boundary and Initial value problems.

**Lecture 5.** Variable coefficients. Elliptic and Parabolic Equations.

**Lecture 6.** Existence and smoothness of solutions.

**Lecture 7.** Dirichlet and Neumann boundary conditions.

**Lecture 8.** Itô's formula, and uniqueness of solutions.

**Lecture 9.** Adjoints and forward equations.

**Lecture 10.** Deterministic control, optimization and Hamilton-Jacobi equations. Regularity and Viscosity solutions.

**Lecture 11.** Stochastic Controls, Bellman equation. Nonlinear Partial differential equations.

**Lecture 12.** Optimal stopping and free boundary problems.

**Lecture 13.** Catch up

## **Other Information.**

**My office:** Room 1313 warren Weaver Hall,

Phone: 8-3334, e-mail <varadhan@cims.nyu.edu >

Office Hours: Monday afternoons. 2PM -5PM. If there is a mathematic colloquium then 2-3.30 PM. Other times by appointment (use e-mail to make one).

**TA for the course:** Nikolaos Zygouras

Room: 1309 Warren Weaver Hall,

Phone: 83329, e-mail: <zygouras@cims.nyu.edu>

**Office Hours:** Mondays, 4-5 and 7-8 PM

Home work will be assigned every week. Will be posted on this website following the Monday class. Is generally due on the Monday two weeks after the class.

There will be a Final take home exam. The final grade will depend on the Final Exam and the answers to the homework that will be graded and returned.