PDE for Finance

Prerequsites: Advanced calculus, some familiarity with ordinary differntial equations and probability theory.

There is no prescribed text. Notes will be posted on the website ahead of class session. Homework problems will be assigned every week and will be due the following week. They will be graded and returned. The assignments will carry 50% of the final grade. The other 50% of the final grade will depend on a final examination. There is a list of related optional reading material on the reseve list at the (CIMS) library.

Course Outline

1. Recurrence Relations, timesteps and differential equations.

2. Linear first order partial differential equations.

3. Recurrence Relations with Noise. Markov Chains.

4. Transition Matrices for Markov Chains. Expectation Operators.

5. Continuos time models with discrete state space and systems of ODEs.

6. Transition to Continuous Space. Random Walks and the Heat equation.

7. Brownian Motion.

8. Stochastic Differential equations as limts of Markov Chains

9. Second order Linear Partial differential equations.

10. Connections between PDE's and Diffusions.

11. Boundary Conditions.

12. Control theory, Optimization, The Bellman equation.

13. Hamilton-Jacobi equations. Viscosity Solutions.

14. Free Boundary problems.