PARTIAL DIFFERENTIAL EQUATIONS
IN FINANCIAL MATHEMATICS
MTH 890–001 FALL 2010

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Course description: Financial mathematics is a very influential, growing, and very exciting area of mathematics! The goal of the course is to introduce the students to those aspects of partial differential equations that are most relevant for financial mathematics. The course will also concentrate on the applications of partial differential equations in modern financial mathematics.

Outline of the major topics: (1) Partial differential equations: Linear parabolic equations, fundamental solution, boundary value problems, maximum principle, Fourier transformation method, free boundary value problems. Dynamic programing and optimal control, Hamilton-Jacobi-Bellman equations. (2) Application to financial mathematics: Black-Scholes partial differential equations, European and American options, boundary conditions, free boundary conditions. Exotic options, barrier options, path-dependent options, Asian options. Portfolio optimization.

Textbooks:

[1] Wilmott, Howison, Dewynne: The Mathematics of Financial Derivatives: a Student Introduction, Cambridge University Press, 1995.

[2] S. Shreve, Stochastic Calculus for Finance II, Springer, 2004.

Recommended Textbooks:

[3] R.L. McDonald, Derivatives Markets, Addison Wesley, 2nd edition, 2006.

[4] J.C. Hull, Options, Futures and Derivatives, Prentice Hall, 7th edition, 2008.

[5] L.C. Evans, An introduction to stochastic differential equations (online).

Grading will be based on homework assignments.