Fall 2011 **Stochastic Financial Theory** QF 5003

The course is designed to provide students with the mathematical background to study modern financial theory. This approach has become extremely important for financial analysts - "QUANT," and risk management. We will study in a systematic way to price (evaluate) and hedge (eliminate) risks associated with the uncertainties of asset prices such as stocks, interest rates, credits, energy, loans, insurance, etc. We shall also introduce some basic ideas of computational finance and financial statistics.

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Prerequisities:
STAT 3875 (basic knowledge of probability and statistics.)
MATH 2030 Advanced Calculus

Textbooks:

1. Steven E. Shreve, "Stochastic Calculus for Finance II: continuous-Time Models," Springer-Verlag, 2003.
2. 孫健, "金融衍生品定價模型" 中國經濟出版社, 2007.
3. 韓傳祥, "金融隨機計算." 2011.

References:

1. J. Hull, "Options, Futures, and Other Derivatives," Latest Edition, Prentice Hall.
2. M. Jeanblanc, M. Yor, and M. Chesney, "Mathematical Methods for Financial Markets," Springer, 2009.
3. P. Glasserman, Monte Carlo Methods for Financial Engineering, Springer-Verlag, New York, 2003.
4. R. S. Tsay, Analysis of Financial Time Series, Wiley-Interscience, 2005.

Course Contents:

1. Elementary probability and stochastic processes (convergence of integrals; change of measure; conditional expectation.)
2. Brownian motion (random walk; discrete-time models in finance; martingale property; variations; Markov property.)
3. The Black-Scholes model (stochastic calculus; Ito's lemma; market completeness; pricing partial differential equation; hedging strategy; Brownian bridge.)
4. Risk-Neutral pricing (Girsanov's theorem; martingale representation theorem; fundamental theorems of asset pricing.)
5. Conditional Expectation and PDEs (Feynman-Kac Formula)
6. Simulation and algorithms for financial models.

Grading:

Assignments 30%, Exams(midterm and final) 50%, Course Project 20%.