Mathematics Department

Brooklyn College, City University of New York

Math 4601 (Financial Instruments and their Pricing) Syllabus

4 hours, 4 credits

Derivative Securities

Forward and futures contracts, caplets, caps, swaps, options(Call, Put, Barrier, Bermudan, Asian, Digital, Exotic)

Binomial no-arbitrage pricing model

One-period Binomial model, Multi-period Binomial model, finite probability space, random variables, distributions and expectations, conditional expectations, Martingales and Markov Processes.

State price and American derivative securities

Change of measure, Radon-Nikodym derivative process, Capital Asset pricing model, non-path-dependent American derivatives, stopping times.

Interest-rate-dependent Assets

Binomial model for interest rates, fixed-income derivatives, forward measures, futures.

Random walk and Brownian motion.

Random walks: first passage times, reflection principle;

Scaled random walks: martingale property, quadratic variation, limiting distribution;

Brownian motion: distribution, martingale property, quadratic variation, first passage time distribution, reflection principle,

Introduction to Stochastic Calculus

Riemann integral, Lebesgue-Stieltjes integral, stochastic integral, Ito's formula, Black-Scholes equation, dynamic replication, Black-Scholes formula, Greeks

Risk-neutral pricing

Risk-neutral measure, Girsanov theorem, Fundamental theorem of asset pricing, Forwards and futures pricing.

Exotic options and American options

Knock-out barrier option, lookback option, Asian option, perpetual American put, finite-expiration American put, American call.