

## APPLIED MATHEMATICS 581 "ADVANCED FUTURES AND OPTIONS"

**Calendar Description:** H(3-0)

Stochastic calculus and the dynamics of asset prices, martingale theory and risk-neutral valuation, interest rate models, energy and commodity markets, value-at-risk and risk management.

**Prerequisite:** Applied Mathematics 483 and Statistics 407

**Corequisite:** Statistics 409

### *Syllabus*

<u>Topics</u>	<u>Time</u>
Introduction to advanced futures and options	1
Introduction to probability theory (basics)	1
Wiener and Poisson processes	2
Conditional expectations. Martingales in discrete and continuous times	3
Discrete-time (B,S)-security markets (basics definitions: capital, strategy, arbitrage, completeness self-financing, risk-neutral valuations, etc..)	2
Cox-Ross-Rubinstein formula	1
General discrete-time (B,S)-security market	1
Ito integral	2
Stochastic differential equations	2
Ito formula	2
Integration by parts formula	1
Girsanov theorem	1
Continuous-time (B,S)-security market (basics definitions: capital, arbitrage, completeness, strategy, self-financing, risk-neutral valuations, etc.)	2
Black-Scholes formula	2
Call-put parity	1
Stopping times, American options	2
Value-at-Risk (Greeks)	2
Interest rates (Vasicek, CIR, HJM)	3
Energy and commodity markets (models and pricing)	4
Risk Management	1
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