Prefix, Number and Name of Course: ACM 654 Mathematics of Finance I: Modeling, Analysis and Numerical Methods

Credit Hours: 1
In Class Instructional Hours: 1 **Labs:** 0 **Field Work:** 0

Catalog Description:
Prerequisites: Math325/Math381 or equivalent and Instructor Permission

Put-call parity equation, risk-neutral probability, binomial tree analysis.

Reasons for addition:
Mathematics of Finance I is the first of the two one-credit courses designed to enrich and broaden the department's graduate course offerings by integrating probability, differential equations and numerical analysis through in-depth study of their connections to finance and economics. This sequence will enhance the Professional Applied and Computational Mathematics program by providing students with additional knowledge that they can build upon in their internship or projects.

Student Learning Outcomes: Students will:	**Content Reference:**	**Assessment:**
1. Break down and analyze the theoretical models and numerical methods for solving the real-world finance problems.	II, III, V, IV.	Group and individual assignments, examinations, and computer projects.
2. Build pricing models and solve problems by applying the key theorems, tools and techniques in mathematical finance.	I, II, IV, V.	Group and individual assignments, examinations, and computer projects.
3. Utilize computer software and develop programs to produce and solve the financial mathematical models.	IV, V.	Group and individual assignments, examinations, and computer projects.

Course Content:

I. Definitions and fundamental financial derivative tools
   A. Fundamental financial derivatives
   B. Pricing futures contracts
   C. Bonds derivatives
   D. Interest rate futures and derivatives
   E. Exchange rate derivatives

II. The fundamental derivatives pricing model: put-call parity
   A. Stock put-call parity equation
   B. Synthetic stocks and treasures
   C. The equation for exchange options
   D. The equation for currency options

III. Comparing options

A. American options
B. Three inequalities

IV. Binomial tree analysis - one period
A. The game theory method
B. The fundamental law of no arbitrage
C. Replicating methods
D. Volatility

V. Binomial tree analysis - general cases
A. Multi-period binomial trees
B. American options
C. Currency options
D. Futures
E. Risk-neutral pricing: true and risk-neutral probabilities

Resources:

Scholarships in the Field:

Ali Hirsa, *Computational Methods in Finance*, CRC, 2012

Chung K. and AitSahlia F., *Elementary Probability Theory: with stochastic processes and an introduction to mathematical finance*, 2003.

Dunbar, N. *Inventing Money: The Story of Long-Term Capital Management and the Legends Behind It*, UK: Wiley 2000

Etheridge Alison, *A Course in Financial Calculus*, Cambridge, 2002

Eberlein Raible, *Mathematical Finance*, Springer 1999

Follmer H. and Schied A. *Stochastic Finance, An introduction in discrete time*, Springer, 2004

John Hull, *Options, Futures, and Other Derivatives 8th*, 2011

Jorion, P. *How Long-Term Lost Its Capital*, 1999

Joseph Stampfli and Victor Goodman, *The Mathematics of Finance: Modeling and Hedging*, Springer 2010

Machiael Steele, *Stochastic Calculus and Financial Applications*, Springer, 2000

Malliavin, *Stochastic Calculas of Variations in Mathematical Finance*, 2005

Salih Neftci, *An Introduction to the Mathematics of Financial Derivatives*, 2000

Thomson, R. and Apocalypse Roulette, *The Lethal World of Derivatives London*, Macmillan, 1998

Periodicals:

Journal of Mathematical Finance

Journal of Computational Finance

Journal of Financial and Quantitative Analysis

Journal of Finance

Journal of Financial Derivatives

Quantitative Finance

The Journal of Fix Income

Finance and Stochastic

Journal of Financial Studies

Journal of Money, Credit and Banking

Journal of Derivatives

Journal of Banking and Finance

Mathematics and Financial Economics

Journal of Futures Markets

Electronic and Audiovisual Resources:

Society of Mathematical Finance, https://win.wisc.edu/organization/smf

International Association of Financial Engineers, http://iafe.org/html/

International Monetary Fund: the statistic measurement of financial derivatives, http://www.imf.org/external/pubs/cat/longres.cfm?sk=2514.0

Department of Mathematics, Financial Mathematics, University of Chicago, http://finmath.uchicago.edu/admissions/lecture_videos.shtml

The Actuarial Profession, www.soa.org/careers

Careers in Applied Mathematics, www.siam.org/careers/

Mathematical Sciences Career Information, www.ams.org/careers

Careers in Statistics, www.amstat.org/careers

101 Careers in Mathematics, www.maa.org/careers.

Occupational Outlook Handbook, www.bls.gov/oco/

Center for Research in Financial Mathematics and Statistics at UC Santa Barbara, http://www.youtube.com/watch?v=bIiQRRllJoA

Financial Engineering & Financial Mathematics http://www.youtube.com/watch?v=ABhfQk3qgVk&playnext=1&list=PLE981F9D9EA1F7078&feature=results_main