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.

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


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

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


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


**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 Fixed 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](https://win.wisc.edu/organization/smf)


The Actuarial Profession, www.soa.org/careers

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

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


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

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