

WGH
WGH
APR 9/23/14

1st Bulletin 4-17-14
2nd Bulletin 4.9.15

1314140

COURSE APPROVAL ROUTING CHECKLIST

1. Course Number: ACM654

2. Course Title: Mathematics of Finance I: Modeling, Analysis and Numerical Methods
(no more than 70 characters)

3. Title Abbreviation: Math Finance I
For use in Course Schedule (no more than 19 characters)

4. Action: New Course Revision IF Designation WAC

Requested IF Designation(s): _____

Course Proposal/Revision Checklist

This checklist will help departments avoid some of the more common mistakes made on course proposals and revisions. Your use of the checklist will allow the College Senate Curriculum Committee to focus its review on more substantive issues, thus expediting the approval process.

- Proposal conforms to all guidelines listed in the *Directory of Policy Statements*.
- Proposal has been proofread for spelling, punctuation, grammar, and narrative style.
- If the course is a new course, reasons for the additions are included; if the course is a revision of an existing course, reasons for revision and a copy of the old course are included as well as the IF submission narrative when appropriate.
- Catalog description follows the guidelines in the *College Senate Curriculum Handbook*.
- Student learning outcomes are correlated appropriately with course content and assessment.
- All resources are listed alphabetically and conform to a conventional academic style.
- Cross-listed courses have been checked with all chairs and deans involved in development of the course.

DEPARTMENTAL ACTION

MW _____ Date 4/10/14
Chair, Department Curriculum Committee

Approved with confirmation that all necessary laboratories, studios, resources, facilities, and personnel for support of this course are available.

Hongliang Xu _____ Date 4/11/14
Signature, Department Chairperson (both Chairs if course is cross-listed)

Mathematics
Department

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/Studio:** 0 **Field Work:** 0

Catalog Description:

Prerequisites: Instructor permission or admission to the Professional Applied and Computational Mathematics Master program.

In-depth study of probability, differential equations and numerical analysis and their connections to finance and economics; 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. Analyze the theoretical models and numerical methods for solving real-world finance problems.	II, III, V, IV	Group and individual assignments and examinations.
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 presentations.
3. Utilize computer software and develop programs to produce and solve the financial mathematical models.	IV, V	Group and individual assignments 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. Comparing American options with European 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. Pricing American options
 - C. Pricing Currency options
 - D. Pricing Futures
 - E. Risk-neutral pricing: true and risk-neutral probabilities

Resources

Scholarship:

Ali Hirs, *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.

Hull, John, *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 Calculus 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:

Finance and Stochastic

Journal of Banking and Finance

Journal of Computational Finance

Journal of Derivatives

Journal of Finance

Journal of Financial Derivatives

Journal of Financial and Quantitative Analysis

Journal of Futures Markets

Journal of Financial Studies

Journal of Mathematical Finance

Journal of Money, Credit and Banking

Mathematics and Financial Economics

Quantitative Finance

Electronic and/or Audiovisual Resources:

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

Careers in Statistics, www.amstat.org/careers

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

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

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

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>

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

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

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

The Actuarial Profession, www.soa.org/careers

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