

~~WG 44 version~~
~~WG #1 - 9/22/14~~

1st Bulletin 4-17-14
2nd Bulletin 4-9-15

1314141

COURSE APPROVAL ROUTING CHECKLIST

1. Course Number: ACM655
2. Course Title: Mathematics of Finance II: Modeling, Analysis, and Numerical Methods
(no more than 70 characters)

3. Title Abbreviation: Math
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

Mary _____ 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.

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

Mathematics
Department

Prefix, Number and Name of Course: ACM 655 Mathematics of Finance II: 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.

Additional study of probability, differential equations and numerical analysis and their connections to finance and economics; Black-Scholes equation, risk-neutral probability, Brownian motion, hedging, continuous and discrete stochastic models.

Reasons for Addition:

Mathematics of Finance II is the second 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. It is a sequence of Mathematics of Finance I, although they are highly related but independent to each other to a large extent. 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 classical models in financial mathematics and master some of the other related models and numerical methods to solve them.	I,II, III, V.	Group and individual assignments, examinations.
2. Set up mathematical models and solve the practical problems raised with real data.	I, III, IV.	Group and individual assignments and presentations.
3. Utilize software and develop programs to solve the financial mathematical models.	I, IV.	Group and individual assignments and computer projects.

Course Content:

- I. Continuous-time models and the Black-Scholes equations
 - A. A continuous-time model
 - B. The discrete model
 - C. An analysis of the continuous model
 - D. The Black-Scholes formula
 - E. Derivation of the Black-Scholes formula

- II. The analytic approach to Black-Scholes
 - A. Strategy for obtaining the differential equation
 - B. Expanding and simplifying $V(S,t)$
 - C. Solving the Black-Scholes differential equation

D. Options on futures

III. Models of hedging

- A. Delta hedging
- B. Methods for hedging a stock or portfolio
- C. Implied volatility
- D. The analysis of parameters

IV. Bonds and interest rate models

- A. Interest rates, forward rate and spot rate
- B. Swaps
- C. Interest rate models
- D. Vasicek and Cox-Ingersoll-Roll models

Resources

Scholarship:

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 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=bliQRRllJoA>

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.