# MATH 5473 SECTION 001, SPRING 2016, SYLLABUS
# FINANCIAL CALCULUS
# CONTINUOUS-TIME FINANCE

FACULTY: WEIPING LI
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## 1. Basic Course Information

**Prerequisites:** Math Math 4153, STAT 4203 (Basic Calculus I and Basic Probability).

**Textbooks:** *Stochastic Calculus for Finance II, Continuous-Time Models*, by Steven E. Shreve, 2004, Springer Finance textbook, and

**The course is applied financial mathematics of the version for FIN 5773 (Financial Engineering).**

**Recommended Books**

- *A course in Derivative Securities, Introduction to Theory and Computation*, by Kerry Back, 2005, Springer Finance textbook.
- *Options, Futures and Other Derivatives*, by John C. Hull, 7th Edition, Prentice Hall, 2008, ISBN 0136015867.
- *Asset Pricing*, by John H. Cochrane, Revised Edition, Princeton University Press, 2005, ISBN-13: 978-0-091-12137-6.
- *Dynamic Asset Pricing Theory*, by Darrell Duffie, Third Edition, Princeton University Press, 2001, ISBN-13: 978-0691090221.

**Content:** It is an intermediate course to learning mathematical finance. The basic machinery of financial engineering comes from fields in applied analysis such as stochastic calculus and martingale theory, whose presentation is often weighed down with overbearing technical considerations.

Part I: Introduction to the Ito integral (stochastic calculus) and martingales; the martingale properties of Brownian motion; Arbitrage pricing, Change of measure, the Radon-Nikodym derivative, Cameron-Marin-Girsanov theorem, Martingale representation theorem, self-financing property, Replicating strategy; Introudces Black-Scholes-Merton theory as a simple, special case of martingale pricing; Connections with PDE (Chapter 3, 4, 5, 6 from Shreve's book and Chapter 3, 4, 5 from Back's book). Simulating Brownian Motion, Realizing volatilities, greek letters, GARCH models, Stochastic Volatility Model, Mnote Carlo.

Part II. Exotic Options and Advanced Option pricing; arithmetic and geometric Asian options, American Derivative Securities and Change of Numeraire; Foreign Exchange and Exchange options, Quanto and Swaps (Chapter 7, 8, 9 from Shreve's book and Chapter 6, 7, 8 from Back's book).

Part III. Fixed Income and Fixed Income Derivatives; Vasick model, Hull-White model, Ho-Lee model, Black-Derman-Toy model, Black-Karasinski model, Cox-Ingersoll-Ross model, Longstaff-Schwartz model, Heath-Jarrow-Morton model; Market-LIBOR model (Chapter 10 from Shreve's book and Chapter 11, 12, 13, 14 from Back's book).

**Teaching Notes and Dropbox**: Available on a Dropbox folder a few days before the class. Dropbox shared folder for this course will be sent to your email.

**Class Time:** TTR 03:30pm–04:45pm, start from January 12, 2016.

**Class Room**: Human Science 326.

**Office Hours:** TTR 2:00pm-3:15pm. Open door policy. In case you need to have a long meeting, please contact me to set a mutually convenient time first. No TA for this course, please be patient for the homework and exam returns.

## 2. Exams, Homework and Grade

Your grades will be determined by the scores on the middle-term exam (100 points), the final exam (100 points), homework (150 points) and a project (50 points).

**A** as above 90 percent;

**B** as above 80 percent and less than 89 percent;

**C** as above 70 percent and less than 79 percent;

**D** as above 60 percent and less than 69 percent;

**F** as less than 59 percent.

**Middle-Term Exam: March 22, 2016, 03:30pm–4:45pm at Human Science 326**.

**FINAL EXAM: Thursday May 5, 2016, 02:00pm–03:50pm at Human Science 326**.

Each homework Assignment will be picked from textbooks and will be announced in **D2L**. If you cannot hand in homework on time or cannot make exam, the homework/exam you miss will be counted a zero.

**No Make-up exam**.

**No Late Homework**. Earlier homework is acceptable.

**Academic Calendar and Syllabus Attachment:**

http://registrar.okstate.edu/Academic-Calendar

https://academicaffairs.okstate.edu/sites/default/files/documents/Spring%202016%20Syllabus%20Attachment.pdf

http://go.okstate.edu/student-life

## 3. Office and Policies

3.1. **Main Office.** Main office of Math Department 401 MS, phone number: 405–744–5688. Fax number: 405 – 744 – 8275.

**Classroom and Email**

Class attendance is essential to your success in the course. You are responsible for all the material covered in the class.

**No cellphone ring or call during the class time in the classroom.**

All your emails will be answered to everyone in the class unless you specify the No Reply (This is to avoid the asymmetry information for other students).

3.2. **Missed Work Policy.** MATHEMATICS DEPARTMENT MODEL POLICY ON MISSED WORK

(A) A student shall be offered reasonable accommodation in the event that he or she misses a major assessment activity for a valid and documented reason.

(B) Appropriate documentation shall be provided by the student in a timely fashion to support his or her request for accommodation.

(C) Major assessment activities are those such that a zero on that activity could reasonably be foreseen to impact the student's grade substantially; this category includes, but is not limited to, exams.

(D) Valid reasons include official University activities, activities associated with military service, illness, family emergencies, mandatory court appearances, and any other events of comparable gravity.

(E) Reasonable accommodation means that the student will be given the opportunity to earn a grade on the assessment activity that is based on criteria as similar as possible to those used to grade his or her classmates. This opportunity should normally be made available in a timely fashion.

## 4. Project

Everyone in the class will be assigned to a project. The project report is expected to finish **before April 24, 2014** (the week before Pre-Final Week).

4.1. **Requirements for the Project.** The project report must be written clearly on

(1) identifying the problem(s),

(2) presenting the background and history on the problem(s),

(3) identifying the method(s) used before and in the article,

(4) the new (innovation) contributions and goal(s) as well as the new findings in the article, and

(5) the main contribution(s) and summary of the article you choose.

4.2. **Choose one of the articles below for your Project.**

(1) PATRICK BOLTON and MARTIN OEHMKE., (2015) Should Derivatives Be Privileged in Bankruptcy? *Journal of Finance, 70*, Issue 6, (pages 2353–2394)

(2) TOMASZ PISKORSKI, AMIT SERU and JAMES WITKIN; (2015) Asset Quality Misrepresentation by Financial Intermediaries: Evidence from the RMBS Market. *Journal of Finance, 70*, Issue 6, (pages 2635–2678)

(3) AMIL DASGUPTA and GIORGIA PIACENTINO; (2015) The Wall Street Walk when Blockholders Compete for Flows. *Journal of Finance, 70*, Issue 6, (pages 2853–2896)

(4) ATIF MIAN, AMIR SUFI and FRANCESCO TREBBI; (2015) Foreclosures, House Prices, and the Real Economy. *Journal of Finance, 70*, Issue 6, (pages 2587–2634)

(5) Tomasz R. Bielecki, Igor Cialenco and Rodrigo Rodriguez; (2015) NO-ARBITRAGE PRICING FOR DIVIDEND-PAYING SECURITIES IN DISCRETE-TIME MARKETS WITH TRANSACTION COSTS. *Mathematical Finance, 25*, Issue 4, (pages 673–701)

(6) Jan Kallsen and Johannes Muhle-Karbe; (2015) OPTION PRICING AND HEDGING WITH SMALL TRANSACTION COSTS. *Mathematical Finance, 25*, Issue 4, (pages 702–723)

(7) Campbell R. Harvey, Yan Liu, and Heqing Zhu; (2016) $\cdots$ and the Cross-Section of Expected Returns. *Review of Financial Studies, 29*, Issues 1, pages 5–68.

(8) Eugene F. Fama and Kenneth R. French; (2016) Dissecting Anomalies with a Five-Factor Model. *Review of Financial Studies, 29*, Issues 1, pages 69–103.

(9) Jack Favilukis and Xiaoji Lin ; (2016) Wage Rigidity: A Quantitative Solution to Several Asset Pricing Puzzles. *Review of Financial Studies, 29*, Issues 1, pages 148–192.

(10) Nicole Branger, Holger Kraft, and Christoph Meinerding; (2016) The Dynamics of Crises and the Equity Premium. *Review of Financial Studies, 29*, Issues 1, pages 232–270.

(11) F. M. Bandi and R. Reno; (2016) Price and volatility co-jumps. *Journal of Financial Economics 119* , pages 107–146.

(12) Alexander Hillert, Ernst Maug, Stefan Obernberger; (2016) Stock repurchases and liquidity. *Journal of Financial Economics 119* , pages 186–209.

(13) Mathias S. Kruttli, Andrew J. Patton, and Tarun Ramadorai (2015) The Impact of Hedge Funds on Asset Markets. *Review of Asset Pricing Studies 5*, pages 185–226.

(14) Hitesh Doshi, Redouane Elkamhi, and Mikhail Simutin (2015) Managerial Activeness and Mutual Fund Performance. *Review of Asset Pricing Studies 5*, pages 156–184.

(15) Agostino Capponi and Martin Larsson (2015) Price Contagion through Balance Sheet Linkages. *Review of Asset Pricing Studies 5*, pages 227–253.

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