

MATH 5473 SECTION 001, SPRING 2012, SYLLABUS
FINANCIAL CALCULUS
CONTINUOUS-TIME FINANCE

FACULTY: WEIPING LI
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1. BASIC COURSE INFORMATION

Prerequisites: Math Math 4153, STAT 4203.

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

A course in Derivative Securities, Introduction to Theory and Computation, by Kerry Back, 2005, Springer Finance textbook.

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

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-Martin-Girsanov theorem, Martingale representation theorem, self-financing property, Replicating strategy; Introduces 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).

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 (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).

Class Time: MWF 1:30pm–2:20pm, start from January 9, 2012.

Class Room: CLB 221.

Office Hours: MWF 2:30pm-3:30pm.

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 (100 points) and a project (100 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 16, 2012, 01:30pm–02:20pm at CLB 221.

FINAL EXAM: Friday May 4, 2012, 02:00pm–3:50pm at CLB 221.

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.

Syllabus Attachment:

<http://academicaffairs.okstate.edu/faculty-a-staff/46-syllabus-attachment>

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 students 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 20, 2012** (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) Bansal, R., Shaliastovich, I., (2011). Learning and Asset-price Jumps, *Review of Financial Studies*, 24 (8): 2738-2780.
- (2) Beliaeva, N., Nawalkha, S., (2012). Pricing American interest rate options under the jump-extended constant-elasticity-of-variance short rate models, *Journal of Banking and Finance*, 36, 151-163.
- (3) Benzoni, L., Collin-Dufresne, P., and Goldstein, R. S., (2011). Explaining asset pricing puzzles associate with 1987 market crash, *Journal of Financial Economics*, 101, 552-573.
- (4) Bollerslev, T., Todorov, V., (2011). Tails, Fears, and Risk Premia, *Journal of Finance*, 66, Issue 6, 2165-2211.
- (5) Bolton, P., Chen, H., and Wang, N., (2011). A unified Theory of Tobin's q, *Corporat Investment, Financing, and Risk Management*, *Journal of Finance*, 66, Issue 5, 1545-1578.
- (6) Chen, H., (2010). Macroeconomic Conditions and the Puzzles of Credit Spreads and Capital Structure, *Journal of Finance*, 65, Issue 6, 2171-2212.
- (7) Chiarawongse, A., Kiatsupaibul, S., Tirapat, S., and Van Roy, B., (2012), Portfolio selection with qualitative input, *Journal of Banking and Fiance*, 36, 489-496.
- (8) Duffee, G. R., (2011). Information in (and not in) the Term Structure, *Review of Financial Studies*, 24 (9): 2895-2934.

- (9) Engle, R. F., (2011). Long-Term Skewness and Systemic Risk, *Journal of Financial Econometrics*, Vol. 9, No. 3, 437-468.
- (10) Garlappi, L., Yan, H., (2011). Financial Distress and the Cross-sections of Equity Returns, *Journal of Finance*, 66, Issue 3, 789-822.
- (11) Grenadier, S. R., and Malenko, A., (2011). Real Options Signaling Games with Applications to Corporate Finance, *Review of Financial Studies*, 24 (12): 3993-4036.
- (12) Jääskelä, J., Jennings, D., (2011). Monetary policy and the exchange rate: Evaluation of VAR models, *Journal of International Money and Finance*, 30, 1358-1374.
- (13) Jondeau, E., and Rockinger, M., (2012). On the Importance of Time Variability in Higher Moments for Asset Allocation, *Journal of Financial Econometrics*, Vol. 10, No. 1, 84-123.
- (14) Kapadia, N., (2011). Tracking down distress risk, *Journal of Financial Economics*, 102, 167-182.
- (15) Kristensen, D., and Mele, A., (2011). Adding and subtracting Black-Scholes: A new approach to approximating derivative prices in continuous-time models, *Journal of Financial Economics*, 102, 390-415.
- (16) Lettau, M., and Wachter, J. A., (2011). The term structures of equity and interest rates, *Journal of Financial Economics*, 101, 90-113.
- (17) Lustig, H., Roussanov, N., Verdelhan, A., (2011). Common Risk Factors in Currency Markets, *Review of Financial Studies*, 24(11): 3731-3777.
- (18) Sundaresan, S., Wang, Z., (2011). On the Design of Contingent Capital with Market Trigger, Federal Reserve Bank of New York Staff Report no. 448. Revised November 2011.
- (19) Topaloglou, N., Vladimirov, H., Zenios, S., (2011). Optimizing international portfolios with options and forwards, *Journal of Banking and Finance*, 35, 3188-3201.
- (20) Yallup, P., (2012). Models of the yield curve and the curvature of the implied forward rate function, *Journal of Banking and Finance*, 36, 121-135.

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