INTRODUCTION TO FINANCIAL MATHEMATICS MTH 457-001 SPRING 2010

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Course description: The goal of the course is to introduce the students to the modern mathematical concepts, techniques and methods used in finance. The course is intended for juniors and seniors interested in financial applications of mathematics. Financial mathematics is a practical subject. Therefore the course will concentrate not only on the theory but also on the numerical practice. The course is also one of the recommended course of the Actuarial Science Specialization program of the mathematics department. The course also helps to prepare for the actuarial FM exam (started in May 2007) and for the financial economics segment (FME) of the actuarial exam M.

Outline of the major topics: Possible topics: Preview of financial mathematics, basic and derivative financial instruments, arbitrage, hedging, random walk model of stock prices. Pricing of futures and forward contracts. European and American options, Black-Scholes model, derivation of the Black-Scholes equation, explicit solution. Partial differential equations, diffusion equation, initial and boundary conditions. American options, the free boundary conditions. Numerical methods, the binomial model, finite difference methods. Monte Carlo valuation. Exotic options. Interest rate models. Updates of the syllabus will be posted on my web page.

Prerequisites: Linear algebra MTH 309, ordinary differential equation MTH 235 or MTH340, some familiarity with probability STT 351 or STT 441. I will not assume that the students have prior knowledge of partial differential equations. No background in finance is required. All the necessary concepts, definitions and tools from partial differential equations, probability theory and finance will be explained in the course. Familiarity with the computer softwares Maple, Mathematica or Mathlab and Excel is helpful but not essential.

Class meetings: MWF 12:40AM–13:30PM Room C306, Wells Hall.

Textbook: The required textbook is

[1] Wilmott, Howison, Dewynne: The Mathematics of Financial Derivatives: a Student Introduction, Cambridge University Press, 1995.

The recommended textbook is

[2] R.L. McDonald, Derivatives Markets, Addison Wesley, 2nd edition, 2006.

Other very good books related to the course:

[3] J.C. Hull, Options, Futures and Other Derivatives, Prentice Hall, 7th edition, 2008.

[4] N. Taleb, Dynamic Hedging, Wiley, 1996.

[5] D.J. Higham, An Introduction to financial option valuation, Cambridge Univ. Press, 2004.

Some lectures will be based on materials from the recommended books.

Tentatively, we plan to cover the most important sections of Chapter $1-10$ and Chapter $17-18$ of the textbook and some additional materials.

Format: Lectures with some computer demonstrations.

Office hours: My office is at the Mathematics Department in the Wells Hall, Room D310. I have office hours on Mondays, and Wednesdays from 11:00 AM–12:00 noon, or by appointments.

Exams: There will be two midterm exams and a comprehensive third exam. The tentative dates for the exams are

Exam 1	Monday, February 15;
Exam 2	Monday, March 29;

No make-up exams will be given.

There will be a comprehensive "take home third exam" distributed on Wednesday, April 28. The deadline of the comprehensive third exam will be 4:00PM, Friday, April 30. If you have any concerns about the third exam, you should let me know during the first two weeks of classes. **No make-up final will be scheduled.**

Homework: *Recommended homework problems* will be assigned during the semester mainly from the textbook. These problems will not be collected or graded. However, solving these problems is essential for the course. At each class you are expected to have done the homework problems related to the previous lecture. There will be regular, graded *homework assignments* with deadlines. Some of the homework assignments will be computational, requiring the use of computer softwares. There will be two or three *projects* during the course. The projects are usually broader in scope than a typical homework assignment. You are encouraged to work together on the homework problems, but your homework assignments and projects have to be independent works!

Grading policy: Your final grade for the course will be based upon the homework assignments, projects, and classroom participation (30%), the mid-term exams (20%

each) and the comprehensive third exam (30%). The total worth of the homework assignments, projects, and classroom participation will be 75 points. Each midterm exam will be worth of 50 points. The comprehensive third exam will be worth of 75 points. If the final total of your points is in the range below then you are guaranteed the corresponding grade:

Total Points	*Grade*
$225 - -250$	4.0
$200 - -224$	3.5
$150 - -199$	3.0
$125 - -149$	2.5
$100 - -124$	2.0
$75 - -99$	1.5
$50 - -74$	1.0
$0 - -49$	0.0

The final grades may be higher than the scale above - if the situation warrants a higher grade – but they will not be lower. More details will be provided in class.

Important dates for Spring Semester 2010:
Monday, January 11 - First day of classes.
Friday, January 15 - Online open add period for Spring semester ends at 8pm.
Monday, January 18 - Martin Luther King Day. Classes cancelled.
Monday 1/18/10 to Friday 1/22/10 - Students go to Undergraduate office, A212 Wells Hall for Mathematics enrollment changes. (late adds, drop to lower course, section changes)
Friday, January 22 - Last day to late add a course or change sections within a course. Last day to drop to a lower level course.
Thursday, February 4 - End of Tuition Refund.
Wednesday, March 3 - MIDDLE OF SEMESTER. Last day to drop a course without a grade being reported.
Monday, March 8 – Friday, March 12 - Spring Break.
Friday, April 30 - Last day of classes.