FALL 2013

BEM 105 "OPTIONS"

Instructor: Jakša Cvitanić; 319 Baxter, 395-1784, cvitanic@hss.caltech.edu
Office Hours: T 2:00-2:30, or by appointment

T.A.: TBA

Class meetings: T Th 2:30-4:00PM

Prerequisites: A basic knowledge of calculus based probability/statistics. Some exposure to stochastic processes and partial differential equations is helpful, but not mandatory.

Grading: 50% homeworks, equally weighted, 50% final exam. For those taking the course on Pass/Fail: you must pass the final exam and you must receive 50% of the grade for each homework to pass the course. Penalty for late submission of homework: 10% per day. Penalty for late submission of final: 33% per day. I do not require you attend the class regularly, but some of the problems in the homeworks and the final exam may be easier to solve if you do. Moreover, I may assign extra work for the students not attending classes on a regular basis.

Collaboration Policy: Discussions of class material are allowed; on homeworks fellow students can give hints - but please report them; no collaboration allowed on the final exam. Homeworks and final are open-book, open-notes. You are not allowed to consult others on the final exam.

Course Material:

The required textbook is:

J. Cvitanić and F. Zapatero: Introduction to the Economics and Mathematics of Financial Markets.

There are many good more advanced books on the subject, such as

S. Shreve: Stochastic Calculus for Finance II : Continuous-Time Models

T. Bjork: Arbitrage Theory in Continuous Time

K.Back: A Course in Derivative Securities: Introduction to Theory and Computation

Topics (subject to change):

(Numbers in parentheses refer to chapters/sections in the textbook.)

1. Main ideas: hedging and no-arbitrage; Financial Markets; options (1, 9.2)

2. Interest rates and dividend yields (2)

3. & 4. Model probabilities and state price probabilities (a.k.a. Equivalent Martingale Measure or risk-neutral probabilities): binomial model (3.1, 3.2, 3.6.1, 3.6.2, 3.6.4, 3.6.5, 6.3.1, 6.3.2, 6.3.3, 6.3.4, 6.3.5, 6.4, 7.1.1)

5. Forward and futures contracts (6.2, 6.3.9, 9.1)

6. Bounds on options prices (6.1)

7. & 8. Stochastic Calculus (3.3 except 3.3.6, 3.3.7)

9. The Black-Scholes(-Merton) model (3.3.6, 3.6.6, 7.2, 7.9)

11. More on Black-Scholes model (3.6.3, 3.6.6, 6.3.6, 6.3.7, 6.3.8, 7.1.2, 7.6.1)

12. American options; dividends; exotic options (7.3, 7.4, 7.5)

13. & 14. Stochastic volatility (7.2.4, 7.6.3, 7.6.4, 7.8)

15. Portfolio risk; Hedging (5.2, 9.3, 11.2)

16. Models with jumps/Incomplete markets (7.6.5, 7.7)

17. Interest rate models (3.4.2, 8.2.1, 8.2.2)

18. Forward rate models: Heath-Jarrow-Morton (8.2.3)

19. Risk management with bonds (10)

20. Numerical methods