

SYLLABUS

Pricing options with mathematical models

CaltechX BEM 1105x

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Winter/Spring 2015

About this course. This is an introductory course on options and other financial derivatives, and their applications to risk management. We will start with defining derivatives and options, continue with discrete-time, binomial tree models, and then develop continuous-time, Brownian Motion models. A basic introduction to Stochastic, Ito Calculus will be given. The benchmark model will be the Black-Scholes-Merton pricing model, but we will also discuss more general models, such as stochastic volatility models. We will discuss both the Partial Differential Equations approach, and the probabilistic, martingale approach. We will also cover an introduction to modeling of interest rates and fixed income derivatives.

I teach the same class at Caltech, as an advanced undergraduate class. This means that the class may be challenging, and demand serious effort. On the other hand, successful completion of the class will provide you with a full understanding of the standard option pricing models, and will enable you to study the subject further on your own, or otherwise.

Prerequisites. A basic knowledge of calculus based probability/statistics. Some exposure to stochastic processes and partial differential equations is helpful, but not mandatory. It is strongly recommended you take the prerequisites test, to see if your mathematical background is strong enough for successfully completing the course. If you get less than 70% on the test, it may be more useful to work further on your math skills before taking this course. Or you can just do a part of the course.

Requirements. To complete this course, the students are required to watch all of the video lectures. They are also required to submit all the problem sets and a final exam. The students are also encouraged to work on additional problems, and to be active participants of the discussion boards.

Grading. The final grade for the course: problem sets (40% of the final grade) and the final exam (60%).

The students who complete the requirements above and obtain a final grade of at least 70% will receive a certificate of satisfactory completion. No grade will be stated in the certificate.

Homework and Final problems. Research shows that students learn the most when they try to solve problems repeatedly, until they get them right. Guided by this fact, there is no limit on the number of attempts for a homework problem, before the deadline for submission. There is no penalty for repeated tries. However, once you press the “Show the Answer” button, further attempts will not be recorded towards your grade. The “Show the Answer” button will show up after you enter a correct response, or after the deadline has passed, whatever happens first.

For multiple choice problems in the final exam, you are allowed to try the final problems two times before the deadline for submission. Thus, if you get it wrong the first time, you have another chance to correct your answer. For numerical problems in the final exam, you are allowed to try three times.

To minimize the temptation of cheating in the final, no solutions will be provided.

Students must complete the final exam completely on their own. In particular, it is not allowed to discuss the final exam on the discussion board, or otherwise..

Deadlines and extensions. Deadlines are strict: there are no extensions. To accommodate the unavoidable and unforeseeable problems, we are providing long deadlines: you will have two weeks to complete the problems sets and the final exam.

Collaboration policy. Students are welcome to work on the problem sets with others. However, students are not allowed to obtain the answers of the problems from other students, either verbally or by looking at others’ solutions.

Students must complete the final exam on their own.

Contact policy for non-Caltech students. Due to the large enrollment in these classes, the only form of contact with non-Caltech students will be through the Discussion Board. In particular, we will not be able to respond to direct e-mails, texts, letters, or phone calls.

Discussion board policy. Discussion Board is an invaluable part of the course, and can be used creatively by students to advance their learning. The course staff will certainly be a participant in the board.

To insure the quality of the Board, we ask the students to follow the following policies:

1. Do not post, or give away, the solutions for the problem sets.
2. Do not discuss the final exam on the board.
3. Be polite and civil at all times, especially with other students.
4. Provide feedback on the course, so we can correct mistakes and improve its content. But please

use rule 3.

5. The Board can only be used to matters related to the course.

6. Above all, please use your common sense.