

MATH 514 , Financial Mathematics I, Fall 2018

Meeting Information:

- Classroom Location: Gambrell 205
- Days and Times: TTH 2:50pm-4:05pm

Instructor Information

Dr. Xiaofeng Yang

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Office Location: LC 423

Office Hours: TTH 1:00PM–2:30PM or by appointment

Textbook:

Sheldon M. Ross, An Elementary Introduction to Mathematical Finance, Third Edition, Cambridge University Press.

Prerequisites

MATH 241 or consent of the instructor. The most important calculus requirements are basic differentiation and integration techniques (MATH 141), the exponential and logarithmic functions (MATH 141), and partial derivatives including the chain rule (MATH 241). No prior knowledge of probability or finance will be assumed. A calculator, preferably the TI83, is required.

Syllabus

Probability: Probability spaces. Outcomes and Events. Conditional probability. Random variables. Bernoulli and binomial random variables. Expected value. Variance and standard deviation.

Continuous Random Variables: Probability density functions. Cumulative distribution functions. The normal distribution. Sums of independent normal random variables. Discussion of the Central Limit Theorem. Normal approximation to the binomial distribution. The lognormal distribution.

Geometric Brownian Motion: The drift and volatility parameters. The standard model of stock price dynamics.

Present Value Analysis: Interest Rates. Present value of an income stream. Abel summation and its application to present value analysis. Coupon and zero-coupon bonds. Yield to maturity and duration. Continuously varying interest rates and the yield curve.

Arbitrage: The No Arbitrage Principle. The Law of One Price. Pricing via arbitrage arguments. Forward contracts. Futures contracts. Options. Simple bounds for options prices. Payoff diagrams. The Put-Call Option Parity Formula.

Options Pricing Theory: Generalized options. The single period model. Risk-neutral valuation. The multiperiod binomial model. Self-financing trading strategies. The Black-Scholes Formula. Partial derivatives.

Homework and Quizzes

Homework will be assigned for each chapter and will be collected by chapter. The instructor will pick 2-3 problems to grade. Students are encouraged to work independent on the homework sets, but are allowed to discuss with group members (Study Groups will be formed and each group will include around 2-3 students). No quizzes.

Exams

There will be **two** midterm exams and a comprehensive final exam. The exams are “closed book” with no books, no notes, no graphing calculators, no labtop comptuer or equivalent technology, etc. You may use the scientific calculator. Picture I.D. is required and must be presented upon request. There are no early exams. A late exam is only possible for a written legitimate documented reason. Note that student athletes, participating in a USC athletic event and with appropriate documentation, are exempt from this rule. You must take your exams with the lecture for which you are registered.

Grades

Exam 1 (25%)

Exam 2 (25%)

Final (40%)

Homework (10%)

For Graduate students outside mathematics department taking this course, some extra projects will be assigned for them.

$$\geq 90\% = A; \geq 80\% = B; \geq 70\% = C; \geq 60\% = D$$

Learning Outcome

The primary goal of this course is to know the mathematical techniques and apply them to the fundamental concepts of financial mathematics. The main contents include: Introduction to probability theory, random variable, probability density, mean, and variance of a random variable. The applications include interest rate, coupon bonds, arbitrage, geometric Brownian motion about mathematical model on stock price, etc.

Attendance and Academic Honesty

Attendance at every class meeting is important and expected. By statistics, students may miss up to 10% of the class meetings (around 4 times) can have their grades lowered. Anyone caught cheating or turning in work that is not their own will be dealt with according to University policies. **Bonus points policy: If your attendance is more than 80%, you will get 3 bonus points for final grade; 60% – 80%, 2 bonus points; 30% – 60%, 0 bonus points; less than 30%, -2 bonus points.**