MAT 308 Financial Calculus

Summer 2024

Course Credits: 4
Contact Hours: 56 hours
Instructor: TBA
Email:TBA

COURSE OBJECTIVES

This course introduces students to the fundamental mathematical concepts and techniques underlying financial modeling and analysis. The course emphasizes the application of calculus, probability theory, and stochastic processes in understanding and predicting financial markets' behavior. Topics covered include risk-neutral valuation, Discrete parameter martingales, continuous-time finance, stochastic calculus, Black–Scholes model, and basic option pricing models.

Upon Completion of this Course, students will be able to:

1. Develop a solid understanding of the mathematical principles underlying financial markets.
2. Understand how mathematical models are used in investment strategies and risk management.
3. Apply stochastic calculus techniques to model financial processes and derive pricing formulas for derivative securities.
4. Develop strong quantitative skills necessary for analyzing financial data, assessing risk, and making informed investment decisions.

PREREQUISITES

FIN 293 Financial Derivatives

GRADING

Grades will be determined by accumulating points, with 100 points being the maximum, as follows:

ITEM	POINTS
4 Quizzes	40 Points
2 Research Papers	20 Points
Midterm	20 Points
Final Exam	20 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F$.

We reserve the right to make adjustments to the overall grading policy.

COURSE MATERIALS

Required Texts:

A Course in Financial Calculus, Etheridge A., CUP, Year: 2002.

Recommended (Optional) Texts or Other Materials:

Options, Futures, and Other Derivatives, Global Edition, John C. Hull, 2017.

COURSE TOPICS

MODULE	TASKS
Module 1	**Topics:** Topic 1: Single period models: some definitions from finance Topic 2: The one-step binary model Topic 3: A ternary model Topic 4: 5 A characterisation of no arbitrage Topic 5: The risk-neutral probability measure **Assessments:** Quiz 1
Module 2	**Topics:** Topic 6: Binomial trees and discrete parameter martingales: the multiperiod binary model Topic 7: Discrete parameter martingales and Markov processes Topic 8: Some important martingale theorems Topic 9: The Binomial Representation Theorem

	Topic 10: Overture to continuous models **Assessments:** Quiz 2
Module 3	**Topics:** Topic 11: Brownian motion: definition of the process Topic 12: Levy's construction of Brownian motion Topic 13: The reflection principle and scaling Topic 14: Martingales in continuous time **Assessments:** Research Paper 1 Midterm
Module 4	**Topics:** Topic 15: Stochastic calculus: stock prices are not differentiable Topic 16: Stochastic integration Topic 17: The Girsanov Theorem Topic 18: The Brownian Martingale Representation Theorem Topic 19: 8 The Feynman–Kac representation **Assessments:** Quiz 3
Module 5	**Topics:** Topic 20: The Black–Scholes model Topic 21: Black–Scholes price and hedge for European options Topic 22: Foreign exchange Topic 23: Dividends and bonds Topic 24: Market price of risk **Assessments:** Quiz 4
Module 6	**Topics:** Topic 25: Different payoffs Topic 26: Multistage options Topic 27: Bigger models: general stock model Topic 28: Multiple stock models Topic 29: Model error **Assessments:** Research Paper 2 Final Exam

STUDY HOURS OF LEARNING ACTIVITIES

ACTIVITY FORM	ACTIVITY HOURS
Lectures	40

Tutorials	16
Assignments and Tests	26
Self-Study	48
Total	130

ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow University Academic Administration Office, the student might get a written warning and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

LEARNING REQUIREMENTS

1) Late assignments are not acceptable and are subjected to grade deductions.

2) Assignments submitted in the wrong format will be counted as not submitted.

3) Failure to submit or fulfill any required course component results in failure of the class.

4) Make-up for midterm and final exams only with valid excuses, as defined by the University.

5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

TECHNOLOGY POLICY

The use of electronic devices in class is distracting, both for the user and for the rest

of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (eg., note taking, reading course documents).

ACEDEMIC INTEGRITY POLICY

Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed. The record might be shown on the official university transcript.

DISABILITY ACCOMMODATION

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.