课程大纲
COURSE SYLLABUS

1.	**课程代码/名称** **Course Code/Title**	MAT7094 随机分析及其在金融中的应用 MAT7094 Stochastic calculus and their applications in finance
2.	**课程性质** **Compulsory/Elective**	专业选修课 Elective Courses
3.	**课程学分/学时** **Course Credit/Hours**	3/48
4.	**授课语言** **Teaching Language**	英文 English
5.	**授课教师** **Instructor(s)**	刘智慧，助理教授，数学系 慧园 3 栋 406 室(答疑时间：周一下午 2-5 点) Liuzh3@sustech.edu.cn LIU Zhihui, Assistant Professor, Department of Mathematics Rm. 406, Huiyuan 3 Bldg. (Office hours: Monday 2-5 pm) Liuzh3@sustech.edu.cn
6.	**是否面向本科生开放** **Open to undergraduates or not**	Yes 是
7.	**先修要求** **Pre-requisites**	（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.） MA301 实变函数, MA215 概率论 MA301 Theory of functions of a real variable, MA215 Probability Theory
8.	**教学目标** **Course Objectives**	
	（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.） With the fast development of mathematical finance in recent years, stochastic calculus has been widely used in finance. This course is designed as the first courses in financial calculus for students having a good background in mathematics. After learning this course, students should understand the key concepts in stochastic analysis such as martingales and change of measure and some deep properties of Brownian motion process. The students should also be able to apply the basic methods and tools learning from this course such as the Ito's formula and the Black-Scholes pricing formula in practical problems in finance. 随着金融数学的迅速发展，随机分析在金融中有了越来越多的应用。本课程是针对具有良好数学背景的学生设计的金融数学里面的第一门课程。通过本课程的学习，学生应该了解在随机分析中的一些关键概念，例如鞅和测度变换和布朗运动过程中的一些深层次的性质。学生还应能运用本课程学习中的基本方法和工具，如伊藤公式和布莱克-斯科尔斯定价公式，来解决金融实际问题。	
9.	**教学方法** **Teaching Methods**	
	（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）	

理论课程，课堂讲授为主。

10. 教学内容
Course Contents
（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

Section 1	Conditional Expectations and Discrete Martingales (6 hours) Existence, uniqueness, and basic properties of conditional expectations; Definition, properties, and convergence theorems of discrete martingales.
Section 2	Brownian Motion (10 hours) Definition of Brownian motion; Levy construction of Brownian motion; Holder Continuity of Brownian Motion; Reflection principle and scaling;
Section 3	Stochastic Calculus (16 hours) Stock prices are not differentiable; Stochastic integration; Ito formula; Integration by parts; Stochastic Fubini theorem; Girsanov theorem; Brownian Martingale representation theorem; Feynman--Kac representation.
Section 4	Black--Scholes Model (16 hours) Basic Black--Scholes model; Black--Scholes price and hedge for European options; Foreign exchange; Dividends; Bonds; Market price of risk; Uniqueness of Risk-Neutral measure.

11. 课程考核
Course Assessment

（①考核形式 Form of examination；②.分数构成 grading policy；③如面向本科生开放，请注明区分内容。If the course is open to undergraduates, please indicate the difference.）

平时作业 Assignments 25% 期中考试 Mid-Term Test 25% 期末考试 Final Exam 50%

12. 教材及其它参考资料
Textbook and Supplementary Readings

Textbook (Main materials: Chapters 3-5):

Alison Etheridge, A course in financial calculus. Cambridge University Press, 2002.

Supplementary Readings:

1. Steven E. Shreve, Stochastic calculus for finance II, 2004.

2. Ioannis Karatzas and Steven Shreve, Brownian Motion and Stochastic Calculus, 1988.

3. Jean Jacod and Philip Protter, Probability Essentials, 2004.

4. Bernt Øksendal, Stochastic Differential Equations: An Introduction with Applications, 2013.