

STAT 516

Stochastic processes in Finance

Instructor: Dr. Boubaker Smii

TEXTBOOK:

T. Mikosch. Elementary Stochastic Calculus with Finance in View. World Scientific Publishing Co. Pte. Ltd. 1998.

Additional references:

- 1- S.M. Ross. Introduction to Probability Models, 11th Edition. Academic Press, 2010.
- 2- Douglas. M and George. R, Applied Statistics and Probability for Engineers, 5th Edition, John Wiley & Sons, 2011

Course Description:

Axioms of Probability, Random variables, Stochastic processes, Brownian motion, Stochastic integral, A simple version of the Itô lemma. Introduction of Stochastic differential equations (SDEs). Applications of Stochastic calculus in Finance: Black-Scholes equation and Black-Scholes Option Pricing formula.

Pre-requisite: Graduate Standing

Objectives

Stochastic processes and stochastic differential equations play a basic and steadily growing role in the description of phenomena occurring in the natural, technical and economical world.

The main objectives of the current course are:

- * Provide the students with the basic mathematical instruments for the understanding of this important area of mathematics
- * Enable students to access a very active area of contemporary mathematical research
- * Enable students to use Stochastic process models to real applications and mainly quantitative Finance.

Learning Outcomes

- * Describe the properties of discrete and continuous stochastic processes
- *Discuss the Ito formula
- *Describe the general techniques for solving linear stochastic differential equations
- *Use Geometric Brownian motion and Black scholes models to real applications, mainly in Finance

Syllabus:

Week	Date	
1	Aug.19-Aug.27	Intro: Course content, Grading policy, Syllabus Overview,... Calculus Review Axioms of Probability
2	Aug.30-Sep.3	Conditional Probabilities Independent events
3	Sep.6-Sep.10	Random variables Discrete random variables Examples of discrete random variables Applications in Finance
4	Sep.13-17	Continuous random variables Expectation and variance of random variables Applications in Finance
5	Sep. 20- 22	Probability density function of a random variable
	National Day Holiday: September 23rd -24th	
6	Sep. 27-Oct.1	Gaussian distribution Lognormal distribution Applications in Finance
7	Oct. 4-8	Stochastic processes Examples of stochastic processes
8	Oct.11-15	Brownian Motion Applications in Finance
9	Oct.18-19	Itô stochastic integral
	Midterm Break: October 20-22	

10	Oct.25- 29	Simple version of Itô formula
Midterm Exam: TBA		
11	Nov.1-5	Introduction to Stochastic differential equations
12	Nov.8-12	Geometric Brownian motion Applications in Finance
13	Nov. 15-19	Linear Stochastic Differential equations Binomial Model
Autumn Braek: November 22-33		
14	Nov. 24- 26	The Option Pricing Problem.
15	Nov. 29- Dec.3	The Black-Scholes equation
16	Dec. 6-10	Catch-Up and Review

Grading policy:

Midterm Exam : 25% **Quizzes(10%)& HWs(10%):** 20% **Projects:** 20%

Final Exam: 35%

Regulation and academic integrity:

Attendance: Students are expected to attend all lecture classes.

- If a student misses a class, he/she is responsible for any announcement made in that class.
- A **DN** grade will be awarded to any student who accumulates more than 20% (**06**) unexcused absences or 33% (**10**) excused and unexcused absences.

Note: The student will be warned **twice** before he/she is assigned a **DN** grade.

The Usage of Mobiles in Class: Students are not allowed to use mobiles for any purpose during class time. Students who want to use electronic devices to take notes must take permission from their instructor.

Violations of these rules will result in a penalty decided by the instructor.

- Attendance on time is very important. Mostly, attendance will be checked within the **first ten minutes** of the class. Entering the class after that is considered an **absence**. The student has to be available until the end of the class; otherwise, he/she will be marked as absent.

Academic Integrity: All KFUPM policies regarding ethics apply to this course. See the Undergraduate Bulletin.

Cheating in Exams: Cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will be reported to the higher university administration.

Cheating in exams includes (but is not limited to):

- looking at the papers of other students
- talking to other students
- using mobiles or any other electronic devices.

No student will be allowed to take the exam if not having his/her KFUPM ID or National/Iqama ID.

DO NOT BRING YOUR MOBILE, SMART WATCH OR ANY ELECTRONIC DEVICE IN THE EXAM HALL.

Missing an Exam:

In case a student misses a Quiz, the midterm Exam, or Final Exam for a legitimate reason (such as medical emergencies), he/she should submit an **official excuse** (from Student Affairs) within **seven calendar days** of the missed Quiz/Exam date, and he/she will be given a make-up Quiz/ exam.