KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
DEPARTMENT OF MATHEMATICS
SEMESTER 251/ 2025

STAT 516

Stochastic processes in Finance

Instructor:Dr. Boubaker Smii

BOOK:

S.M. Ross*. Introduction to Probability Models, 10th Edition. Academic Press, 2010.

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

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

COURSE 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.

* Give them access to a very active area of contemporary mathematical research.

* Put them in a position to actively handle problems arising from real world applications.

COURSE OUTCOMES

*Students will be able to analyse and solve some stochastic differential equations.

*They will have the basis of fundamental tools in stochastic analysis such as Itô's formula, and using them to solve Linear stochastic differential equations.

* They will be at ease in handling problems of stochastic analysis for modeling in different applications areas such as financial mathematics.

Syllabus:

Week	Date		
1	Aug.24-Aug.28		Axioms of Probability
2	Aug.31-Sep.4		Conditional Probabilities Independent events
3	Sep.7-Sep.11		Random variables Discrete random variables Examples of discrete random variables
4	Sep.14-18		Continuous random variables Density, Expectation and variance of random variables
5	Sep. 21- 25		Probability density function of a random variable Conditional Expectation
	National Holiday: September 23rd		
6	Sep. 28-30		Limit Theorems Gaussian and Lognormal distribution
7	Oct. 5-9		Stochastic processes
8	Oct.12-16		Brownian Motion Processes Derived from Brownian motion
9	Oct.19-23		Itô stochastic integral
	Midterm Break: October **26-30**		
10	Nov.2- 6		Simple version of Itô formula
	Midterm Exam: TBA		
11	Nov.9-13		Introduction to Stochastic differential equations
12	Nov.16-20		Geometric Brownian motion
13	Nov.23-27		Linear Stochastic Differential equations Binomial Model
14	Nov. 30- Dec.4		The Option Pricing Problem.
15	Dec. 7- Dec.11		The Black-Scholes equation
	Dec. 14		**Catch-Up and Review**

Grading policy:

Midterm Exam : 30% **Quizzes(10)& HWs(5): 15%** **Projects: 15%**

Final Exam: 40%

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** by his instructor 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 five minutes of the class. Entering the class after that, is considered as one late, and every two times late equals to one absence. The student has to be available until the end of the class.

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 the midterm Exam or Final Exam for a legitimate reason (such as medical emergencies), he/she will be given a make-up final exam.