KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
DEPARTMENT OF MATHEMATICAL SCIENCES
SEMESTER 222/ 2023

AS 491

Special Topics in Mathematical 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, Limit theorems, Markov Chains, Stochastic processes, Brownian motion, Stochastic integral, A simple version of the Itô lemma. Stochastic differential equations (SDEs). Applications of Stochastic calculus in Finance, Black-Scholes equation and Black-Scholes Option Pricing formula.

Pre-requisite: Junior 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 for profitably attending future lectures related to more advanced topics and use SDE's in research, both at universities and industrial institutions.

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

Syllabus:

Week	Date	Sections	
1	Jan.15-Jan.19	1	Axioms of Probability
2	Jan.22-26	2	Conditional Probabilities Independent events
3	Jan.29-Feb.2	3.1	Random variables Discrete random variables Examples of discrete random variables
4	Feb.5-9	3.2	Continuous random variables Expectation and variance of random variables Expectation of a function of a Random variable
5	Feb. 12- Feb. 16	4.1	Probability density function of a random variable Conditional Expectation
6	Feb. 19-23	4.2	Limit Theorems Guassian and Lognormal distribution
7	Feb. 26-Mar.2	5.1 5.2	Stochastic processes Markov chains Application of Markov chains to Finance
Sunday March 5th , 2023: First Exam [Sections: 1—5.2]			
8	Mar.5-9	5.3 5.4	Brownian Motion Processes Derived from Brownian motion
9	Mar.12-16	6.1	Itô stochastic integral
10	Mar.19-Mar.23	6.2 6.3	Itô formula Stochastic differential equations Solving SDEs
11	Mar.26-30	7.1	Geometric Brownian motion Linear Stochastic Differential equations
Sunday April 2nd, 2023: Second Exam [Sections: 5.3—7.1]			
12	Apr.2-Apr. 6	7.2	Introduction to Finance
13	Apr. 9-13	7.3	What is an option ? Binomial Model
****	Apr.14-Apr.27	*****	Eid Al-Fitr Holidays

14	Apr. 30- May.4	8.1	A Mathematical Formulation of the Option Pricing Problem.
15	May. 7- 11	8.2	The Black-Scholes equation and Black-Scholes Formula
	May. 15	-----	**Catch-Up and Review**

Grading policy:

Exam I: 20% **Exam II: 20%** **Quizzes(10)& HWs(3): 13%** **Projects: 10%**

Attendance: 2% **Final Exam: 35%**

Attendance: Students are expected to attend all lecture classes.

* 2% will be deducted in case of **4 absences** or more.

➢ 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% (**09**) unexcused absences or 33% (15) 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.

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