KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
DEPARTMENT OF MATHEMATICAL SCIENCES
SEMESTER 211/ 2021

MATH 564

Stochastic Analysis in Finance

Instructor: Dr. Boubaker Smii

BOOK:

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

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

Course Description: Stochastic processes, Gaussian processes, Brownian motion, Itô stochastic integral, the Itô lemma. Introduction to stochastic differential equations, Geometric Brownian motion, financial examples. Feynman-Kac formula, Girsanov Formula and application to Black Scholes PDE and 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 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	Section	
1	Aug.29-Sep.2	1	1.1 Sample Spaces and Events, Probabilities defined on Events. 1.2 Conditional Probabilities, Independent events, Bayes's Formula.
2	Sep.5-9	2	2. Random variables: 2.1. Discrete random variables. 2.2. Continuous random variables
3	Sep.12-16	3	3.1. Independence and Dependence of random variables. 3.2. Expectation of random variables and probability distributions
4	Sep.19-**23***	3	3.2.1. Probability distribution of continuous random variables.
	September 23		**National day**
5	Sep. 26- 30	4	4. Stochastic processes.
6	Oct. 3-7	4	4.1. Examples of stochastic processes.
7	Oct. 10-14	4	4.1.1. Markov chains
8	Oct.17-21	4	4.2. Brownian motion: Defining properties 4.3. Processes derived from Brownian motion
9	Oct.24-28	4	4.4. Geometric Brownian motion. 4.4. Applications of Geometric Brownian motion
10	Oct.31-Nov.4	5	5.1. The Riemann-Steiltjes integral 5.2. Itô stochastic integral: A motivating example
11	Nov.7-11	5	5.3. Itô stochastic integral for simple processes
12	Nov. 14- 18	6	6.1. Itô formula: A simple version of the Itô lemma
13	Nov. 21-25	6	6.2. Itô lemma and applications
	Nov. 28-Dec.2	----	Midterm Break: Nov. 28- Dec.2
14	Dec. 5-9	7	7.1. Stochastic Differential equations (SDEs) 7.2. Solving SDEs.
15	Dec. 12- 16	7-8	7.3. Linear stochastic differential equations 8.1. Applications of Stochastic Calculus in Finance
	Dec. 19-20	8	8.2. The Black-Scholes Option Pricing Formula 8.3. A Mathematical Formulation of the Option Pricing Problem.

Grading policy:

Midterm Exam: 30% **Quizzes(10) &Projects(20): 30%**

Final Exam: 40%

Midterm Exam: November 2nd , 2021. Materials: 1.1-----4.4