KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
DEPARTMENT OF MATHEMATICAL SCIENCES
YEAR 2013-14, 1ST TERM

MATH 590
Introduction to stochastic differential equations and applications to Mathematical Finance

Instructors: Boubaker Smii & Sergio Albeverio

BOOKS:

[1] B. Øksendal, Stochastic Differential Equations: An Introduction with Applications. Springer 2010.

[2] Thomas Mikosch, Elementary stochastic Calculus with Finance in View, World Scientific 2008.

Course Description: Probability spaces, random variables, probability distributions, Characteristic functions, stochastic processes, Brownian motion, Itô integral, Itô formula, SDEs, Applications of stochastic Calculus in Finance, The Black-Scholes Option Pricing Formula.

Prerequisite: Graduate standing

2. Syllabus

Week	Section	
1	1	1.2. σ-algebra, probability measure, probability spaces 1.2 Continuous probability spaces
2	2	2.1 Real and vector valued random variables 2.2 Standard results of measure and integration theory
3	3	3.1 Probability distributions 3.2 Density of probability measures
4	3	3.3 Characteristic functions 3.4 Properties of characteristic functions
5	4	4.1 Stochastic processes
6	4	4.2 Brownian motion: Defining properties 4.3 Processes derived from Brownian motion
7	5	5.1 The Riemann-Steiltjes integral 5.2 Itô stochastic integral: A motivating example
8	5	5.3 Itô stochastic integral for simple processes
9	6	6.1 Itô formula: A simple version of the Itô lemma
10	6	6.2 Extended version of Itô lemma
11	7	7.1 Stochastic Differential equations (SDEs) 7.2 Solving SDEs
12	7	7.3 Linear stochastic differential equations
13	8	8.1 A Mathematical Formulation of the Option Pricing Problem
14	8	8.2 Applications of stochastic Calculus in Finance 8.3 The Black-Scholes Option Pricing Formula
15	8	8.4 An interpretation of the Black-Scholes Formula by Change of measure.

Grading policy:

Exam I: 35% **HW&Projects: 25%**

Final Exam: 40%