KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS
DEPARTMENT OF MATHEMATICAL SCIENCES
SEMESTER 141 - 2014/2015

MATH 690
Stochastic Differential Equations and Applications

Instructor: Dr. Boubaker Smii

BOOK:

[1] B. Øksendal, Stochastic Differential Equations: An Introduction with Applications. 6th Edition. Springer 2010.

Course Description: Probability spaces, characteristic functions, stochastic processes, martingales, Markov Chains, Brownian motion, Itô calculus, Itô formula, stochastic differential equations, applications of stochastic differential equations.

Pre-requisite: Math 531 or Instructor's Consent

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 in various areas of science, engineering and technology.

Syllabus:

Week	Section	
1	1	1.1 σ-algebra, probability measure, 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 Characteristic functions 3.2 Properties of characteristic functions
4	4	4.1 Stochastic processes
5	4	4.2 Martingales and Markov Chains
6	4	4.3 Brownian motion: Defining properties 4.4 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)
12	7	7.2 Solving SDEs
13	8	7.3 Linear stochastic differential equations
14	8	8.2 Applications of SDEs
15	8	8.2 (cont.) Applications of SDEs