King Fahd University of Petroleum and Minerals
Department of Mathematics
MATH-562: Fundamentals of Option Pricing
Term 212

Instructor: Dr. Brahim Mezerdi   **Office:** 5 - 330
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Office Hours: 2:00 pm – 3:00 pm UT   **Class**: 5:20 pm – 6:35 pm U.T
                                           Location: Blg # 59 - 1009

Course Objectives:
Introduce discrete and continuous time finance and the theory and practice of derivative pricing and hedging. Provide students with the mathematical skills needed for the valuation of derivatives. Focus will be on the application of results rather than their mathematical derivation. Be able to apply of stochastic methods to analyse and solve the famous Black-Scholes formula, to price options.

Course Description:

MATH562: Fundamentals of Option Pricing   **(3-0-3)**
Basic principles of option pricing, binomial model, the Black-Scholes model, arbitrage, complete and incomplete markets, trading strategies, European options, American options. Topics include Risk-neutral Valuation, options on stock Indices, currencies, futures, the Greek letters, Interest Rate Derivatives, Black-Scholes PDE and formula.

Pre-requisite: MATH 564

Textbook: Hugo D. Junghenn, An Introduction to Financial Mathematics, Option Valuation. Chapman and Hall/CRC, Second Edition 2019.

Reference: **Robert L. McDonald** (2009), Derivative Markets. Pearson, Third Edition, **2013**.

Assessment*

Activity	Weight
Class Evaluation (quizzes)	10%
Homework	20%
Midterm Exam	30%
Final Exam (Comprehensive)	40%

Grade Assignment
Relative Grading based on overall performance of the students registered in this course.

Academic Integrity
All KFUPM policies regarding **ethics** and **academic honesty** apply to this course.

General Notes
Students are encouraged to regularly check the blackboard announcements.

Syllabus (Tentative)

Week	Sections	Topics
1	1.1 – 1.5	**Basic finance** • Interest rate, Inflation, Annuities • Bonds , Internal rate of return
2	2.1 - 2.2	**Probability Spaces** • Sample spaces and events • Discrete probability spaces
3	2.4 - 2.5	**Probability Spaces** • Conditional probability • independence
4	3.3 – 3.4	**Random Variables** • Discrete random variables • Continuous random variables
5	3.6- 3.8	**Random Variables** • Independent random variables • Identically random variables • Sums independent random variables
6	4.1 – 4.3	**Options and arbitrage** • The price of an asset • Arbitrage • Classification of derivatives
7	4.4 – 4.9	**Options and arbitrage** • Forwards and currency forwards • Futurs • Call and Put Options • Properties of options
8	5.1 – 5.2	**Discrete time portfolio processes** • Discrete time stochastic processes • Portfolios processes and the value process
9	5.3 – 5.5	**Discrete time portfolio processes** • Self financing trading strategies • Equivalent characterizations of self financing • Option valuation by portfolios
10	6.6 - 6.7	**Expectation and variance** • The strong law of large numbers • The central limit theorem
11	7.1 – 7.2	**The Binomial Model** • Construction of the binomial model • Completeness and arbitrage in the binomial model
12	11.1 – 11.2	**Stochastic calculus** • Continuous time stochastic processes • Brownian motion and geometric Brownain motion
13	11.3 – 11.5	**Stochastic calculus** • Stochastic integrals • Ito formula • Stochastic differential equations
14	12.1 – 12.3	**Black Scholes Merton Model** • The stock price SDE • Continuous time portfolios • The Black Scholes formula

Eid Al-Fitr Holidays April 24-May 7

Week	Sections	Topics
15	12.4	**Black Scholes Merton Model** • Properties of the Black Scholes call function
16		**Review and catch up**