INSTITUTO DE FÍSICA
FACULTAD DE FÍSICA

COURSE	:	**QUANTITATIVE FINANCE FOR PHYSICISTS**
TRANSLATION	:	FINANZAS CUANTITATIVAS PARA FÍSICOS
NUMBER	:	FIM4141
CREDITS	:	15 UC / 9 SCT
MODULES	:	2
REQUISITES	:	MAT1620, MAT1640
CONECTOR	:	AND
RESTRICTIONS	:	030401, 030501, 020601, 020701
CHARACTER	:	OPTATIVE
FORMAT	:	THEORETICAL LECTURES
QUALIFICATION	:	STANDARD
FORMATIVE LEVEL	:	DOCTORATE
DISCIPLINE	:	QUANTITATIVE FINANCE

I.COURSE DESCRIPTION

This course is an introduction to the analysis of problems inherent to financial markets, from a quantitative point of view. Various relevant mathematical concepts are introduced for this type of problem. In particular, the tools necessary to understand derivatives valuation and financial risk management are taught. Throughout the course, both tools used in practice in the financial sector and models considered by academics and researchers are exposed.

II.LEARNING OUTCOMES

1. Identify and understand the basic elements and concepts of financial markets and instruments.
2. Know and apply statistical tools to the analysis of financial data.
3. Analyze financial problems from a quantitative point of view using mathematical methods such as probabilities and stochastic calculus.

III.CONTENT

1. Introduction
    i. Financial markets and products
    ii. Forwards and futures
    iii. Choices

2. Odds:
    i. Probability distributions
    ii. Moments and characteristic function
    iii. Random path
    iv. Normal and Binomial Distributions

3. Valorization of options I: Binomial model

4. The random behavior of prices and stochastic calculation
    i. Central Limit Theorem
    ii. Wiener process
    iii. Itô's lemma

5. Valuation of options II: Black-Scholes equation
    i. Derivation of E. from B-S
    ii. The "Greek letters"
    iii. Solving the E. of B-S
    iv. Implied volatility
    v. Finite difference methods

6. Estimating volatility
    i. Implied volatility
    ii. Maximum likelihood estimator
    iii. Estimating price volatility
    iv. Maximum likelihood method

7. Fixed income instruments
    i. Bonds
    ii. Price performance ratio
    iii. Duration and convexity
    iv. Time-dependent interest rate and "forward" rates
    v. Swaps saw. Relationship between swaps and bonds

8. Statistical modeling of the interest rate

9. Portfolio management
    i. Risk and diversification
    ii. Optimal portfolio (Markowitz)
    iii. Models with indices and Capital Asset Pricing Model
    iv. Value at risk (VaR or "Value at Risk")

10. Credit risk
    i. Merton model
    ii. Statistical modeling of default risk
    iii. Credit rating

IV.METHODOLOGICAL STRATEGIES

- Theoretical classes
- Homework
- Final project and presentation

V.EVALUATIVE STRATEGIES

- Homework 70%
- Final project 30%

VI.BIBLIOGRAPHY

REQUIRED

"Investments", Zvi Bodie, Alex Kane, Alan J. Marcus, McGraw-Hill Education (2014).

"Paul Wilmott Introduces Quantitative Finance", Paul Wilmott, John Wiley & Sons (2007).

"Options, Futures and Other Derivatives" 9th edition, John C. Hull, Prentice Hall (2014).

OPTIONAL

"Theory of Financial Risk and Derivative Pricing: From Statistical Physics to Risk Management", Jean-Philippe Bouchaud and Marc Potters, Cambridge University Press (2003).

"Quantitative Finance for Physicists: An Introduction", Anatoly B. Schmidt, Elsevier Academic Press (2005).