UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	
ACADEMIC YEAR	
ANNO ACCADEMICO EROGAZIONE	
SUBJECT	
CODE	
SCIENTIFIC SECTOR(S)	
HEAD PROFESSOR(S)	GIANSANTE SIMONE Ricercatore a tempo determinato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	
TERM (SEMESTER)	
ATTENDANCE	
EVALUATION	
TEACHER OFFICE HOURS	**GIANSANTE SIMONE** Tuesday 10:00 12:00 dSEAS, primo piano, stanza 105

DOCENTE: Prof. SIMONE GIANSANTE

PREREQUISITES	Introductory statistics. Students are expected to be familiar with mean, variance, marginal and joint probability; density and cumulative probability distribution function; matrix algebra.
LEARNING OUTCOMES	1) Knowledge and understanding. Students will familiarize with quantitative methods aiming at assessing market completeness, portfolio replication and derivative pricing. Moreover, students will familiarize with numerical techniques to forecast asset prices. 2) Applying knowledge and understanding. At the end of the module, students will be able to employ quantitative methods to price and evaluate risk associated with financial derivatives. The students will then obtain the basic skills necessary to provide consultancy regarding quantitative-financial issues. 3) Making judgements. Students will be able to fully understand and critically evaluate financial markets and their structure. The will be able select the appropriate mathematical model to analyse financial instruments. 4. Communication skills. At the end of the module, students will get the necessary skills to write reports analysing the performance and limitation of several pricing techniques. 5. Learning skills. Student will be able to conduct research and analysis in the field of economics and finance using mathematical models.
ASSESSMENT METHODS	100% written test. The written test aims at detecting the knowledge and skills possessed by the student. The test, with a maximum total duration of 2 hours, involves questions of a practical and / or theoretical nature. The text of each question is well-defined and solely interpretable, allowing the student to formulate the answer autonomously and is structured to allow comparison with that provided by other students. The oral exam aims to deepen the written work and to better evaluate the student's learning through an additional question. The sufficiency threshold (equal to a score of 18 on a scale of 18-30) is, overall, obtained on the basis of a weighted average of the written and oral tests (with the weights indicated above). This threshold is reached if the student shows an adequate use of the terms relating to the basic concepts of the course.
EDUCATIONAL OBJECTIVES	At the end of the course the student will be able: 1) To evaluate the completeness of a market 2) To exploit arbitrage opportunities 3) To price complex derivative products and implement numerical techniques to evaluate derivative products 4) To distinguish between continuous and discrete pricing
TEACHING METHODS	lectures and seminars
SUGGESTED BIBLIOGRAPHY	1. Cerný, A. (2009), Mathematical Techniques in Finance: Tools for Incomplete Markets, 2nd ed., Princeton University Press [Chapters 1,2,5,6] 2. Paolo Brandimarte: Numerical Methods in Finance and Economics, 2nd ed., Wiley 2006 3. Jim Gatheral: The Volatility Surface, Wiley 2006 [Chapters 7,8] 4. John C. Hull: Options, futures, and other derivatives, 8th ed., Pearson, 2012 [Chapter 12] 5. Craig C. Mounfield: Synthetic CDOs, Cambridge University Press, 2009 [Chapters 1,2,3,4,5,7,8,9,12,13] 6. Dominic O'Kane: Modelling single-name and multi-name Credit Derivatives, Wiley, 2008 [Chapter 22] 7. Ann Rutledge and Sylvain Raynes: Elements of Structured Finance, Oxford University Press 2010 [Chapter 10] 8. Paul Wilmott, Sam Howison and Jeff Dewyne: The Mathematics of Financial Derivatives, Cambridge University Press 1995 [Chapters 2,3,10] 9. Damiano Brigo, Andrea Pallavicini and Roberto Torresetti: Credit Models and the Crisis, Wiley, 2010 [Chapters 1-8] Please note that most of the topics covered in Mounfield (2009) is also contained in O'Kane (2008). While this unit follows Mounfield (2009), students may want to consider O'Kane (2008) as an alternative text.

SYLLABUS

Hrs	Frontal teaching
2	Presentation of the objectives of the course. Representation of asset payoffs. Arrow-Debreu securities. Portfolio of assets. Hedging.
2	Representation of returns. Types of arbitrage. Arbitrage Price Theorem. Risk-neutral probabilities
2	Pricing in multi-period models. Replicating strategies.
2	owards continuous-time. IID returns and volatility. Time scaling of mean and variance. Brownian motion. Black–Scholes option pricing formula.

SYLLABUS

Hrs	Frontal teaching
2	Lemma di Ito. Derivazione del modello Black-Scholes. Oltre Black-Scholes: volatilità' stocastica e processi jump-diffusion.
2	Implied volatility. Volatility smile and skew. Volatility indices
2	Numerical technique 1: Binomial Lattice. Calibration, performance and extension to other derivatives
2	Numerical technique 2: Monte-Carlo simulation. Calibration, performance and hedging.
2	Numerical technique 3: Finite differences. Calibration, performance and comparison with other numerical techniques
2	Characteristics of Mortgage-backed Securities (MBS). Valuation and pre-payment modelling. Hedging MBS
2	Modelling and pricing corporate default. Hazard rates. Determining default rates. Credit Default Swaps (CDS)
2	Collateralized Debt Obligations (CDO). Valuation of default baskets. Pricing of synthetic CDOs. Monte-Carlo simulations.

Hrs	Practice
4	Hedging. Arbitraggio. Risk-neutral probabilities
4	Option pricing (Binomial Model and Black–Scholes formula) using MATLAB
4	Numerical techniques for option pricing using MATLAB
2	Pricing credit derivatives
2	Implied and base correlations of CDO tranches. Portfolios of CDOs. Hedging default risk. Credit indices.
2	Designing CDOs and exotic CDOs. Leveraged credit derivatives (CPPI, credit CPPI and CPDO). The process of CDO creation