UNIVERSITÀ DI PAVIA

Anno Accademico 2018/2019

ECONOPHYSICS

Enrollment year	2018/2019
Academic year	2018/2019
Regulations	DM270
Academic discipline	FIS/02 (THEORETICAL PHYSICS, MATHEMATICAL MODELS AND METHODS)
Department	DEPARTMENT OF PHYSICS
Course	
Curriculum	Fisica teorica
Year of study	1°
Period	1st semester (01/10/2018 - 18/01/2019)
ECTS	6
Lesson hours	48 lesson hours
Language	Italian
Activity type	ORAL TEST
Teacher	MONTAGNA GUIDO (titolare) - 6 ECTS
Prerequisites	A good knowledge of the fundamental concepts of probability and statistics. Basic university preparation in mathematics and physics, with particular reference to differential equations. A knowledge of the main results of Statistical Mechanics is also welcome.
Learning outcomes	The course is an introduction to the role played by statistical physics, and particularly the theory of stochastic processes, in the modeling of the dynamics of financial markets and main financial instruments. The course provides a window on the modern interdisciplinary applications of theoretical physics and could stimulate the interest of the students for a future enrollment in the financial industry.
Course contents	The main applications of the methods of theoretical physics to the modeling of the dynamics of financial markets are discussed. The first part of the course is devoted to the theory of stochastic processes, while

	the second part describes the role of stochastic processes in econophysics and finance. Brownian motion and interpretations of Einstein and Langevin. Random walk, diffusion processes and link with the central limit theorem. Markov processes, Wiener processes and their properties. Fokker-Planck equation. Stochastic differential equations and elements of stochastic calculus. Ito and Ornstein-Uhlenbeck processes. Introduction to financial markets and instruments. Geometric brownian motion and lognormal distribution of stock prices. Options and Black-Scholes model. Limits of the Black-Scholes model. Exotic options and binomial trees. Interest rates, bonds and Vasicek model. Empirical analysis of high-frequency financial data. Power law distributions, Levy processes and generalized central limit theorem. Introduction to stochastic volatility models.
Teaching methods	Lectures aimed at providing an illustration of all the conceptual and mathematical aspects inherent to each topic. All the necessary financial notions will be given, thus making the course self-consistent.
Reccomended or required readings	W. Paul, J. Baschnagel, Stochastic processes from physics to finance, Springer. R.N. Mantegna, H.E. Stanley, An introduction to econophysics, Cambridge Univ. Press
Assessment methods	Oral exam. The student will be asked to have acquired the theory of stochastic processes (in particular, the main rules of stochastic calculus) and its application to the modeling of financial markets and instruments.
Further information	
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile