Stampare su carta intestata del CdS

General information	
Academic subject	Mathematical Models for Finance
Degree course	Master's degree program in Economics, Finance and Business
Academic Year	2021-2022
European Credit Transfer and Accumulation System (ECTS)	8
Language	Italian
Academic calendar (starting and ending date)	I semester - 2 year
Attendance	No

Professor/ Lecturer	
Name and Surname	Giovanni Villani
E-mail	giovanni.villani@uniba.it
Telephone	
Department and address	Department of Economics and Finance
Virtual headquarters	
Tutoring (time and day)	Tuesday, 3.00 pm

Syllabus	
Learning Objectives	At the end of the course, the student theoretically knows the most relevant topics relating to the pricing of derivative securities in the hypothesis of the absence of arbitrage opportunities, to determine the efficient composition of a securities portfolio with n risky and one non-risky assets, to carry out choices in conditions of uncertainty.
Course prerequisites	Knowledge of the discounting and capitalization tools of the RIC; calculation of derivatives and integrals; knowing how to optimize a function in n variables; knowledge of linear algebra.
Contents	**A) Evaluation of an operation in conditions of uncertainty.** 1) Elements of probability calculation. Discrete and continuous random variable. Distribution function. Expected value of a discrete random variable. Variance and standard deviation. Covariance. Correlation coefficient. Conditional probability. Independent events. Unrelated random variables. 2) Criteria for the evaluation of random quantities. The criterion of the average value and fair games. Limits to the average value criterion. The St. Petersburg paradox. The utility function. The usefulness of uncertain sums. The concept of certain equivalent. Risk aversion. 3) The stochastic dominance of the first and second order. The mean-variance criterion. Risk and return analysis. 4) The portfolio theory. Risky and non-risky investments. The case of two titles. The case of n risky securities. The case of n risky and one non-risky securities. The market equilibrium model. **B) Valuation of derivatives.** 5) Introduction to stochastic processes. Basic definitions. Processes in independent increments. Martingale. Brownian motion. Stochastic differential. Ito's lemma. Stochastic differential equations. 6) Evaluation of financial options. General information on options. Call and put parity relationship. One-period binomial model. Cox-Ross-Rubinstein model. 7) The Black and Scholes model. The Monte Carlo method for option valuation.

	8) Valuation of "futures" and "swap" contracts.
Books and bibliography	G. Castellani, M. De Felice, F. Moriconi. “Manuale di Finanza Vol III. Modelli stocastici e contratti derivati”. Eds Il Mulino.
Additional materials	

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
200	56		144
ECTS			
8			

Teaching strategy	Frontal Lesson and Exercise on Excel
Expected learning outcomes	
Knowledge and understanding on:	At the end of the course, the student must be able to choose the optimal financial portfolio based on risk and return according to the individual's needs in terms of risk aversion / propensity. Furthermore, he will have to know how to determine the price of the most important derivative instruments.
Applying knowledge and understanding on:	The student must be able, also through Excel, to solve the problems of choosing the optimal portfolio and to determine the price of derivatives according to binomial models, monte carlo and Black-Scholes.
Soft skills	• *Autonomy of judgment*: the student must have the ability to connect the knowledge acquired during the course and to deal with complex problems through the models, the logical and formal tools made available during the course. • *Communication skills*: the student will have to acquire clear and effective communication skills, thanks to a good command of the vocabulary concerning the topics covered during the course. • *Ability to learn independently*: the student must have developed good learning skills, which allow them to independently deepen the knowledge acquired during the course by tackling personalized study paths.

Assessment and feedback	
Methods of assessment	
Evaluation criteria	The written test consists in carrying out some exercises on the topics main of the course. For example: pricing of derivatives using the binomial method, Black and Scholes formula and Monte Carlo simulation; minimum variance portfolio consisting of n risky securities; stochastic dominance. The oral part of the exam can be taken by the student who has reported, in the written test, an evaluation of at least 18/30. The oral part of the exam will ascertain the level of overall preparation on all the topics of the program. For a sufficient assessment, the student will have to show knowledge of concepts (through their definitions) and links between the various topics, and also an understanding of mathematical reasoning.
Criteria for assessment and attribution of the final mark	• <18 Fragmentary and superficial knowledge of the contents, errors in applying the concepts, lack of exposure; • 18-20 Knowledge of sufficient but general contents, simple exposition, uncertainties in the application of theoretical concepts; • 21-23 Appropriate but not in-depth knowledge of contents, ability to apply

	theoretical concepts, ability to present contents in a simple; • 23-26 Appropriate and broad knowledge of the contents, fair ability to application of knowledge, ability to present content in an articulated way. • 27-29 Broad, complete and in-depth knowledge of contents, good application of contents, good ability to analyze and synthesize, safe and correct presentation. • 30-30L Very broad, complete and in-depth knowledge of contents, well-established ability to apply contents, excellent ability to analyze, synthesize and interdisciplinary connections, mastery of exposure.
Additional information	