



COURSE OF STUDY	TWO-YEAR MASTER OF SCIENCE PROGRAMME IN MATHEMATICS
ACADEMIC YEAR	2023-2024
ACADEMIC SUBJECT	PROBABILISTIC METHODS IN FINANCE

General information	
Programme year	Second
Term	Second semester (February 26, 2024 – May 31, 2024)
European Credit Transfer and Accumulation System credits (ECTS)	7
SSD	MAT/06 – Probability and Mathematical Statistics
Language	Italian
Mode of attendance	Not compulsory

Lecturers		
Name and surname	Vitonofrio Crismale (instructor of record)	Stefano Rossi
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Department and office	Department of Mathematics room 18 second floor	Department of Mathematics room 14 second floor
Virtual meeting room		
Web page	https://www.dm.uniba.it/it/members/crismale	https://www.dm.uniba.it/it/members/rossi
Office hours	By appointment via e-mail	

Work schedule				
	Total	Lectures	Hands-on learning (recitations)	Self-study
Hours	175	48	15	112
ECTS credits	7	6	1	

Learning objectives	
	Computation of prices for derivatives based on stochastic processes. European and American options, derivatives, forward and futures. Use of mathematical models to analyze and solve problems from finance.

Course prerequisites	
	Multivariate Calculus, Elements of Measure Theory, Probability Theory

Syllabus	
Course contents	<ol style="list-style-type: none"> 1. Basic concepts of finance, with tools. 2. Stochastic Processes, Conditioning, martingale, Markos Processes (basic). 3. Symmetric Random Walk. Brownian Motion and properties. Volatility for geometric Brownian Motion. First passage time, stopping time and reflection principle. 4. Stochastic Calculus: Ito integral, Ito formula, Ito processes. Generalized geometric Brownian Motion. Black-Scholes equation. Greeks. Put-Call Parity. 5. Risk-neutral measure and Girsanov Theorem. Stocks, Portfolio and Price



	<p>under the risk-neutral measure. Martingale representation Theorem. First and second fundamental theorems for asset pricing. Dividends. Forward and Futures. 6. Exotic Options. Up-and-Out Call. Lookback options and Black-Scholes equation. Price computation for a lookback option. Asian options. Fixed-strike Asian Call. 7. American Derivative Securities. Perpetual American Put. Price under arbitrary and optimal exercises. American Call.</p>
Reference books	<p>- S.E. Shreve: Stochastic Calculus for Finance I – Continuous-time models (Springer 2004) - A. Pascucci: Calcolo Stocastico per la Finanza (Springer Universitext 2008)</p>
Additional course materials	
Repository	Notes on the e-learning platform

Expected learning outcomes

Knowledge and understanding	<ul style="list-style-type: none"> ○ Fundamental knowledge of mathematical finance and stochastic processes ○ Computation techniques
Applying knowledge and understanding	<ul style="list-style-type: none"> ○ Computation of asset pricing ○ Mathematical models for finance
Soft skills	<p><i>Making judgements:</i></p> <ul style="list-style-type: none"> ○ Solving problems from finance ○ Developing techniques for derivatives pricing
	<p><i>Communication skills:</i></p> <ul style="list-style-type: none"> ○ Showing knowledge in a public speaking ○ Problem solving
	<p><i>Learning skills:</i> Reading and understanding books or scientific papers on the topics</p>

Teaching methods

	Lectures and exercises sessions.
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Assessment

Assessment methods	Oral exam, during which the committee will evaluate the comprehension of the theoretical topics presented in the lectures, and the capacity to solve problems arising in option pricing by the candidate.
Evaluation criteria	<ul style="list-style-type: none"> • <i>Knowledge and understanding:</i> <ul style="list-style-type: none"> ○ Fundamental knowledge of mathematical finance and stochastic processes ○ Computation techniques • <i>Applying knowledge and understanding:</i> <ul style="list-style-type: none"> ○ Computation of asset pricing ○ Mathematical models for finance • <i>Making judgement:</i> <ul style="list-style-type: none"> ○ Solving problems from finance ○ Developing techniques for derivatives pricing • <i>Communication skills:</i>



	<ul style="list-style-type: none">○ Showing knowledge in a public speaking○ Problem solving • <i>Learning skills:</i> Reading and understanding books or scientific papers on the topics
Grading policy	The minimum score to pass is 18/30, the maximum is 30/30. Evaluation derives from the criteria presented above. High ranked evaluation will be achieved by any student with deep knowledge of the topics and autonomy in solving problems.

Further information

	Attending lectures is highly recommended.
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