

## GDAŃSK UNIVERSITY

## Subject card

Subject name and code	, PG_00055430								
Field of study	Mathematics								
Date of commencement of studies	October 2023		Academic year of realisation of subject			2023/2024			
Education level	second-cycle studies		Subject group			Optional subject group Subject group related to scientific research in the field of study			
Mode of study	Full-time studies		Mode of delivery			at the university			
Year of study	1		Language of instruction			Polish			
Semester of study	1		ECTS credits			5.0			
Learning profile	general academic profile		Assessment form			assessment			
Conducting unit	Institute Of Applied Mathematics -> Faculty Of Applied Physics And Mathematics -> Wydziały Poli Gdańskiej					Politechniki			
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Karol Dziedziul						
	Teachers dr hab. Karol Dziedziul								
Lesson types and methods	Lesson type	Lecture	Tutorial Laboratory Project		t	Seminar	SUM		
of instruction	Number of study	30.0	15.0	0.0	15.0		0.0	60	
	E-learning hours inclu	L uded: 0.0							
Learning activity and number of study hours	Learning activity	Participation in classes includ	n didactic ed in study	Participation i consultation h	n Iours	Self-study		SUM	
	Number of study hours	60		5.0		60.0		125	
Subject objectives	Getting to know the models of the derivative market and mathematical modeling. An introduction to effective Monte Carlo methods based on continuous models for pricing option.								
Learning outcomes	Course outcome		Subject outcome			Method of verification			
	[K7_W05] Has enhanced knowledge of a selected branch of mathematics: knows most classical definitions and theorems and their proofs, Understands problems being examined, Knows relations between problems from particular field with other branches of mathematics, theoretical and applied		The subject combines probability theory, stochastic processes and numerical methods. This is done in the context of the valuation of derivatives. The ability to evaluate them is rather intuitive, combining theory with practice.			[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects			
	[K7_U09] Is able, at an advanced level and covering modern mathematics, to apply and present in speech and in writing the methods of at least one selected branch of mathematics: mathematical and functional analysis, theory of differential equations and dynamical systems, algebra and number theory, geometry and topology, calculus probability and statistics, discrete mathematics and graph theory, logic and set theory.		An ability to solve analytically stochastic equations. It uses these methods to value options.			[SU1] Assessment of task fulfilment			
Subject contents	Discrete model: self-financing portfolio, arbitration. Equivalence theorem of local martingales, generalized martingales, martingales transformations. Theorem on the existence of a martingale measure for markets without arbitrage. Esher Lemma.Continuous models. Stochastic differential equations, Equations with affine coefficients solved exact. Numerical solutions. Standard Black Scholes model Heston model. Short-term rate models, Vasick's model.								
Prerequisites and co-requisites	Probability theory. Measure theory								

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade			
		60.0%	100.0%			
Recommended reading	Basic literature	1. J. Jakubowski, A. Palczewski, M. Rutkowski, Ł. Stettner ,,Matematyka finansowa Wydawnictwo Naukowo-Techniczne 2003.				
		2. J. Hull ,, Options, Futures, and the Cliffs, Prentice-Hall 2007	e Other Derivatives Englewood			
		3. A.N. Shiryaev ,,Essentials of Stochastic Finanse:Facts, Models, Theory Singapore, World Scientific 1999				
		4. Glasserman P, Monte Carlo Methods In Financial Engineering, Springer, 2003				
	Supplementary literature	[JYC] M. Jeanblanc, M. Yor, M. Chesney, Mathematical methods for financial markets. Springer Finance. Springer-Verlag London, Ltd., London, 2009.				
	eResources addresses	Uzupełniające				
		Adresy na platformie eNauczanie:				
		Kontrakty terminowe - Moodle ID: 6 https://enauczanie.pg.edu.pl/moodle	0153 e/course/view.php?id=6153			
Example issues/ example questions/ tasks being completed	Determine the value of a financial instrument (S_T-K)^2. Solve stochastic differential equation withAffine Coefficients: Method of Variation of Constants. Example 1.5.4.8 [JYC]					
Work placement	Not applicable					

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