



## Subject card

Subject name and code	, PG_00052286						
Field of study	Mathematics						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2024/2025		
Education level	second-cycle studies	Subject group			Specialty subject group		
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			4.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Instytut Matematyki Stosowanej -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Karol Dziejul				
	Teachers		dr hab. Karol Dziejul				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	15.0	0.0	60
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	60		5.0		35.0	100
Subject objectives	Introduction to models of derivatives and options markets. In the case of continuous models, an introduction to effective Monte Carlo models that allow determining the value of the functional, i.e. the option price.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W07] describes well symbolic computation software package and statistical data processing package.	The ability to solve stochastic equations analytically using Ito's formula. These methods are used to value options. Comparison with numerical methods.			[SW3] Assessment of knowledge contained in written work and projects		
	[K7_U03] uses differential and integral calculus, elements of complex analysis, algebraic methods, applies them in typical practical	The subject combines probability theory, stochastic processes and numerical methods. This is done in the context of valuing derivatives. The ability to value them is at a analytic and intuitive level, combining theory with practice.			[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools		
Subject contents	Discrete model: self-financing portfolio, arbitrage. Theorem on the equivalence of local martingales, generalized martingales, martingale transformations. Theorem on the existence of a martingale measure for markets without arbitrage. Esher's lemmaContinuous models. Stochastic differential equations, Equations with affine coefficients - exact solutions. Numerical solutions. Standard Black Scholes model, Heston model. Short-term rate models, Vasicek model.						
Prerequisites and co-requisites	Probability, Measure theory						
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade		
	points for tests		60.0%		100.0%		

Recommended reading	Basic literature	<p>1. J. Jakubowski, A. Palczewski, M. Rutkowski, Ł. Stettner „Matematyka finansowa Wydawnictwo Naukowo-Techniczne 2003.</p> <p>2. J. Hull „ Options, Futures, and the Other Derivatives Englewood Cliffs, Prentice-Hall 2007</p> <p>3. A.N. Shiryaev „Essentials of Stochastic Finance:Facts, Models, Theory Singapore, World Scientific 1999</p> <p>4. Glasserman P, Monte Carlo Methods In Financial Engineering, Springer, 2003</p>
	Supplementary literature	[JYC] M. Jeanblanc, M. Yor, M. Chesney, Mathematical methods for financial markets. Springer Finance. Springer-Verlag London, Ltd., London, 2009.
	eResources addresses	<p>Podstawowe</p> <p><a href="https://drive.pg.edu.pl/s/41wrEzlszHw4qaY">https://drive.pg.edu.pl/s/41wrEzlszHw4qaY</a> - Discrete models=kontraktyU.pdf. Continuous models =kontraktyU2.pdf</p> <p>Adresy na platformie eNauczanie:</p>
Example issues/ example questions/ tasks being completed	Determine the value of the financial instrument $(S_T - K)^2$ . Solve the stochastic equation with affine coefficients Example 1.5.4.8 [JYC].	
Work placement	Not applicable	

Document generated electronically. Does not require a seal or signature.