GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00052286		
Field of study	Mathematics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	Specialty 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	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Karol Dziedziul	
	Teachers	dr hab. Karol Dziedziul	

Lesson types

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

Course content – lecture

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

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>points for tests</td><td>60.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. J. Jakubowski, A. Palczewski, M. Rutkowski, Ł. Stettner ,,Matematyka finansowa Wydawnictwo Naukowo-Techniczne 2003.
2. J. Hull ,, Options, Futures, and the Other Derivatives Englewood Cliffs, Prentice-Hall 2007

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</td></tr>
<tr><td>Supplementary literature</td><td>[JYC} M. Jeanblanc, M. Yor, M. Chesney, Mathematical methods for financial markets. Springer Finance. Springer-Verlag London, Ltd., London, 2009.</td></tr>
<tr><td>eResources addresses</td><td>Basic
https://drive.pg.edu.pl/s/41wrEzlszHw4qaY - Discrete models=kontraltyU.pdf. Continiuous models =kontraktyU2.pdf</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Determine the value of the financial instrument (S_T-K)^2. Solve the stochastic equation with affine coefficients Example 1.5.4.8 [JYC].</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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