GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Risk Processes, PG_00044138		
Field of study	Mathematics		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2022/2023
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	2	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Zakład Równań Różniczkowych i Zastosowań Matematyki -> Instytut Matematyki Stosowanej -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Wojciech Czernous	
	Teachers	dr Wojciech Czernous	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	0.0	30.0	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	60.0	125

Subject objectives

Introduction to basic mathematical problems related to risk modeling in terms of stochastic (Markov) processes and stochastic differential equations.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W09	Student applies methods of stochastic processes in financial engineering, in particular in modelling insurance risk or survival analysis.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation
K7_U11	Student poses basic problems related to building appropriate mathematical models of risk processes - in particular ruin processes.	[SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information
K7_K04	Student solves mathematical problems implied by the models of risk, e.g. related to bankruptcy (ruin).	[SK5] Assessment of ability to solve problems that arise in practice
K7_U04	Student analyses continuous-time Markov risk processes.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools

Subject contents

Discrete-time Markov processes. Basics of Itô integral. Stochastic differential equations. Standard risk models in terms of stochastic differential equations. The Heath Jarrow Morton model. Reduced form credit risk model. Topics on survival analysis will be presented by students on seminars.

Prerequisites and co-requisites

Courses completed: Probability Theory, Stochastic Processes

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Project	51.0%	50.0%
Exam	51.0%	50.0%

<table>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. Jacek Jakubowski, Rafał Sztencel, Wstęp do teorii prawdopodobieństwa. SCRIPT, Warszawa, 2010.
2. Steven E. Shreve, Stochastic Calculus for Finance II. Continuous-Time Models. Springer, 2004.
3. Robert A. Jarrow, Continuous-Time Asset Pricing Theory. A Martingale-Based Approach. Springer, 2018.
4. D.G. Kleinbaum, M. Klein, Survival Analysis, A Self-Learning Text, (3rd Edition), Springer</td></tr>
<tr><td>Supplementary literature</td><td>1. Olav Kallenerg, Foundations of Modern Probability. Springer, 2002.
2. Ioannis Karatzas and Steven E. Shreve. Brownian Motion and Stochastic Calculus. Springer, 1991.
3. Tomasz R. Bielecki, Marek Rutkowski, Credit Risk: Modeling, Valuation and Hedging, Springer, 2004.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:
Procesy ryzyka - Moodle ID: 30552
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30552</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">At the beginning of the term the student is provided with the list of topics to be worked out and finally to be presented as a project on a prescribed date. Theoretical components from lectures and seminars are verified on the exam.

Give and prove the properties of a homogeneous Markov chain.

Give and prove the Doob's theorem on conditional independence.

Apply the Itô's formula and find the stochastic differential of the process.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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