



Subject card

Subject name and code	Risk Processes, PG_00044138						
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					
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 Układów Dynamicznych -> Instytut Matematyki Stosowanej -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Sergey Kryzhevich				
	Teachers		dr hab. Sergey Kryzhevich				
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 of basic mathematical tools 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] Knows the rules of stochastic modeling in financial and actuarial mathematics or in natural sciences, in particular physics, chemistry or biology.	Applies stochastic processes in engineering problems, in particular in insurance risk modeling or survival analysis.			[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation		
	[K7_U04] Is familiar with the methods of solving classical ordinary and partial differential equations, is able to apply them in typical practical problems.	Student can analyze continuous Markov processes modelling risks.			[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools		
	[K7_U11] Can construct mathematical models used in specific advanced applications of mathematics, can use stochastic processes as a tool for modeling phenomena and analyzing their evolution.	Student can resolve basic issues related to construction mathematical models of processes of risks, including bankruptcy.			[SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information		
	[K7_K04] Can form opinions on fundamental mathematical issues.	Student solves mathematical problems resulting from adopted risk assessment models e.g. in relation to bankruptcy.			[SK5] Assessment of ability to solve problems that arise in practice		
Subject contents	Markovian processes with discrete time. Elements of the Itô integral. Stochastic differential equations. Standard risk models in terms of stochastic differential equations. The Heath, Jarrow and Morton model. Reduced insolvency risk model. During the seminars accompanying the lecture, students will present issues related to survival analysis.						
Prerequisites and co-requisites	Assessment in the following subjects: probability calculus, stochastic processes						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Exam	51.0%	50.0%
	Project	51.0%	50.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Steven E. Shreve, Stochastic Calculus for Finance II. Continuous-Time Models. Springer, 2004. 2. Robert A. Jarrow, Continuous-Time Asset Pricing Theory. A Martingale-Based Approach. Springer, 2018. 3. D.G. Kleinbaum, M. Klein, Survival Analysis, A Self-Learning Text, (3rd Edition), Springer 	
	Supplementary literature	<ol style="list-style-type: none"> 1. Olav Kallenberg, 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. 	
	eResources addresses	<p>Podstawowe https://enauczanie.pg.edu.pl/moodle/course/view.php?id=38042 - The Risk Processes course at e-nauczanie platform Adresy na platformie eNauzanie:</p>	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		