

。 GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Actuarial models, PG_00056621							
Field of study	Mathematics							
Date of commencement of studies	October 2023		Academic year of realisation of subject			2024/2025		
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	2		Language of instruction		Polish Polish (English if necessary)			
Semester of study	3		ECTS credits		5.0			
Learning profile	general academic profile		Assessment form		exam			
Conducting unit	Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics							
Name and surname of lecturer (lecturers)	Subject supervisor		mgr Piotr Lebiedź					
	Teachers		mgr Piotr Lebiedź					
Lesson types and methods	Lesson type	Lecture	Tutorial	Laboratory	Projec	t	Seminar	SUM
of instruction	Number of study hours	30.0	0.0	15.0	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	30		0.0			60
Subject objectives	The objective of the course is to familiarize students with the concept of actuarial models, particularly those used for the valuation of property insurance. Throughout the course, students will also learn about market standards and best practices. During the course, students should become acquainted with: the technical account of an insurance company; the role of pricing; data processing methods related to insurance valuation; GLM/GAM models; Machine Learning models with techniques for explaining them; commercialization of models and comparison of various scenarios; risk modeling, demand modeling, and price optimization. As part of the course assessment, each student will prepare their own project using Python.							

Learning outcomes	Course outcome	Subject outcome	Method of verification			
	[K7_U13] Understands the mathematical foundations of the analysis of algorithms and computational processes, can construct algorithms with good numerical properties, used to solve typical and unusual mathematical problems.	Knowledge of building GLM/GAM models, ML models, and price optimization problems.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment			
	[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.	Preparation of high-quality predictive models using various variables, their transformations, and trend analysis.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment			
	[K7_U08] Knows probability distributions and their properties; is able to use them in practical issues, is familiar with the basics of statistics (estimation issues and hypothesis testing) and the basics of statistical data processing.	Knowledge of Poisson, Gamma, Negative Binomial, Bernoulli, Tweedie, Normal, and Inverse Gaussian distributions, along with their characteristics and applications. Understanding of the t-test and interpretation of p- values.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment			
	[K7_W09] Knows the rules of stochastic modeling in financial and actuarial mathematics or in natural sciences, in particular physics, chemistry or biology.	Knowledge of the specifics of stochastic modeling, discounting, and accounting for trend changes and inflation.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects			
Subject contents	The course consists of:					
	Lectures, covering topics such as: • The technical account of an insurance company • The role of pricing and the actuary • Data preparation • The architecture of actuarial models • Risk and demand models • GLM/GAM • Machine Learning and explainability • Commercialization of models • Price optimization • Scenario analysis • Implementation of ready-made pricing models Laboratories, where students will use Python to: • Process data • Create visualizations • Build and compare models • Develop and analyze various business scenarios Project, where students will independently: • Prepare a tariff for a motor insurance product, taking into account both frequency and severity models.					

Prerequisites and co-requisites	Basic knowledge of the following courses: 1. Probability Theory 2. Statistics 3. Statistics II 4. Databases 5. Forecasting Theory 6. Mathematical Analysis I 7. Mathematical Analysis II 8. Actuarial Mathematics Basic knowledge of Python programming language.					
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade			
	Project	50.0%	100.0%			
Recommended reading	 Basic literature "Generalized Linear Models for Insurance Ratemaking", CA Monograph Series. "Pricing in General Insurance" - Pietro Parodi "Comparative performance analysis between Gradient Boo models and GLMs for non-life pricing", Viktor Martinez de I Kostornichenko, University Carlos III of Madrid, Master in A Science and Quantitative Finance. "Price Writer", Jeremy Keating. 					
	Supplementary literature	Quantee Blog - https://www.quantee.ai/blog - access 9.08.2024.				
	eResources addresses	Adresy na platformie eNauczanie:				
Example issues/ example questions/ tasks being completed	 Create well-predicting frequency model; Create well-predicting severity model; Create well-predicting demand model; Compare GLM to GBM built using the same variables; Compare two GLMs with different features and/or transformations; Reverse engineer premium using available variables. 					
Work placement	Not applicable					

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