



Subject card

Subject name and code	Actuarial models, PG_00069472						
Field of study	Mathematics						
Date of commencement of studies	October 2025		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	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Marcin Szatkowski				
	Teachers		dr Marcin Szatkowski				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	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		5.0		35.0	100
Subject objectives	The aim of the course is to familiarize students with the concept of actuarial models, particularly those used in claims reserving, risk management, and claims forecasting in non-life insurance. During the course, students will also learn about industry standards and best practices. During the course, students should gain an understanding of: - the technical account of an insurance company; - what claims reserves are, how they can be projected, and how their variability can be estimated; - the basic principles of the Solvency II Directive and the methods used to calculate the Standard Formula; - how claims can be forecast and how reinsurance works. As part of the course assessment, each student will prepare an individual analytical project.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U07] at an advanced level and covering modern mathematics, applies and presents in speech and in writing the content and methods of a selected branch of mathematics	The student has advanced knowledge of probability theory, actuarial mathematics, statistics, and mathematical modelling, particularly in the area of actuarial models used in non-life insurance.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject
	[K7_U09] constructs mathematical models used in specific advanced applications of mathematics, can use stochastic processes as a tool for modeling phenomena and analyzing their evolution, constructs mathematical models used in specific advanced applications of mathematics, uses stochastic processes as a tool for modeling phenomena and analyzing their evolution, recognizes mathematical structures in physical theories	The student constructs mathematical models used in insurance. Stochastic processes are an important tool for, among other applications, risk management and the assessment of reserve risk variability.	[SU4] Assessment of ability to use methods and tools
	[K7_K04] forms opinions on mathematical issues	The student formulates opinions on mathematical issues, including the appropriateness and quality of models developed for practical actuarial applications.	[SK5] Assessment of ability to solve problems that arise in practice
	[K7_W02] has enhanced knowledge of a selected branch of mathematics, theoretical or applied, knows classical definitions and theorems and their proofs and connections with other fields, understands problems being examined	The student understands the key aspects of actuarial models used in non-life insurance and is familiar with the main models, the underlying theorems, and their properties. The student understands how such models are analysed and validated, and which aspects require particular attention in practical applications.	[SW3] Assessment of knowledge contained in written work and projects
Subject contents	Course content – lecture		
	The lectures cover the following topics:		
	1. Reserve risk models and the associated estimators. 2. Selected aspects of the Solvency II Directive and the calculation of the Standard Formula. 3. Methods for forecasting claims and applications of reinsurance.		
	Course content – laboratory		
	During the laboratory classes, students develop models in a selected programming environment, following the topics covered in the lectures.		
	Course content – project		
	As part of the project, students extend the models developed during the classes by incorporating additional aspects, apply them to different datasets, interpret the results, and present their findings.		

Prerequisites and co-requisites	Basic knowledge of the following courses is required:		
	1. Probability Theory		
	2. Statistics		
	3. Statistics II		
	4. Databases		
	5. Forecasting Theory		
	6. Mathematical Analysis I		
	7. Mathematical Analysis II		
	8. Actuarial Mathematics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project 1	50.0%	50.0%
	Project 2	50.0%	50.0%
Recommended reading	Basic literature	1. M. V. Wüthrich, M. Merz, 2008, <i>Stochastic Claims Reserving Methods in Insurance</i> , Wiley.	
		2. Commission Delegated Regulation (EU) 2015/35 of 10 October 2014 supplementing Directive 2009/138/EC of the European Parliament and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II).	
		3. H. Albrecher, J. Beirlant, J. L. Teugels, 2017, <i>Reinsurance: Actuarial and Statistical Aspects</i> , Wiley.	
	Supplementary literature	Articles from the following magazines:	
	1) Insurance Mathematics & Economics		
	2) ASTIN Bulletin		
	3) European Actuarial Journal		
	eResources addresses		
Example issues/ example questions/ tasks being completed	1. What claims reserve should be established for a given line of business, and what is its variability?		
	2. What is the capital requirement for a given risk under the Standard Formula, based on specified parameters of an insurance company?		
	3. What is the effect of non-proportional and proportional reinsurance on a given insurance portfolio?		
Practical activities within the subject	Not applicable		