

Subject card

Subject name and code	Life insurance mathematics, PG_00155470						
Field of study	Mathematics						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2025/2026		
Education level	Master's studies		Subject group		Obligatory subject group 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		5.0		
Learning profile	academic		Assessment form		exam		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Milena Matusik				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	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		60.0	125
Subject objectives	To introduce students to basic concepts and facts in the mathematics of life insurance.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[MATMU2_U01] can construct mathematical reasoning: prove theorems and refute hypotheses through construction and selection of counterexamples	The student is able to solve problems involving the mathematics of life insurance.	[SU1] oral statement/conversation/discussion [SU4] test/exam - oral or written
	[MATMU2_W01] knows and understands in-depth the theory of selected areas of mathematics	The student knows the basic definitions and formulas in the mathematics of life insurance. Correctly formulates and proves basic facts and theorems in the mathematics of life insurance.	[SW4] test/exam - oral or written
	[MATMU2_W02] knows and understands well the role and importance of the construction of mathematical reasoning	The student understands the role and importance of proof in mathematics and the importance of assumptions.	[SW4] test/exam - oral or written
	[MATMU2_K02] is ready to precisely formulate questions to deepen his/her understanding of a given topic or find missing elements of reasoning	The student is able to precisely formulate questions that serve to deepen understanding of a given topic.	[SK1] oral statement/conversation/discussion
	[MATMU2_K01] is willing to acknowledge the limitations of his or her own knowledge and is willing to pursue further education	The student knows the limitations of his or her own knowledge and demonstrates readiness for further education.	[SK8] observation of student's independent or team work
	[MATMU2_U06] is able to apply methods and examples from a selected field of mathematics in related fields	The student is able to solve problems in the field of life insurance mathematics using both standard methods of mathematical analysis and probability as well as definitions, facts and theorems learned during lecture.	[SU5] implementation of a problem task [SU8] observation of student's independent or team work
	[MATMU2_W03] knows and understands in-depth a selected field of theoretical or applied mathematics and is able to understand the formulations of issues in this field that are still at the research stage and knows the connections of issues in this field with other areas of mathematics	The student has in-depth theoretical knowledge of results and arguments in the field of life insurance mathematics.	[SW1] oral statement/conversation/discussion [SW2] presentation/project/paper/report
	[MATMU2_K05] is ready to independently search for information in literature, also in foreign languages	The student is able to independently search for information in professional literature.	[SK2] presentation/project/paper/report [SK8] observation of student's independent or team work
	[MATMU2_U04] is able, at an advanced level and including modern mathematics, to apply and present, orally and in writing, methods of at least one selected branch of mathematics	The student is able to apply and present methods of life insurance mathematics at an advanced level.	[SU2] presentation/project/paper/report [SU8] observation of student's independent or team work
	[MATMU2_U05] can perform proofs in a selected field and, if necessary, also use tools from other areas of mathematics	The student is able to apply methods from the field of life insurance mathematics in argumentation and proof.	[SU1] oral statement/conversation/discussion [SU3] text preparation/written work [SU8] observation of student's independent or team work
	[MATMU2_K06] is ready to formulate opinions on basic mathematical issues	The student is able to formulate opinions on selected issues of life insurance mathematics.	[SK1] oral statement/conversation/discussion
	[MATMU2_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; ethical conduct	The student understands and appreciates the importance of intellectual honesty.	[SK8] observation of student's independent or team work
	[MATMU2_U03] can understand mathematical texts of various types from selected fields of mathematics	The student acquires the ability to understand texts on the mathematics of life insurance at an advanced level.	[SU2] presentation/project/paper/report

Subject contents	1. Elementary topics in financial mathematics - interest rates, standard payment sequences. 2. Life expectancy - fractional life expectancy and its interpolation. 3. Life insurance - single net premium in continuous and discrete insurance. 4. Life annuities - actuarial present value of continuous and discrete annuities. 5. Standard insurance and net premiums. 6. Net mathematical reserves - loss sharing in annual policies, Hattendorff's theorem. 7. Multiple losses, group policies. 8. Commutation functions. 9. Gross mathematical reserves.		
Prerequisites and co-requisites	Possess knowledge of mathematical analysis I, II and probability theory.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	observation of the student's attitude	51.0%	0.0%
	test	51.0%	40.0%
	project	51.0%	20.0%
	written exam	51.0%	40.0%
Recommended reading	Basic literature	1. J. Czarnowska, K. Dziedziul, Ubezpieczenia na życie i komunikacyjne, Wyd. Politechniki Gdańskiej, 2010. 2. B. Błaszczyszyn, T. Rolski, Podstawy matematyki ubezpieczeń na życie, WNT, 2004. 3. N. Bowers, H. Gerber, J. C. Hickman, D. A. Jones, C. J. Nesbitt, Actuarial Mathematics, The Society of Actuaries, 1986. 4. H. Gerber, Life insurance mathematics, Springer, 1995. 5. A. Leung, Actuarial Principles. Lifetables and mortality models, Academic Press, 2022.	
	Supplementary literature	1. M. Skalba, Ubezpieczenia na życie, WNT, 1999. 2. P. Jaworski, J. Micał, Modelowanie matematyczne w finansach i ubezpieczeniach, Poltext, 2005.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	None.		
Work placement	Not applicable		

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