

Subject card

Subject name and code	Stochastic Processes, PG_00206845						
Field of study	Mathematics						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2026/2027		
Education level	Master's studies		Subject group		Obligatory subject group in the field of study 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	1		ECTS credits		5.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Monika Wrzosek				
	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		3.0		62.0	125
Subject objectives	The aim of the course is to familiarize students with the basics of the theory of stochastic processes, the construction of the Wiener process and its basic properties, the basics of the theory of martingales and Ito stochastic integral.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[MATMU2_U05] is able to apply new or adapt existing methods and tools from a selected field of mathematics and information and communication technologies in related fields		The student is able to use the known proof methods and methods of solving tasks, and uses the learned concepts correctly.		[SU4] test/exam - oral or written		
	[MATMU2_W01] knows and understands in depth the theory of selected areas of mathematics or related fields, the complex relationships between them and their development trends		The student knows and understands the elements of the theory of stochastic processes, in particular the theorems that are the subject of the lecture along with the appropriate definitions, examples, and proofs.		[SW4] test/exam - oral or written		
Subject contents	1. Stochastic process: definition, process trajectory, independent and stationary increases, Gaussian process. 2. Wiener process: definition, construction sketch. 3. Properties of the Wiener process (variation and quadratic variation, continuity and non-differentiability of trajectories) 4. Conditional expected value: definition, properties. 5. Stopping times. Martingales, submartingales, supermartingales. Doob inequality. 6. Ito stochastic integral: construction, basic properties.						
Prerequisites and co-requisites	Probability theory						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	tests	51.0%	50.0%
	final exam	51.0%	50.0%
	observation of the student's attitude	51.0%	0.0%
Recommended reading	Basic literature	1. F. Klebaner, Introduction to Stochastic Calculus with Applications, ICP 2005. 2. Z. Brzeźniak, T. Zastawniak, Basic Stochastic Processes, Springer 2005.	
	Supplementary literature	1. I. Karatzas, S. E. Shreve, Brownian motion and stochastic calculus, Springer-Verlag, Berlin-Heidelberg-New York, 1988. 2. I. I. Gichman, A. W. Skorochod, Wstęp do teorii procesów stochastycznych, PWN, 1968. 3. J. Jakubowski, R. Sztencel, Wstęp do teorii prawdopodobieństwa, Script, 2000. 4. A. D. Wentzell, Wykłady z teorii procesów stochastycznych, PWN 1980.	
	eResources addresses		
	Example issues/ example questions/ tasks being completed	not included	
Work placement	Not applicable		

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