University of Gdańsk

Subject card

Subject name and code	Stochastic Processes, PG_00207078						
Field of study	Mathematical Modeling and Data Analysis						
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 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 polish			
Semester of study	1		ECTS credits	5.0			
Learning profile	academic		Assessment form	exam			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Anita Dąbrowska				
	Teachers		dr hab. Anita Dąbrowska				
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 selected topics in the theory of continuous-time stochastic processes, including the Wiener process and its properties, martingale theory, and the Itô stochastic integral.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MMiADM2_U01] is able to construct mathematical reasoning: prove theorems, formulate, test and refute hypotheses by constructing and selecting counterexamples, choosing, if necessary, methods and tools from various branches of mathematics and related sciences	The student can apply the theorems and proof methods learned during the lecture, utilize the ideas and techniques used in the proofs of the theorems and examples presented during the lecture, identify the applications of the learned theorems, solve practical problems related to the lecture subject.	[SU4] test/exam - oral or written [SU6] demonstration of practical skills
[MMiADM2_W03] knows and understands to a deep degree a selected field of mathematics or related sciences and is able to understand the formulations of issues in this field that are still at the research stage and knows the connections between issues in this field and other areas of mathematics	The student knows and understands the theory of continuous-time stochastic processes, is aware of its applications, and is able to identify its connections with other branches of mathematics.	[SW4] test/exam - oral or written
[MMiADM2_W01] knows and understands in depth the theory of selected areas of mathematics, 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. Probability concepts and theorems used in the theory of stochastic processes
2. Conditional expectation: definition and properties
3. Stochastic process: definition, sample path, moment functions
4. Gaussian process. Process with independent increments. Stationary processes
5. Markov property
6. Wiener process
7. Properties of the Wiener process: variation and quadratic variation, continuity and non-differentiability of sample paths
8. Stopping times. Martingales, submartingales, supermartingales
9. Itô stochastic integral: construction and properties
10. Presentation of the subject-related nomenclature in English

Prerequisites and co-requisites

Probability theory

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Evaluation of the student's attitude	100.0%	0.0%
Final exam	51.0%	50.0%
Tests	51.0%	50.0%

Recommended reading

Basic literature	1. F. Klebaner, Introduction to Stochastic Calculus with Applications, ICP 2005. 2. V. Capasso, D. Bakstein, An Introduction to Continuous-Time Stochastic Processes, Springer New York Heidelberg Dordrecht London, 2012. 3. A. Plucińska, E. Pluciński, Probabilistyka. Statystyka matematyczna. Procesy stochastyczne. Rachunek prawdopodobieństwa. Wydawnictwo WNT, Warszawa 2017. 4. Z. Brzeźniak, T. Zastawniak, Basic Stochastic Processes, Springer 2005.
Supplementary literature	1. J. Jakubowski, R. Sztencel, Wstęp do teorii prawdopodobieństwa, Script, 2000. 2. I. Karatzas, S. E. Shreye, Brownian motion and stochastic calculus, Springer-Verlag, Berlin-Heidelberg-New York, 1988. 3. I. I. Gichman, A. W. Skorochod, Wstęp do teorii procesów stochastycznych, PWN, 1968. 4. A. D. Wentzell, Wykłady z teorii procesów stochastycznych, PWN 1980.
eResources addresses	

Example issues/ example questions/ tasks being completed

Not applicable

Work placement

Not applicable

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