University of Gdańsk

Subject card

Subject name and code	Introduction to Stochastic Differential Equations, PG_00206849		
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	2	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 theory of stochastic differential equations and selected properties of solutions to stochastic differential equations.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MATMU2_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 areas of mathematics	The student is able to apply the learned proof techniques and problem-solving methods, and correctly uses the concepts they have learned.	[SU4] test/exam - oral or written
[MATMU2_W03] knows and understands to a deep degree 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 between issues in this field and other areas of mathematics	The student knows the theorem on the existence and uniqueness of solutions to stochastic differential equations.	[SW4] test/exam - oral or written

Subject contents

1. The Ito process and Ito's lemmas.
2. Solution of a linear stochastic differential equation.
3. Theorem on the existence and uniqueness of a strong solution to the stochastic differential equation in the space of Ito processes.
4. The concept of a weak solution of a stochastic differential equation.
5. Properties of solutions of stochastic differential equations.
6. Diffusion generator, Dynkin formula, Feynman-Kac formula.

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Basics of the theory of stochastic processes.</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>observation of the student's attitude</td><td>51.0%</td><td>0.0%</td></tr>
<tr><td>final exam</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>tests</td><td>51.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">1. F. C. Klebaner, Introduction to Stochastic Calculus with Applications, ICP 2005.
2. B. Øksendal, "Stochastic Differential Equations: An Introduction with Applications." Springer, 2003.</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">1. Z. Brzeźniak, T. Zastawniak, "Basic Stochastic Processes", Springer, 1999.
2. J. Cyganowski, P. Kloeden, J. Ombach, "From Elementary Probability to Stochastic Differential Equations with Maple", Springer, 2002.
3. W. Feller, "Wstęp do rachunku prawdopodobieństwa", t. I i II, PWN, Warszawa 1977.
4. A.D. Wentzell, "Wykłady z teorii procesów stochastycznych", PWN, Warszawa 1980.</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">Not applicable</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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