GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Stochastic integral, PG_00021509		
Field of study	Mathematics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Nonlinear Analysis and Statistics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Tomasz Szarek	
	Teachers	prof. dr hab. inż. Tomasz Szarek dr Klaudiusz Czudek	

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

eNauczanie source addresses:

Moodle ID: 5405 Całka Stochastyczna
https://enauczanie.pg.edu.pl/2025/course/view.php?id=5405

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

Main aim is to equip the student is advanced mathematical tools in technical subjects.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U08] in a selected field, examines evidence, in which also can use tools from other branches of mathematics,	The ability to use basic tools in stochastic modeling.	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_W01] has enhanced knowledge of basic branches of mathematics,demonstrates knowledge theorem and hypotheses, has understanding of the role and importance of mathematical reasoning structure.	Students have dep knowledge on stochastic processes, are able to integrate with respect to semimartingales	[SW2] Assessment of knowledge contained in presentation
[K7_U05] recognize topological structures in mathematical objects occurring, for example, in geometry or mathematical analysis; uses the basic topological properties of sets, functions and transformations, uses the language and methods of functional analysis	Students have knowledge on the theory of stochastic integral.	[SU1] Assessment of task fulfilment

Subject contents

Course content – lecture

Probability spaces with filtraation. Stochastic basis. Stoping times and their basic properties. Classyfication of stoping times. Optional i prognose sigam-algebras. Increasin processes, processes with finite wariation and processes with integrable wariation. Localization. martingales with continuous time. and their basic properties. The Doob-Meyer decomposition. Square integrable martingales. Stochastic integral with respect to local martingales with continuous paths.and their basic properties. Ito's formula and it applications.. The Girsanov theorem. The decomposition of lokal martingales. Stochastic integral with respect to local martingales and semimartingales.

Course content – exercises

Probability spaces with filtraation. Stochastic basis. Stoping times and their basic properties. Classyfication of stoping times. Optional i prognose sigam-algebras. Increasin processes, processes with finite wariation and processes with integrable wariation. Localization. martingales with continuous time. and their basic properties. The Doob-Meyer decomposition. Square integrable martingales. Stochastic integral with respect to local martingales with continuous paths.and their basic properties. Ito's formula and it applications.. The Girsanov theorem. The decomposition of lokal martingales. Stochastic integral with respect to local martingales and semimartingales.

Prerequisites and co-requisites

Probability theory, measure theory and functional analysis.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Colloquium 1	51.0%	20.0%
Colloquium 2	51.0%	20.0%
Exam	51.0%	60.0%

Recommended reading

Basic literature

1) R. Elliot: Stochastic calculus and applications, Springer 1982.

2) H. Kuo, Introduction to stochastic integration, Springer 2006.

Supplementary literature

1) C. Dllecherie, P..A. Meyer, Probabilities and potential, tom 2., North-Holland 1982..

2) P. Protter, Stochastic Integration and differential equations, Springer 1990.

3) O. Kallenberg, Foundations of modermn probability, Springer 2001.

4) Sheng-wu He, Jia-gang Wang, Jia-an Yan, Semimartingale theorey and stochastic

calculus, Science Press, New York 1992.

eResources addresses

Example issues/ example questions/ tasks being completed

Discuss the construction of stochastic integrals with respect to local martingales with continuous paths.

Give the general stopping theorem.

Give the Ito formula and proved it.

Practical activites within the subject

Not applicable

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