



## Subject card

Subject name and code	Stochastic integral, PG_00021509						
Field of study	Mathematics						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2026/2027		
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					
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	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	<p>Course content – lecture Probability spaces with filtration. Stochastic basis. Stopping times and their basic properties. Classification of stopping times. Optional i prognose sigma-algebras. Increasing processes, processes with finite variation and processes with integrable variation. 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 its applications.. The Girsanov theorem. The decomposition of local martingales. Stochastic integral with respect to local martingales and semimartingales.</p> <p>Course content – exercises Probability spaces with filtration. Stochastic basis. Stopping times and their basic properties. Classification of stopping times. Optional i prognose sigma-algebras. Increasing processes, processes with finite variation and processes with integrable variation. 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 its applications.. The Girsanov theorem. The decomposition of local martingales. Stochastic integral with respect to local martingales and semimartingales.</p>														
Prerequisites and co-requisites	Probability theory, measure theory and functional analysis.														
Assessment methods and criteria	<table border="1" data-bbox="451 530 1487 674"> <thead> <tr> <th data-bbox="451 530 794 566">Subject passing criteria</th> <th data-bbox="794 530 1137 566">Passing threshold</th> <th data-bbox="1137 530 1487 566">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 566 794 602">Colloquium 1</td> <td data-bbox="794 566 1137 602">51.0%</td> <td data-bbox="1137 566 1487 602">20.0%</td> </tr> <tr> <td data-bbox="451 602 794 638">Colloquium 2</td> <td data-bbox="794 602 1137 638">51.0%</td> <td data-bbox="1137 602 1487 638">20.0%</td> </tr> <tr> <td data-bbox="451 638 794 674">Exam</td> <td data-bbox="794 638 1137 674">51.0%</td> <td data-bbox="1137 638 1487 674">60.0%</td> </tr> </tbody> </table>			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%
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Example issues/ example questions/ tasks being completed	<p>Discuss the construction of stochastic integrals with respect to local martingales with continuous paths.</p> <p>Give the general stopping theorem.</p> <p>Give the Ito formula and prove it.</p>														
Practical activities within the subject	Not applicable														

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