



Subject card

Subject name and code	Stochastic processes, PG_00062081						
Field of study	Procesy stochastyczne						
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	1		ECTS credits		5.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Division of Dynamical Systems -> Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics -> Wydział Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Klaudiusz Czudek				
	Teachers		dr Klaudiusz Czudek				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	30.0	60
	E-learning hours included: 0.0						
	eNauczanie source addresses: Moodle ID: 2369 Procesy stochastyczne https://enauczanie.pg.edu.pl/2025/course/view.php?id=2369						
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	Introduction to basic notions and theorems of the theory of stochastic processes. Equipping a student in the knowledge supporting modelling of the dynamics of random phenomenon.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W02] has enhanced knowledge of a selected branch of mathematics, theoretical or applied, knows classical definitions and theorems and their proofs and connections with other fields, understands problems being examined	Gives definitions of a stochastic process, Wiener process, Poisson process. Gives the statement of the Kolmogorov existence theorem. Gives basic properties of Brownian motion.	[SW1] Ocena wiedzy faktograficznej
	[K7_U04] applies the concepts of measure theory in typical theoretical and practical problems	Evaluates characteristics of stochastic processes using methods of measure theory and Lebesgue integral.	[SU4] Ocena umiejętności korzystania z metod i narzędzi [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu
	[K7_U06] uses probability distributions and their properties in practical issues, is familiar with the basics of statistics and the basics of statistical data processing	Describes families of finite dimensional distributions using classical probability measures	[SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu
	[K7_U09] constructs mathematical models used in specific advanced applications of mathematics, can use stochastic processes as a tool for modeling phenomena and analyzing their evolution, constructs mathematical models used in specific advanced applications of mathematics, uses stochastic processes as a tool for modeling phenomena and analyzing their evolution, recognizes mathematical structures in physical theories	Constructs risk models of selected problems in non-life and life insurance.	[SU2] Ocena umiejętności analizy informacji
Subject contents	Course content – lecture LECTURES Revision of selected parts of probability theory and introduction of notion. Moment generating function and its properties. Stochastic processes - definition and examples. Finite dimensional distributions of a stochastic process. Homogeneous Poisson process. Non - homogeneous Poisson process. Markov chains. Branching processes. Martingales. Doob Theorem. Renewal processes. Classical Brownian motion process. Gaussian processes. Trajectories of a classical Brownian motion and their properties. Diffusion processes. Kolmogorov Theorem. SEMINARS Revision of methods of probability theory. Sequences of random variables (exponential, Bernoulli, geometrical) and their asymptotic properties. Moment generating function. Random walks. Markov chains. Poisson processes. Renewal processes. Stochastic matrices. Ergodic theory of Markov operators. Reversible chains. Markov semigroups and their generators. Martingales. Stationary processes. Gaussian processes.		
Prerequisites and co-requisites	Courses completed: Probability Theory (MAT1013)		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Exam	51.0%	50.0%
	Tests	51.0%	50.0%
Recommended reading	Basic literature J. Jakubowski, R. Sztencel, Wstęp do teorii prawdopodobieństwa, Wydawnictwo SCRIPT, Warszawa, 2012. W. Feller, Wstęp do rachunku prawdopodobieństwa, t.I i II, PWN, Warszawa, 2014. O. Kallenberg "Foundations of modern probability" Billingsley "Prawdopodobieństwo i miara"		

	Supplementary literature	van Kampen "Stochastic processes in physics and chemistry" J.R.Norris, Markov Chains, Cambridge University Press, Cambridge, 2007. S.R.S.Varadhan, Stochastic Processes, AMS, Rhode Island, 2007.
	eResources addresses	
Example issues/ example questions/ tasks being completed	The students present solution of problems from a given set. Tests problems are selected from mentioned lists and the exam on topics from lectures. Evaluate the extinction/ruin probability. Find stationary distribution. Find one-parameter semigroup from its generator. Classify states. Verify whether a given process is a martingale. Verify the strong Markov property.	
Practical activities within the subject	Not applicable	

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