GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Probability Theory, PG_00025511		
Field of study	Mathematics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2027/2028
Education level	first-cycle 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	blended-learning
Year of study	3	Language of instruction	Polish
Semester of study	5	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department Of Probability Theory And Biomathematics -> Faculty Of Applied Physics And Mathematics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Tomasz Szarek	
	Teachers		

Lesson types and methods of instruction

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: 28.0

Adresy na platformie eNauczanie:

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 of modern probability based on measure theory. Equipping a student in the knowledge necessary for uderstanding randomness and relevant interaction with the surrounding environment and sociopolitical reality.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_U11	Precisely describes different types of random events using the language of axiomatic probability theory. Distinguishes different types od random variables and evaluates their expectations, variances and other moments. Interprets (in applications)laws of large numbers. Estimates parameters of distributions. Performs statistical inference.	[SU3] Assessment of ability to use knowledge gained from the subject
K6_W04	Uses methods of logic, analysis, algebra and measure theory in probability.	[SW1] Assessment of factual knowledge
K6_W02	Recognizes conditional probability, independence of events and random variables.	[SW1] Assessment of factual knowledge
K6_U02	Explains different nodes of stochastic convergence.	[SU1] Assessment of task fulfilment
K6_U03	Constructs probability space to a concrete phenomena. Applies methods of linear algebra and analysis to describe multivariate random effects.	[SU4] Assessment of ability to use methods and tools

<table>
<tr><td>Subject contents</td><td>LECTURES Radon-Nikodym theorem. Conditional expectation. Regression. Sums of independent random variables. Weak law of large numbers. L^2 law of large numbers. Strong law of large numbers (Kolmogorov, Etemadi). Stationary sequences. Maximal ergodic lemma. Individual ergodic theorem for stationary sequences. Empirical distributions. Glivenko-Cantelli theorem. Weak convergence of measures. Characteristic functions. Central limit theorem. Multivariate Gaussian distributions. Fourier transform of measures on R^n. Descriptive statistics. Point estimators. Confidence intervals. Hypothesis testing. Statistical inferring.

TUTORIALS During tutorial classes (closely correlated with lectures) students solve numerical exercises and selected theoretical problems.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Courses completed: Probability Theory term IV (MAT1013/1)</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Test 1</td><td>51.0%</td><td>25.0%</td></tr>
<tr><td>Test 2</td><td>51.0%</td><td>25.0%</td></tr>
<tr><td>Exam</td><td>51.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>J.Jakubowski, R.Sztencel, Wstęp do teorii prawdopodobieństwa, Wydawnictwo SCRIPT, Warszawa, 2012.

J.Jacod, P.Protter, Probability Essentials, Springer, Berlin Heidelberg, 2000.

W.Feller, Wstęp do rachunku prawdopodobieństwa, t.I i II, PWN, warszawa, 2009.</td></tr>
<tr><td>Supplementary literature</td><td>I.I.Gichman, A.W.Skorochod, Wstęp do teorii procesów stochastycznych, PWN, Warszawa, 1968.

P.Billingsley, Prawdopodobieństwo i miara, PWN, Warszawa, 1987.

G.Grimmett, D.Stirzaker, Probability and Random Processes, Oxford University Press, 2006.

R.Magiera, Modele i metody statystyki matematycznej, GiS, Wrocław, 2002.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>At the beginning of the term students are provided with the list of problems and exercises to be solved or worked out by themselves. Their solutions are presemted on exercises where students give their comments and suggest improvements. Test problems are based on mentioned lists and exam on topics from lectures.

Find conditional expectation with respect to a fixed sigma algebra. Study weak convergence and find the limit distribution foe a given sequence of random variables. Estimate a probability of a random event using the central limit theorem.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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