GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Probability Methods and Statistics, PG_00047544		
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2020/2021
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	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Teleinformation Networks -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Roman Rykaczewski	
	Teachers	dr hab. inż. Roman Rykaczewski dr inż. Maciej Sac dr inż. Mariusz Dzwonkowski dr inż. Bartosz Czaplewski	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	15.0	0.0	0.0	0.0	30

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	30	3.0	42.0	75

Subject objectives

Knowledge of basic methods of one- and multidimensional random variable analysis. Knowledge of basic ideas from mathematical statistics.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U07] can apply methods of process and function support, specific to the field of study	Student is able to apply the acquired knowledge to formulating problems and proposing the proper solving method	[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
[K6_W01] Knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	Student is possessing a skill of formulating problems requiring solving non-deterministic problems using mathematical methods	[SW1] Assessment of factual knowledge
[K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn	The student is possessing the basic knowledge and skills of formulating problems and applying probabilistic appropriate methods in solving technical application problems	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject

Subject contents	1. Definition of random event, algebra of random events, axiomatic and other definitions of the probability. 2. Conditional probabilities, independent events, law of total probability, Bayes theorem 3. Definitions of continous and discrete random variables. Definition and properties of cumulative distribution function. Definition and properties of probability density function. 4. Multidimensional random variables (MRV), cumulative distribution function of MRV, marginal distributions of MRV. 5. Conditional distributions of RV. Examples of conditional distributiuons calculation; properties of conditional distributions. 6. Mean value: definition, properties, conditional expected value and its properties, connection between conditional expected value of RV and its mean value 7. Higher order statistical moments of RV; variance of RV: definition, properties; standard deviation. 8. Moments of multidimensional RV, mixed moments, correlation coefficient, covariance coefficient, covariance matrix, normed correlation coefficient. 9. Examples and areas of implementation of discrete RV distributions: two-point, binomial, Poisson, geometric. 10. Examples and applications of continuous RV distributions: exponential, Weibull, Rice, Rayleigh, Gauss. 11. Gauss distribution of multidimensional RV. 12. Functions of RV: probability distribution of discrete RV function, probability density function of continous RV. Examples of applications. 13. Definitions of limits of RV sequences. First and second Tchebyschev inequalities. Markov large number theorem, limit theorems. 14. Entropy of RV: definition, joint entropy, quantity of information, digital channel capacity. 15. Elements of mathematical statistics: definition and properties of estimators. 16. Examples of estimators of mean value and variance of RV.
Prerequisites and co-requisites	No requirements
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
exam (problems and questions)	50.0%	40.0%
2 tests (problems and questions)	50.0%	60.0%

Recommended reading	Basic literature	Sobczak W., Konorski J., Kozłowska J.:Probabilistyka stosowana, Wyd. PG, 2004r.
	Supplementary literature	A. Papoulis: Probability, Random Variables, and Stochastic Processes, McGraw-Hill, 1991
	eResources addresses	
Example issues/ example questions/ tasks being completed	Example **problem**: Random variable (RV) probability density function is given by the formula $p(x) = Cx$ for $-2 \le x \le 1$ as well as for $1 \le x \le 2$ and $p(x)=0$ for x outside of these intervals. Calculate: the constant C, cumulative distribution function; the mean value of RV $\underline{X}$; probability density function of RV $\underline{Y}=\ln\lvert\underline{X}\rvert$ and its mean value. Example **question**: Write and prove Markov inequality.	
Work placement	Not applicable	