GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Random Processes, PG_00047425
Field of study	Electronics and Telecommunications

Date of commencement of studies	October 2022	Academic year of realisation of subject	2023/2024
Education level	second-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	2	Language of instruction	English
Semester of study	3	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment

Conducting unit	Department of Teleinformation Networks -> Faculty of Electronics, Telecommunications and Informatics

Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Bartosz Czaplewski
	Teachers	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	4.0	16.0	50

Subject objectives	Knowledge of basic properties of random processes and obtaining skills of computing and analysing of random processes characteristics.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by:n-appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation,n-application of appropriate methods and toolsn	Student identifies, classifies and describes basic types of random processes, analyses their properties, calculates parameters and characteristics of random processes.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
	[K7_W01] Knows and understands, to an increased extent, mathematics to the extent necessary to formulate and solve complex issues related to the field of study.	Student knows basic kinds and properties of random processes	[SW1] Assessment of factual knowledge

Subject contents	
	1.Random vectors: Definition of a random vector, Cumulative distribution function of a random vector, Probability mass function of a random vector, Probability density function of a random vector, Joint cumulative distribution and joint probability density functions, Marginal cumulative distribution and marginal probability density functions, Conditional cumulative distribution and conditional prob. density functions, Complex random vectors2.Statistical moments of random vectors: Estimator, The mean value of the random vector, Autocorrelation matrix and cross-correlation matrix, Autocovariance matrix and cross-covariance matrix, Conditional mean value of a random vector3.Central Limit Theorem (Lindberg-Levy)4.Estimation of statistical moments of random vectors5.Multivariate Gaussian distribution6.Linear transformations of random vectors7.Diagonalization of autocorrelation matrices and autocovariance matrices8.Random processes: Definition of a random process, Classification of random processes, Cumulative distribution function of a random process, Probability density distribution of a random process, Conditional probability density distributions of random processes, Independence of random processes9.Statistical moments of random processes: The mean value function of a random process, Autocorrelation function of a random process, Autocovariance function of a random process, Cross-correlation function of random processes, Cross-covariance function of random processes, Properties of correlation and covariance functions10.Stationarity of random processes11.Ergodicity of random processes12.Bernoulli random process13.Binomial process14.The random walk process15.Wiener random process16.Gaussian (Normal) random processes17.Markov random processes18.Markov chains19.Hidden Markov model20.The martingales and absolutely fair processes21.Periodic random processes22.Description of random processes in the frequency domain: Power spectral density, Cross power spectral density, Sampling theorem for random processes, White noise

Prerequisites and co-requisites	No requirements

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	50.0%	100.0%

Recommended reading	Basic literature	A. Papoulis, Probability, Random Variables, and Stochastic Processes, McGraw-Hill, 1991 Therrien, C. W. Discrete Random Signals and Statistical Signal Processing. Prentice-Hall, 1992. Hwei P. Hsu, Theory and Problems of Probability, Random Variables and Random Processes, McGraw-Hill, 1997.
	Supplementary literature	No requirements
	eResources addresses	Adresy na platformie eNauczanie: Random Processes 2023/2024 - Moodle ID: 29308 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29308

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable