



## Subject card

Subject name and code	Random Processes, PG_00048303						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	February 2023	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	1	Language of instruction			Polish		
Semester of study	2	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.		The student knows basic kinds and properties of random processes		[SW1] Assessment of factual knowledge		

Subject contents	<p>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 vectors</p> <p>2. 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 vector</p> <p>3. Central Limit Theorem (Lindberg-Levy)</p> <p>4. Estimation of statistical moments of random vectors</p> <p>5. Multivariate Gaussian distribution</p> <p>6. Linear transformations of random vectors</p> <p>7. Diagonalization of autocorrelation matrices and autocovariance matrices</p> <p>8. 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 processes</p> <p>9. 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 functions</p> <p>10. Stationarity of random processes</p> <p>11. Ergodicity of random processes</p> <p>12. Bernoulli random process</p> <p>13. Binomial process</p> <p>14. The random walk process</p> <p>15. Wiener random process</p> <p>16. Gaussian (Normal) random processes</p> <p>17. Markov random processes</p> <p>18. Markov chains</p> <p>19. Hidden Markov model</p> <p>20. The martingales and absolutely fair processes</p> <p>21. Periodic random processes</p> <p>22. Description of random processes in the frequency domain Power spectral density Cross power spectral density Sampling theorem for random processes White noise</p>
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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: Procesy losowe 2023/2024 - Moodle ID: 29307 <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=29307">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=29307</a>	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		