GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00044948						
Field of study	Mathematics						
Date of commencement of studies	October 2021		Academic year of realisation of subject		2023/2024		
Education level	first-cycle studies		Subject group		Optional 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	3		Language of instruction		Polish		
Semester of study	5		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Zakład Równań Różniczkowych i Zastosowań Matematyki -> Instytut Matematyki Stosowanej -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Robert Krawczyk					
	Teachers	dr inż. Robert Krawczyk					

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	15.0	0.0	60
	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	60	5.0	35.0	100

Subject objectives	The use of mathematical tools in selected methods of signal analysis; identifying and solving problems related to signal processing and mathematical modeling of phenomena from other fields of science and engineering.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K6_U08	The student applies the acquired mathematical knowledge in issues related to signal analysis, data analysis and optimization.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
	K6_K03	Students in groups of 2-3 people carry out project tasks related to signal analysis.	[SK4] Assessment of communication skills, including language correctness [SK1] Assessment of group work skills
	K6_U06	The student applies the acquired mathematical knowledge in signal analysis.	[SU3] Assessment of ability to use knowledge gained from the subject
	K6_U05	The student analyzes the known methods of signal processing and reconstruction and uses them in various cases; constructs and critically evaluates mathematical models.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
	K6_W03	The student learns the basic concepts of system identification, mathematical modeling and sampling theory. The student combines knowledge of mathematics with knowledge of other fields.	[SW1] Assessment of factual knowledge

Subject contents	The concept of mathematical model, signal and identification. Continuous- and discrete-time Fourier transform (CTFT and DTFT), frequency spectrum of the signal. LTI and impulse response systems. The concepts of sampling, quantizing and filtering of the signal. The sampling process and the relation between CTFT of a continuous signal and DTFT of its sampled signal. Shannon-Nyquist sampling theorem in signal reconstruction. Bohr almost periodic functions: definition and basic properties. Generalized trigonometric polynomial and Fourier series. Continuous almost periodic signals as sums of periodic signals. Wavelet transform, Haar wavelets.
Prerequisites and co-requisites	Knowledge from courses: Mathematical Analysis, Linear Algebra and Differential equations. Additionally: selected topics of Functional Analysis and Measure Theory/Probability.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Passing lecture classes (Quiz on eNauczanie and Final Test)	50.0%	40.0%
	Project	50.0%	30.0%
	Test in practical exercises	50.0%	30.0%

Recommended reading	Basic literature	Y. C. Eldar, *Sampling theory: Beyond Bandlimited Systems*, Cambridge University Press, 2015
		S. Stoiński, *Funkcje prawie-okresowe*, Wydawnictwo Naukowe UAM, Poznań, 2008
		P. Wojtaszczyk, *Teoria falek. Podstawy matematyczne*, Wydawnictwo Naukowe PWN, Warszawa, 2000
		J. Andres, A.M.Bersani, R.F. Grande, *Hierarchy of almost-periodic function spaces*, Rendiconti di Matematica, Serie VII Volume 26, Roma (2006), 121-188
	Supplementary literature	G.Kaiser, *A Friendly Guide to Wavelets*, Birkhauser, Boston, 1995
		R. Isermann, M. Münchhof, *Identification of Dynamic Systems. An Introduction with Applications.* Springer-Verlag Berlin Heidelberg 2011. A. Bogges, F. J. Narcowich, *A first course in wavelets with Fourier analysis.* Upper Saddle River, NJ
	eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	Calculate CTFT transform of a given signal. Nyquist rate. Almost periodic signal. Autocorrelation function. Haar system. Examples of causal and non-causal LTI systems.
Work placement	Not applicable