GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Digital Signal Processing, PG_00038275		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
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	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Partment of Metrology and Information Systems -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Ariel Dzwonkowski	
	Teachers	dr inż. Ariel Dzwonkowski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	20.0	0.0	10.0	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	6.0	39.0	75

Subject objectives

The aim of the course is to provide the student with knowledge of digital signal processing. The student will gain knowledge of analog-digital processing processes. The student will learn about frequency and time-frequency analysis of signals. In addition, the student will learn about the types of filters and their parameters as well as methods of their design.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U10] is able to apply the known mathematical tools and methods and computer techniques to analyse and evaluate automation and robotics components, devices, systems and systems	Determines signal parameters. Implements frequency analysis algorithms. Characterizes digital filters and verifies their parameters. Calculates time-frequency spectra of signals.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[K7_W03] has knowledge of digital signal processing algorithms, knows methods of designing digital circuits with given parameters	Defines types of signals and their characteristics. Implements methods of frequency analysis of signals. Defines types of filters and methods of their design. Uses algorithms for processing non-stationary signals.	[SW1] Assessment of factual knowledge

Subject contents

Course content – lecture

LECTURE

Types of signals. Correlation and autocorrelation of signals. Analog-to-digital and digital-to-analog processing. Aliasing phenomenon. Continuous and discrete Fourier transform. Signal filtration. Finite and infinite impulse response filters - principle of operation, comparison, design. Hilbert transform. STFT and wavelet analysis, basics and applications. Two-dimensional signal processing. Examples of digital signal processing applications.

LABORATORY

Introduction to Digital Signal Processing in LabVIEW. Sampling, quantization, signal reconstruction, aliasing, spectral analysis. Filters of finite and infinite impulse response. Adaptive filtering. Time-frequency analysis (STFT, wavelet analysis).

Prerequisites and co-requisites

Basic knowledge of mathematical analysis.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory - Practical exercise	60.0%	40.0%
	Lecture - midterm colloquium	60.0%	60.0%
Recommended reading	Basic literature	1. Zieliński T. P.: Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań. Wydawnictwa Komunikacji i Łączności. Warszawa 2005. 2. Marven C., Ewers G.: Zarys cyfrowego przetwarzania sygnałów. Wydawnictwa Komunikacji i Łączności. Warszawa 1999. 3. Lyons R. G.: Wprowadzenie do cyfrowego przetwarzania sygnałów. Wydawnictwa Komunikacji i Łączności. Warszawa 2006. 4. Ryszard S. Choraś, Przetwarzanie sygnałów. Wydawnictwa Uczelniane Uniwersytetu Technologiczno-Przyrodniczego, Bydgoszcz, cop. 2014. 5. Mark Owen, Przetwarzanie sygnałów w praktyce, z jęz. ang. tł. Michał Klebanowski, Warszawa : Wydawnictwa Komunikacji i Łączności, 2009. 6. Wojciech Zając, Cyfrowe przetwarzanie sygnałów w zastosowaniach. Akademia im. Jakuba z Paradyża w Gorzowie Wielkopolskim, 2020, Gorzów Wielkopolski.	
	Supplementary literature	1. Kehtarnavaz N., Kim N.: Digital Signal Processing. System-Level Design Using LabVIEW. Elsevier 2005. 2. Clark C. L.: Digital Signal Processing and Digital Communications. McGraw-Hill 2005. 3. Haykin S.: Communication Systems. John Wiley & Sons 2000. 4. Świsulski D.: Komputerowa technika pomiarowa. Oprogramowanie wirtualnych przyrządów pomiarowych w LabVIEW. Agenda Wydawnicza PAK, Warszawa 2005.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	1. How are they made and what they are sample & hold circuits? 2. What is aliasing? 3. Types of digital filters. 4 What is the Fourier transform for discrete signals? 5. What is the STFT analysis? 6. Describe the properties of parametric Kaiser window. 7. Introduce an example of practical use of digital signal processing.		
Practical activites within the subject	Not applicable		

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