GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Dynamic Signals and Systems, PG_00058787		
Field of study	SYGNAŁY I SYSTEMY DYNAMICZNE		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	
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	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Intelligent and Decision Support Systems -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Bartosz Puchalski	
	Teachers	dr inż. Bartosz Puchalski dr inż. Tomasz Rutkowski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	0.0	0.0	45

E-learning hours included: 0.0

eNauczanie source addresses:
Moodle ID: 856 SYGNAŁY I SYSTEMY DYNAMICZNE [ET][2025/26]
https://enauczanie.pg.edu.pl/2025/course/view.php?id=856

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	45	3.0	27.0	75

Subject objectives

The aim of the course is to provide students with knowledge and skills in the analysis and processing of continuous and discrete time signals.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_U04	Performs discrete Fourier transforms (DFT) for the analysis of discrete signals and sampled continuous signals. Designs and implements digital filters.	[SU1] Ocena realizacji zadania [SU2] Ocena umiejętności analizy informacji [SU4] Ocena umiejętności korzystania z metod i narzędzi
K6_W08	Performs frequency analysis of continuous and discrete signals. Determines relationships between the spectra of sampled signals and analog originals. Models and analyzes linear continuous and discrete dynamic systems in the time and frequency domains. Determines relationships between the spectra of analog reconstructions and discrete originals.	[SW1] Ocena wiedzy faktograficznej

Subject contents

Course content – lecture
LECTURE Representations of continuous and discrete signals. Sampling. Frequency of discrete signals. Sampling theorem. Complex exponential signal. Fourier series of a continuous signal. Fourier series of a discrete signal. Fourier transform of continuous and discrete signals. Discrete Fourier transform. Z transform. Basic properties of systems. Representations of linear dynamic systems: differential/difference equations, transfer function, spectral transfer function, discrete convolution. Signal transmission through linear systems. Basic structures of digital filters. Designing digital filters based on the characteristics of analog filters. Reconstruction of analog signals. Increasing and decreasing the sampling frequency.

Course content – laboratory
LABORATORY Fourier series. Implementation of discrete Fourier transform (DFT). Use of sampling and DFT for frequency analysis of selected analog signals (rectangular, sawtooth, etc.). Spectral analysis of distorted signals. Determination of the total harmonic distortion (THD) index of these waveforms. Design, implementation, and testing of selected digital filters.

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Knowledge acquired and relevant to the current field of study, level, semester, and form of study that the student is enrolled in.</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Test of lecture-related knowledge</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Reports and tests related to laboratory exercises</td><td>50.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">1. Śleszyński W.: Sygnały i systemy dynamiczne. Politechnika Gdańska, Wydział Elektrotechniki i Automatyki, Gdańsk 2010.
2. Wojciechowski J. M.: Sygnały i systemy. WKŁ, Warszawa 2008.
3. Zieliński T.P.: Cyfrowe przetwarzanie sygnałów. WKŁ, Warszawa 2007.
4. Oppenheim A. V., Willsky A. S., Nawab S. H.: Signal and Systems.Prentice-Hall, 1997.
5. Chen C.-T.: System and Signal Analysis. Saunders College Publishing, 1994.</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">1. Szabatin J.: Podstawy teorii sygnałów. WKŁ, Warszawa 2000.
2. Izydorczyk J., Płonka G., Tyma G.: Teoria sygnałów. Helion, Gliwice 1999.
3. Gabel R., Roberts R. A.: Sygnały i systemy liniowe. WNT, Warszawa 1978.
4. Lyons R.G.: Wprowadzenie do cyfrowego przetwarzania sygnałów. Warszawa: WKŁ 2000.
5. Oppenheim A. V., Schafer R.W.: Cyfrowe przetwarzanie sygnałów. WKŁ, Warszawa 1979.
6. Franklin G.F., Workman M.L., Powell D.: Digital Control of Dynamic Systems. Addison-Wesley, 1998.</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">1. A periodic sequence of period N is made of the following samples (per period): 4, 2, 0, 3, 0, -3, 2, 0. Find the Fourier series coefficient c2.
2. Draw a block schematic of the discrete-time system defined by a given transfer function.
3. Find the difference equation of the dynamic system defined by a given transfer function. Compute the first 6 samples of the response of the system to a given input sequence.
4. Find the difference equation an transfer function of the filter defined by a given block schematic. Compute the filter gain for selected frequencies.
5. Using the "Euler backward" method (s = (1 - 1/z) / T), digitize the PI controller with the following transmittance:
R(s) = Kp + Ki / s. Give the differential equation of the controller. Calculate the steady-state value of the impulse response and the starting value of the step response.</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="3">Not applicable</td></tr>
</table>

Document generated electronically. Does not require a seal or signature.