GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Signal Processing, PG_00067427		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	first-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	Polish
Semester of study	3	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Radiocommunication Systems and Networks -> Faculty of Electronics Telecommunications and Informatics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jarosław Sadowski	
	Teachers	dr hab. inż. Jarosław Sadowski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	0.0	45
	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	45	2.0	28.0	75

Subject objectives	Student uses basic analog and discrete-time signal processing algorithms and tools. Student analyzes signals and systems in the time and frequency domains. Student designs elementary discrete-time systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W03] knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	The student understands the basic properties of analog, discrete-time, and digital signals. The student knows basic methods of signal processing in digital systems.	[SW1] Assessment of factual knowledge
[K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn	Student uses the basic tools of signals and discrete-time systems analysis. Student is able to choose the right tool for the analysis and design of discrete-time systems and assess obtained results.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[K6_U03] can design, according to required specifications, and make a simple device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Student is able to design and analyze a simple digital signal processing system.	[SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment

Subject contents

Topics covered during the lecture: 1. Classification of signals. 2. Representation of continuous-time signals in the frequency domain. Continuous Fourier transformation. 3. Properties of continuous Fourier transformation. Analogue signal spectrum. 4. Discrete-time Fourier transformation (DTFT). 5. Properties of the DTFT. Discrete-time signal spectrum. 6. Processing of a discrete-time signal by a linear system. 7. Discrete-time complex signal - instantaneous amplitude, phase and angular frequency. 8. Hilbert transformation of a discrete-time signal. Applications. 9. Complex envelope of a discrete-time band-pass signal. 10. Analog to digital conversion 11. Digital to analog conversion. 12. Quantization noise and its additive model. 13. Estimating the signal to quantization noise power ratio. 14. Difference equations for discrete-time linear systems having finite (FIR) and infinite (IIR) impulse responses. 15. Block schemes of discrete-time systems. 16. The Z transformation. 17. Transfer function of a discrete-time system. 18. Discrete-time systems of finite impulse response. 19. Discrete-time systems of infinite impulse response. 20. Realizability of dicrete-time systems in real time versus causality. 21. Stability. Minimum-phase discrete-time systems. 22. Introduction to digital FIR and IIR filtering. 23. Examples of designing elementary digital filters. 24. Discrete Fourier transformation (DFT). 25. Fast Fourier transformation (FFT). Applications. 26. Relationships between: DTFT, DFT and Z transformations. 27. Discrete linear convolution. 28. Circular convolution. Applications. 29. Introduction to interpolation and decimation. 30. Applications of interpolation and decimation.

Topics covered during classes: frequency domain analysis of analog, discrete-time and digital signals, signal sampling and quantization, design and analysis of digital filter properties, properties and applications of the Z transform in signal processing.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Midterm colloquium	50.0%	50.0%
Written exam	50.0%	50.0%

Recommended reading

Basic literature	A.V. Oppenheim, R.W. Schafer with J. R. Buck: Discrete-Time Signal Processing. Prentice Hall International, 1999.
Supplementary literature	S.W.Smith: The scientist and engineer's guide to digital signal processing, California Technical Pub,1997
eResources addresses	

Example issues/ example questions/ tasks being completed

Work placement

Not applicable

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