



Subject card

Subject name and code	Signal Processing, PG_00068214						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	October 2026	Academic year of realisation of subject				2027/2028	
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 Teleinformation Networks -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Jarosław Sadowski				
	Teachers		dr hab. inż. Jarosław Sadowski				
Lesson types	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		4.0		26.0	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_W04] knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices	The student knows and describes basic tools and algorithms of analog and discrete-time and digital signal processing methods. The student is familiar with the basic methods of signals and systems analysis in the time and frequency domain. The student knows the structures and design methods of basic discrete-time signal processing systems.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
	[K6_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study	The student uses basic tools of discrete signals analysis and is able to design and analyze a simple digital signal processing system.			[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		

Subject contents	<p>Course content – lecture 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 discrete-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.</p> <p>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.</p>		
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. Schaffer 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			
Practical activities within the subject	Not applicable		

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