



## Subject card

Subject name and code	Advanced Techniques of Signal Processing, PG_00064011						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	February 2025		Academic year of realisation of subject			2025/2026	
Education level	second-cycle studies		Subject group			Optional subject group Specialty 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	1		Language of instruction			Polish	
Semester of study	2		ECTS credits			2.0	
Learning profile	general academic profile		Assessment form			assessment	
Conducting unit	Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Janusz Smulko				
	Teachers		prof. dr hab. inż. Janusz Smulko				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	15.0	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		4.0		16.0	50
Subject objectives	Mastering knowledge of the selected advanced methods of analyzing and signal processing. The methods are selected by focusing on applications in engineering practice. The methods are illustrated with exemplary, engineering applications. The methods should help students in solving problems related to measurement and control systems, which use the signals collected from various sensors and systems.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by: - appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation, - application of appropriate methods and tools	Student can apply analysis methods to solve metrology problems.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools
	[K7_W03] knows and understands, to an increased 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	Knowledge of the selected DSP algorithms.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
	[K7_W04] knows and understands, to an increased extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or other elements or programmable devices specific to the field of study, and organization of work of systems using computers or such devices	DSP methods can be applied for metrology, to solve different issues.	[SW3] Assessment of knowledge contained in written work and projects
Subject contents	The principles of digital signal processing (nonuniform signal sampling), methods of spectral analysis (power spectral density estimation, higher spectra), stochastic resonans phenomena, Winer and Kalman filtering, linear and nonlinear adaptive filtering, methods of time-frequency analysis, methods of regression and detection using PCA and SVM algorithms, audio and video signals coding, DSL modem, multimedia apps in embedded systems - how to prepare.		
Prerequisites and co-requisites	Don't apply		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	seminar presentation	0.0%	50.0%
	test	50.0%	50.0%
Recommended reading	Basic literature	Haykin S.: Adaptive filter theory. Prentice Hall, 2001.  Zieliński T.P.: Cyfrowe przetwarzanie sygnałów. WKiŁ, Warszawa 2005.  Vaseghi S.V.: Advanced Digital Signal Processing. Wiley 2009.	
	Supplementary literature	Bilinskis I.: Digital alias2free signal processing. Wiley 2007. Haykin S.: Adaptive filter theory. Prentice Hall, 2001.  Kuo S.M., Gan W.S.: Digital signal processors 2 architectures, implementations and applications. Prentice Hall, 2005.  Chassaing R.: Digital signal processing and applications with the C6713 and C6416 DSK. Wiley 2005.	
	eResources addresses	Adresy na platformie eNauczanie:	

<p>Example issues/ example questions/ tasks being completed</p>	<p>nonuniform sampling power spectra (parametric and nonparametric methods: ARMA, ME, Welch method) polispectra (e.g., bispectrum) stochastic resonance, applications optimal linear filtering (Wiener, Kalman filtering) algorithms of adaptive filtering active noise reduction in headphones ADSL modem mp3 files coding methods of time-frequency analysis(time-frequency resolution, time-varying filtering) image denoising (wavelets, fractals, Savitzky-Golay smoothing, median filter, reduction of harmonic distortions) algorithms of video coding (DCT, quantization, run-length coding, Huffman coding) video transmission by Internet</p>
<p>Work placement</p>	<p>Not applicable</p>

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