



Subject card

Subject name and code	Signal and image processing, PG_00057031						
Field of study	Mechatronics						
Date of commencement of studies	February 2023		Academic year of realisation of subject		2023/2024		
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	Full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		3.0		
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		dr inż. Marcin Strąkowski				
	Teachers		dr inż. Marcin Strąkowski				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	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 gains knowledge in the field of advanced methods of processing and analysis of digital signals and images.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_W01] has extended knowledge in terms of selected areas of mathematics, including discrete and applied mathematics, optimisation methods, mathematical and numerical methods essential for: 1) modelling and analysis of nonstationary mechatronics, continuous and discrete time systems as well as physical phenomena; 2) description and analysis of mechatronic systems that include programmable devices 3) description and analysis of signal processing algorithms 4) synthesis of non-stationary mechatronic systems		Student knows the methods of description, modeling and analysis of discrete systems for digital signal and image processing.		[SW1] Assessment of factual knowledge		
	[K7_U06] is able to evaluate feasibility and possibility of application of new achievements (technical and technological) in terms of mechatronics		Chooses and applies methods of noise reduction, filtration and analysis of stochastic digital signals and images correctly.		[SU1] Assessment of task fulfilment		
	[K7_W05] has detailed, supported by the theory knowledge in terms of control theory, identification methods, concurrent and real time programing, signal and image processing and Artificial Intelligence		Student has knowledge related to the design and implementation of advanced digital signal and image processing systems. He knows the methods and tools used today for advanced signal and image processing, including noise reduction and adaptive filtering.		[SW1] Assessment of factual knowledge		

Subject contents	Digital filtering of signals and images (including non-uniform sampling), spectral analysis and estimation of power spectral density, higher order spectra, Wiener and Kalman filter, linear and nonlinear adaptive filtering, time-frequency analysis (STFT, wavelet), methods of noise reduction , regression and detection methods according to PCA and SVM algorithms, image processing in measurement applications, vision (stereovision) measurement systems.		
Prerequisites and co-requisites	Knowledge of the basics of digital signal and image processing.Basic knowledge of discrete mathematics.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Tests during semester	50.0%	60.0%
	Completion of all laboratory exercises	50.0%	40.0%
Recommended reading	Basic literature	1. Haykin S.: Adaptive filter theory. Prentice Hall, 2001. 2. Zieliński T.P.: Cyfrowe przetwarzanie sygnałów. WKiŁ, Warszawa 2005. 3. Vaseghi S.V.: Advanced Digital Signal Processing. Wiley 2009. 4. W. Malina, M. Smiatacz, Cyfrowe przetwarzanie obrazów. Akademicka Oficyna Wydawnicza EXIT, Warszawa 2008	
	Supplementary literature	1. Bilinskis I.: Digital alias2free signal processing. Wiley 2007. 2. Haykin S.: Adaptive filter theory. Prentice Hall, 2001. 3. Kuo S.M., Gan W.S.: Digital signal processors 2 architectures, implementations and applications. Prentice Hall, 2005. 4. Chassaing R.: Digital signal processing and applications with the C6713 and C6416 DSK. Wiley 2005. 5. M. Seul, L. O'Gorman and M. Sammon, Practical Algorithms for Image Processing, Cambridge University Press, USA, 2000.	
	eResources addresses	Adresy na platformie eNauczanie: Przetwarzanie sygnałów i obrazów, WIMiO, II st., Mechatronika sem. 02 - 23/24 (PG_00057031) - Moodle ID: 29054 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29054	
Example issues/ example questions/ tasks being completed	1. Signal sampling 2. Parametric and non-parametric spectral analysis 3. Filtration according to Wiener and Kalman 4. Time-frequency analysis methods 5. Mono- and stereovision 3D scanners		
Work placement	Not applicable		