



## Subject card

Subject name and code	Signal analysis, PG_00060218						
Field of study	Analiza sygnału						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2025/2026		
Education level	first-cycle studies		Subject group		Optional 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	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Katedra Fizyki Teoretycznej i Informatyki Kwant. -> Faculty of Applied Physics and Mathematics -> Wydział Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Marek Czachor				
	Teachers		prof. dr hab. Marek Czachor				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	15.0	45
	E-learning hours included: 0.0						
	eNauczanie source address: <a href="https://enauczanie.pg.edu.pl/2025/course/view.php?id=1205">https://enauczanie.pg.edu.pl/2025/course/view.php?id=1205</a>						
	Moodle ID: 1205 Analiza sygnału <a href="https://enauczanie.pg.edu.pl/2025/course/view.php?id=1205">https://enauczanie.pg.edu.pl/2025/course/view.php?id=1205</a>						
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		5.0		25.0	75
Subject objectives	Introduction to Fourier and wavelet analysis						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W07] has knowledge of the construction and operation of physical instruments, measurement and research equipment		Knowledge of theoretical basis of Fourier and wavelet analysis.		[SW1] Ocena wiedzy faktograficznej [SW2] Ocena wiedzy zawartej w prezentacji		
	[K6_U07] presents facts within the scope of physics and other scientific disciplines in a clear manner		The ability to apply theoretical principles to prepare simple illustrations of sound and image analysis.		[SU1] Ocena realizacji zadania [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU4] Ocena umiejętności korzystania z metod i narzędzi [SU5] Ocena umiejętności zaprezentowania wyników realizacji zadania		
	[K6_W05] has knowledge of programming methodology and techniques, and the use of selected IT tools in physics and technology		Ability to apply modern programming techniques, in particular using artificial intelligence.		[SW2] Ocena wiedzy zawartej w prezentacji [SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym		
	[K6_U08] can prepare written works and speeches in Polish and English, concerning detailed issues of physics and related fields, and scientific disciplines		The ability to prepare a written thesis that meets the requirements of a diploma thesis or scientific publication.		[SU1] Ocena realizacji zadania [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU4] Ocena umiejętności korzystania z metod i narzędzi		

Subject contents	Lecture		
	1. Signal as a vector, signal analysis as a change of basis, scalar products and unitarity, resolutions of unity 2. Discrete Fourier transforms: complex, fast, cosine 3. Consequences of unitarity: Parseval's and Plancherel's theorems 4. Fourier transform on an interval and a line 5. Shannon's sampling theorem; Shannon's wavelet 6. Windowed Fourier transform; bases and frames 7. Fast Haar transform 8. Subband coding; downsampling and upsampling 9. Lowpass and highpass filters 10. Bi-orthogonality 11. From filters to wavelets 12. Compression		
	Seminar		
	1. Application of discrete Fourier transform to sound analysis 2. Two-dimensional Fourier transform applied to image compression 3. 2-dimensional Haar transform applied to image compression 4. Gibbs phenomenon and its minimization applied to a selected discontinuous signal 5. Sound analysis using windowed transform		
Prerequisites and co-requisites	Knowledge of elementary theory of Hilbert spaces and complex analysis		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	lecture	60.0%	50.0%
	seminar	50.0%	50.0%
Recommended reading	Basic literature	J. T. Białasiewicz, Falki i aproksymacje, WNT, Warszawa 2000 P. Wojtaszczyk, Teoria falek, PWN, Warszawa, 2000 G.Kaiser, A Friendly Guide to Wavelets, Birkhauser, Boston, 1995	
	Supplementary literature	No requirements	
	eResources addresses	Basic <a href="https://enauczanie.pg.edu.pl/2025/course/view.php?id=1205">https://enauczanie.pg.edu.pl/2025/course/view.php?id=1205</a> - Pdf files of the lectures, supplemented by comments in mp4 format	
Example issues/ example questions/ tasks being completed	Types of discrete Fourier transforms		
	Scheme of multiresolution analysis		
	Prove Shannon's sampling theorem		
Practical activities within the subject	Not applicable		

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