GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Processing of digital signals and images, PG_00065005		
Field of study	Mechanical and Medical Engineering		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2025/2026
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	1	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Mechatronics -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Marek Galewski	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	0.0	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	6.0	14.0	50

Subject objectives

Teaching students essential elements of digital sinal (ADC, DAC, filtration, spectral analysis) and image processing (point, context and morphological transformations)

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U15] evaluates the feasibility of advanced methods and tools for solving complex engineering tasks of a practical nature, characteristic of the field of study, and selects and applies appropriate methods and tools for this purpose	The student selects appropriate hardware components (considering their key parameters) and algorithms for signal and image processing, and avoids problems such as frequency leakage and aliasing	[SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
[K7_U02] formulates hypotheses to test research problems in the field of medical engineering	The student interprets the results of signal (e.g., signal spectrum) and image processing to verify research hypotheses.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
[K7_W01] describes constructions of medical devices and their functioning on the base of knowledge related to the medical engineering	The student describes basic algorithms in the field of signal and image processing	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>

Lectures

- Signal Processing
  - Signals classification
  - Analog to digital conversion
  - Digital to analog conversion
  - Besic signal parameters
  - Fourier transform and signal spectrum
  - FFT, IFFT
  - Frequency leakage, time windows
  - Sampling theorem
- Image processing
  - Digital image and it's representation
  - Geometrical transforms
  - Point transfrorms
  - Context transforms
  - Spectral transforms
  - Morphological transforms
  - Image analysis
- Artifficial Intelligence in signal and image processing

Laboratories

- Signal Processing:
  - Signal generation,
  - Signal manipulations,
  - A/C Processing - principles and selection of transducer parameters,
  - FFT,
  - Frequency leakage,
  - Time windows,
  - Signal sampling,
  - Aliasing,
  - Signal filtering
- Image processing:
  - geometric transformations,
  - point transformations,
  - contextual transformations,
  - morphological transformations,

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<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>

Subject passing criteria	Passing threshold	Percentage of the final grade
2 written tests	52.0%	70.0%
Practical lab. exercises	52.0%	30.0%

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<tr><td>Recommended reading</td><td>

Basic literature	Lyons S.G, Understanding Digital Signal Processing, 2010 Gonzalez R., Woods R. Digital Image Processing, Person, 2018
Supplementary literature	additional materials given during lectrue
eResources addresses	

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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Appropriate list of test subjects and questions will be given to the student a few weeks before the test.

Examples:
Present Nyquist condition for sampling frequency. What will happen in analog signal will be sampled without fulfilling Nyquist condition?
Describe the structure of a typical AD channel</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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