GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00044948		
Field of study	Mathematics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Divison of Differential Equations and Applications of Mathematics -> Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Robert Krawczyk	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	0.0	15.0	0.0	60

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	60	5.0	35.0	100

Subject objectives

The use of mathematical tools in selected methods of signal analysis; identifying and solving problems related to signal processing and mathematical modeling of phenomena from other fields of science and engineering.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_U08	The student applies the acquired mathematical knowledge in issues related to signal analysis, data analysis and optimization.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
K6_U06	The student applies the acquired mathematical knowledge in signal analysis.	[SU3] Assessment of ability to use knowledge gained from the subject
K6_W03	The student learns the basic concepts of system identification, mathematical modeling and sampling theory. The student combines knowledge of mathematics with knowledge of other fields.	[SW1] Assessment of factual knowledge
K6_U05	The student analyzes the known methods of signal processing and reconstruction and uses them in various cases; constructs and critically evaluates mathematical models.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
K6_K03	Students in groups of 2-3 people carry out project tasks related to signal analysis.	[SK1] Assessment of group work skills [SK4] Assessment of communication skills, including language correctness

<table>
<tr><td>Subject contents</td><td>Course content – lecture
The concept of mathematical model, signal and identification. Continuous- and discrete-time Fourier transform (CTFT and DTFT), frequency spectrum of the signal. LTI and impulse response systems. The concepts of sampling, quantizing and filtering of the signal. The sampling process and the relation between CTFT of a continuous signal and DTFT of its sampled signal. Shannon-Nyquist sampling theorem in signal reconstruction. Bohr almost periodic functions: definition and basic properties. Generalized trigonometric polynomial and Fourier series. Continuous almost periodic signals as sums of periodic signals. Wavelet transform, Haar wavelets.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge from courses: Mathematical Analysis, Linear Algebra and Differential equations. Additionally: selected topics of Functional Analysis and Measure Theory/Probability.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Passing lecture classes (Quiz on eNauczanie and Final Test)</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>Project</td><td>50.0%</td><td>30.0%</td></tr>
<tr><td>Test in practical exercises</td><td>50.0%</td><td>30.0%</td></tr>
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</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>Y. C. Eldar, Sampling theory: Beyond Bandlimited Systems, Cambridge University Press, 2015

S. Stoiński, Funkcje prawie-okresowe, Wydawnictwo Naukowe UAM, Poznań, 2008

P. Wojtaszczyk, Teoria falek. Podstawy matematyczne, Wydawnictwo Naukowe PWN, Warszawa, 2000

J. Andres, A.M.Bersani, R.F. Grande, Hierarchy of almost-periodic function spaces, Rendiconti di Matematica, Serie VII
Volume 26, Roma (2006), 121-188</td></tr>
<tr><td>Supplementary literature</td><td>G.Kaiser, A Friendly Guide to Wavelets, Birkhauser, Boston, 1995

R. Isermann, M. Münchhof, Identification of Dynamic Systems. An Introduction with Applications. Springer-Verlag Berlin Heidelberg 2011.
A. Bogges, F. J. Narcowich, A first course in wavelets with Fourier analysis. Upper Saddle River, NJ</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Calculate CTFT transform of a given signal. Nyquist rate. Almost periodic signal. Autocorrelation function. Haar system. Examples of causal and non-causal LTI systems.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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