GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Time-Space Signal Processing, PG_00048386
Field of study	Electronics and Telecommunications, Biomedical Engineering, Biomedical Engineering, Biomedical Engineering

Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
Education level	second-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	2.0
Learning profile	general academic profile	Assessment form	assessment

Conducting unit	Department of Marine Electronic Systems -> Faculty of Electronics, Telecommunications and Informatics

Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Roman Salamon
	Teachers	prof. dr hab. inż. Roman Salamon

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	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	2.0	18.0	50

Subject objectives	The aim of the course is to acquire by students the skills of computer simulation of the basic methods of signal processing in the time and space domain in echolocation systems.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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.	He knows the methods of space-time signals processing and can apply them to simulation of echolocation systems	[SW1] Assessment of factual knowledge
	[K7_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret obtained results and draw conclusions	He mastered the ability to design radio and hydrolocation antennas, knows their parameters and their impact on the operation of echolocation systems.	[SU3] Assessment of ability to use knowledge gained from the subject
	[K7_W04] Knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices	He mastered algorithms of space-time signal processing in echolocation systems and the method of their implementation in the MATLAB environment.	[SW2] Assessment of knowledge contained in presentation
	[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Student can write a program in MATLAB environment simulating the functioning of a selected hydro or radiolocation system. He is able to design and program the GUI graphical user interface of the selected echolocation system.	[SU4] Assessment of ability to use methods and tools
	[K7_U09] can carry out a critical analysis of the functioning of existing technical solutions and assess these solutions, as well as apply experience related to the maintenance of advanced technical systems, devices and facilities typical for the field of studies, gained in the professional engineering environment	Using the written program that simulates the functioning of the system can interpret the impact of individual technical parameters of echolocation systems on its operational parameters.	[SU4] Assessment of ability to use methods and tools

Subject contents	
	1. Organization of the course conditions of passing 2. Techniques of remote detection, localization and parameters of objects in the environment 3. Problem of space search duration and techniques of its solutions 4. General structure of multibeam space filters 5. Multielement antennas, their structure 6. Beam patterns and their parameters 7. Basics of delay-and-sum multibeam space filters (DSMSF) 8. Structure and techniques of realizing DSMSF 9. Realization of filters in time domain 10. Realization of narrow-band filters in frequency domain 11. Realization of wide-band filters in frequency domain 12. Methods and techniques of beam focusing 13. Electronic steering of transmission beam 14. Space spectrum and the direction of wave arrival 15. Fourier method of space spectrum estimation 16. High resolution techniques of space spectrum estimation: parametric methods of spectrum estimation 17. Super resolution methods of spectrum estimation 18. Adaptation methods

Prerequisites and co-requisites	

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	60.0%	30.0%
	Project	60.0%	70.0%

Recommended reading	Basic literature	1. R. Salamon Systemy hydrolokacyjne. Wyd. Gdańskie Towarzystwo Naukowe, Gdańsk 2006 2. A.V. Oppenheim, R.W. Schafer Digital Signal Processing. Prentice-Hall, Englewood Clifs 1975

	Supplementary literature	No requirements
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	