GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Echolocation Systems, PG_00048131						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2027/2028		
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	6		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department Of Signals And Systems -> Faculty Of Electronics Telecommunications And Informatics -> Wydziały Politechniki Gdańskiej						
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	30.0	0.0	15.0	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		3.0		27.0	75
Subject objectives	Understanding the basic principles, technical solutions and parameters of echolocation systems.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		

Subject contents	1. Course organization, requirements, consultations. 2. General principles of echolocation systems functioning. 3. Echolocation systems purposes and classification. 4. Functional model of echolocation systems. 5. Range, angular and range resolution, time of space sector scanning. 6. Space sector scanning techniques. 7. Single- and multi-beam systems. 8. Narrowband sounding signals: time length, spectrum and autocorrelation function. 9. Frequency modulated sounding signals: time length, spectrum and autocorrelation function. 10. Ambignity function. 11. Antennas of echolocation systems. 12. Definition of directivity pattern. 13. Techniques of directivity patterns determination. 14. Examples of echolocation systems antennas directivity patterns. 15. Directivity index. 16. Source level. 17. General characteristics of echolocation systems channels. 18. Space distribution of propagation velocity. 19. Refraction and wave propagation trajectories. 20. Wave reflection, echolocation targets. 21. Reverberations. 22. Noises in echolocation channels. 23. Receiver electric noise. 24. Echo signals. 25. Problem of echo signals detection and parameters estimation. 26. Detection as testing of hypotheses. 27. Reception of a known signal with Gaussian noise background, matched receiver. 28. Reception sinusoidal signal of a unknown frequency with Gaussian noise background. 29. Detection threshold. 30. Receiver operation characteristics ROC. 31. Receiver processing gain. 32. Range equation. 33. Range equation parameters. 34. Determination of technical parameters of the system from the range equation. 35. Techniques of echo signals imaging. 36. Aviation radiolocation systems. 37. Marine radiolocation systems. 38. Acoustics waves in echolocation systems 39. Hydrolocation systems in navigation, fishery and oceanology. 40. Military hydrolocation systems. 41. Ultrasonography. 42. Defectoscopy. 43. Summary.
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Practical exercise	60.0%	40.0%
Midterm colloquium	60.0%	60.0%

Recommended reading	Basic literature	A. Nowicki "Diagnostyka ultradźwiękowa" Makmed, 2000 R. Salamon: Systemy hydrolokacyjne, Wyd. GTN, 2006 M. Skolnik: Radar Handbook, McGraw-Hill Professional, 2008
	Supplementary literature	No requirements
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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