



Subject card

Subject name and code	Echolocation Systems, PG_00048131						
Field of study	Electronics and Telecommunications						
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	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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Roman Salamon					
	Teachers	prof. dr hab. inż. Roman Salamon					
Lesson types	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	<p>Course content – lecture</p> <ol style="list-style-type: none"> 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. Ambiguity 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	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Subject passing criteria</th> <th style="width: 33%;">Passing threshold</th> <th style="width: 33%;">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Midterm colloquium</td> <td>60.0%</td> <td>60.0%</td> </tr> <tr> <td>Practical exercise</td> <td>60.0%</td> <td>40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Midterm colloquium	60.0%	60.0%	Practical exercise	60.0%	40.0%
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Example issues/ example questions/ tasks being completed												
Practical activities within the subject	Not applicable											

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