University of Gdańsk

Subject card

Subject name and code	Marine Acoustics - auditory classes, PG_00206206		
Field of study	Oceanography		
Date of commencement of studies	October 2027	Academic year of realisation of subject	2027/2028
Education level	Master's studies	Subject group	Obligatory subject group in the field of study 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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	1.0
Learning profile	academic	Assessment form	credit
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	mgr Aleksandra Malecha-Łysakowska	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	15.0	0.0	0.0	0.0	15
	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	15	1.0	9.0	25

Subject objectives	
	1. This advanced course will allow students to gain a deeper understanding of complex phenomena related to the propagation of acoustic waves in the sea and their generation and recording, learn about the laws governing these processes and advanced methods of their research. 2. To provide knowledge on the most important issues in marine acoustics and their links to other fields of oceanography (extended scope). 3. To demonstrate the effectiveness of innovative remote hydroacoustic techniques in interdisciplinary marine environmental research (extended scope). 4. Familiarizing students with the practical applications of innovative remote hydroacoustic techniques for monitoring the marine environment for its sustainable exploitation and effective management (extended scope). 5. Transferring knowledge and developing the skills necessary to conduct natural science research and the effective practical use of hydroacoustic techniques (extended scope).

Learning outcomes

Course outcome	Subject outcome	Method of verification
[OCEANMU2-K03] is ready to effectively organize his/her own work, is active and persistent and punctuality in completing tasks, is ready to carrying out evaluation of their own activities	is ready to organize his/her work effectively, is active, persistent and punctual in completing tasks related to the subject of marine acoustics	[SK4] test/exam - oral or written [SK5] implementation of a problem task
[OCEANMU2-U06] is able to use specialized computer software as well as advanced mathematical and statistical methods to analyze data and describe processes and phenomena occurring in the marine and coastal environment; evaluates their reliability and usefulness and performs critical analysis	is able to use specialized computer software in the analysis of hydroacoustic data	[SU4] test/exam - oral or written [SU5] implementation of a problem task
[OCEANMU2-W05] knows and understands the principles of planning and conducting field and laboratory research as well as advanced methods and tools of scientific research, especially in the field of the studied specialty	has an in-depth understanding of basic and advanced techniques, research methods, and tools (mathematical, statistical, IT) used in hydroacoustics to analyze phenomena and processes occurring in the marine environment and in the work of an oceanographer conducting hydroacoustic monitoring of marine ecosystems	[SW4] test/exam - oral or written [SW5] implementation of a problem task
[OCEANMU2-U04] is ready to develop in an analytical and synthetic way research and analysis results and based on them creating conclusions	is able to analyze and synthesize the results of hydroacoustic analyses during exercises	[SU4] test/exam - oral or written [SU5] implementation of a problem task

Subject contents

Tutorials will cover topics listed below. A number of analytical problems on these topics will be solved and discussed in-class.

A.1 Fundamentals of wave theory (definition of a wave, classification of waves, wave phenomena). Equations of hydrodynamics. Equations of linear acoustics. Wave equation and its solutions for selected situations.
A.2 Propagation of acoustic waves in the sea: reflection and transmission of waves at the boundary between two media, sound absorption in seawater, refraction in underwater sound channels (in-depth mathematical description).
A.3 Scattering of acoustic waves in the sea: scattering at uneven sea boundaries, scattering at volume inhomogeneities,
coherent and diffuse fields, physical models of acoustic wave scattering.
A.4 Principles of operation of modern hydroacoustic transceivers, their characteristics and applications.
A.5 Passive and active acoustics and their application to marine ecosystem research.
A.6 Hydroacoustic data processing.

Prerequisites and co-requisites

A knowledge of higher mathematics and the fundamentals of physics is essential.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
written mid-term tests	51.0%	70.0%
problems solved in-class	51.0%	30.0%

Recommended reading	Basic literature	1. Lurton X., 2002. An Introduction to Underwater Acoustics. Principles and Applications, Springer 2. Clay C. S. and Medwin H., 1977. Acoustical Oceanography: Principles and Applications. Wiley, New York 3. Medwin H. and Clay C. S., 1998. Fundamentals of Acoustical Oceanography. Academic Press, Boston 4. Medwin H., 2005. Sounds in the Sea. From Ocean Acoustics to Acoustical Oceanography. Cambridge University Press, New York 5. Śliwiński A., 2001. Ultradźwięki i ich zastosowania, Wyd. NT, Warszawa 6. Brekhovskikh, L.M., Lysanov, Yu.P., 2003, Fundamentals of Ocean Acoustics, Springer 7. Urick R. J., 1975. Principles of underwater sound, McGraw-Hill studiowana samodzielnie przez studenta 1. Poszczególne rozdziały w pozycjach 1 do 7 2. http://hyperphysics.phy-astr.gsu.edu/hbase/sound/soucon.html 3. http://www.physicsclassroom.com/Class/sound/soundtoc.html 4. http://www.dosits.org/science/intro.htm 5. Wybrane artykuły naukowe polsko- i anglojęzyczne 6. Stepnowski A., 2001. Systemy akustycznego monitoringu środowiska morskiego. Gd. Tow. Nauk., Gdańsk, 283.
	Supplementary literature	1. Tolstoy I., Clay C. S., 1966. Ocean acoustics: Theory and experiments in underwater sound. McGraw-Hill. 2. Wybrane artykuły naukowe polsko- i anglojęzyczne
	eResources addresses	
Example issues/ example questions/ tasks being completed	Scattering of acoustic waves in the sea: scattering at uneven sea boundaries, scattering at volume inhomogeneities, coherent and diffuse fields, physical models of acoustic wave scattering. Principles of operation of modern hydroacoustic transceivers, their characteristics and applications.	
Work placement	Not applicable	

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