University of Gdańsk

Subject card

Subject name and code	Marine Acoustics - lecture, PG_00205013		
Field of study	Oceanography		
Date of commencement of studies	October 2027	Academic year of realisation of subject	2028/2029
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	2	Language of instruction	Polish
Semester of study	3	ECTS credits	2.0
Learning profile	academic	Assessment form	credit
Conducting unit	Department of Geophysics -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Jarosław Tęgowski	
	Teachers		

Lesson types

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

1. The advanced subject will allow students to gain a deeper understanding of the complex phenomena related to the propagation of acoustic waves in the sea and their generation and recording, to learn the laws governing these processes and advanced methods of their research. 2. To provide knowledge on the most important problems in the field of marine acoustics and their connections with other fields of oceanography (extended scope). 3. To demonstrate the effectiveness of using innovative remote hydroacoustic techniques in interdisciplinary (biological and ecological, geological, physical and chemical) studies of the marine environment (extended scope). 4. To familiarize students with the possibilities of practical use of innovative remote hydroacoustic techniques for monitoring the marine environment for the purpose of its sustainable exploitation and effective management (extended scope). 5. To provide knowledge necessary to conduct natural research and practical use of hydroacoustic techniques (extended scope).

Learning outcomes

Course outcome	Subject outcome	Method of verification
[OCEANMU2-W01] knows and understands in-depth specialized terminology used in oceanography and related sciences (in Polish and a selected foreign language)	Knows and understands in-depth the specialist terminology relevant to marine acoustics	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[OCEANMU2-W02] knows and understands complex processes and phenomena occurring in the marine environment, with particular emphasis on the coastal zone, as well as complex relationships between living and non-living elements of the aquatic environment	knows, understands and correctly describes complex physical phenomena related to the generation, reception and propagation of acoustic waves in the marine environment and the laws governing them	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[OCEANMU2-W04] has an in-depth understanding of the latest research trends in oceanography, as well as the possibilities for practical application of related achievements; evaluates their usefulness and limitations in solving scientific research problems, and critically analyzes and assesses their applicability	Knows and understands complex research issues/problems and the latest research directions in the field of marine acoustics	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[OCEANMU2-U02] is able to fluently and accurately use scientific terminology when presenting and discussing oceanographic issues, and to propose and justify innovative solutions	Is able to use scientific terminology in the field of marine acoustics fluently and correctly	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
[OCEANMU2-U05] is able to use source information in Polish and a chosen foreign language, including archival and electronic databases, within the field of oceanography; critically analyzes and synthesizes information, and is capable of performing critical interpretation and synthesis of data	Is able to use source information on marine acoustics, in Polish and English, available in traditional and electronic form, perform synthetic analysis and synthesis of information	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
[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	Knows and understands in-depth the basic and advanced techniques, research methods and tools (mathematical, statistical, computer) used in hydroacoustics to analyse 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 [SW1] oral statement/ conversation/discussion
[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 effectively organize his/ her own work, demonstrates activity and is characterized by perseverance and punctuality in carrying out tasks related to the implementation of the subject of marine acoustics	[SK1] oral statement/conversation/ discussion [SK4] test/exam - oral or written

Subject contents

A.1 Fundamentals of wave theory (wave definition, wave classification, 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 of two media, absorption of sound in sea water, 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 volumetric inhomogeneities, coherent and diffusive fields, physical models of the phenomenon of acoustic wave scattering. A.4 Principles of operation of modern transmitting-receiving hydroacoustic devices, their characteristics and applications. A.5 Passive and active acoustics and their application to the study of marine ecosystems. A.6 Processing of hydroacoustic data. A7. Application of innovative remote acoustic methods for monitoring the marine environment for its sustainable exploitation and effective management.

Prerequisites and co-requisites

Knowledge of the basics of higher mathematics and basic physics is necessary.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
oral exam	51.0%	100.0%

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
	Supplementary literature	Selected Polish and English scientific articles
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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