University of Gdańsk

Subject card

Subject name and code	Introduction to Marine Acoustics - lecture, PG_00201111		
Field of study	Marine Hydrography		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2027/2028
Education level	Bachelor's studies	Subject group	Obligatory subject group 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	practical	Assessment form	exam
Conducting unit	Laboratory of Physical Oceanography -> Department of Physical Oceanography and Climate Research -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Jakub Idczak	
	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	1.0	19.0	50

Subject objectives

1. To introduce students to the fundamental phenomena related to the propagation of acoustic waves in the sea, their generation and reception, the laws governing these processes, and the methods of their investigation.

2. To provide knowledge on the most important research problems in the field of marine acoustics and their connection to other fields of oceanography and hydrography (basic level).

3. To demonstrate the effectiveness of using innovative remote hydroacoustic techniques in interdisciplinary research and marine environmental monitoring (introductory level).

4. To impart knowledge and develop the skills necessary for conducting natural science research and the effective practical use of hydroacoustic techniques (basic level).

5. To lay the foundation for the effective use of courses related to the application of hydroacoustic techniques in marine hydrography.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[HML3-W03] knows and understands, at an advanced level, directions of development and the latest discoveries in the field of scientific disciplines forming the theoretical basis appropriate to the field of study	knows innovative remote hydroacoustic techniques used in interdisciplinary research and marine environmental monitoring	[SW4] test/exam - oral or written
[HML3-K02] is ready to correctly determine the priorities in professional work for the implementation of a task specified by himself/ herself or others	is ready to complete tasks on time, whether working individually or as part of a team	[SK4] test/exam - oral or written
[HML3-U07] is able to effectively use information and communication techniques, including utility programs to solve professional problems	is able to effectively use specialized IT tools for the analysis and interpretation of hydroacoustic data	[SU4] test/exam - oral or written
[HML3-U14] is able to use the applicable terminology in presenting and discussing problems related to the field of study	is able to correctly use the relevant terminology when presenting and discussing issues related to marine acoustics	[SU4] test/exam - oral or written
[HML3-U19] is able to plan and implement independent learning and improvement of his/her professional competences	is able to plan and carry out independent learning and improve their professional skills	[SU4] test/exam - oral or written
[HML3-U08] is able to independently use the professional literature available in traditional and electronic form, make an assessment, critical analysis and synthesis as well as the correct interpretation of the information obtained	is able to independently use professional literature on marine acoustics available in both print and electronic formats, and to evaluate, critically analyze, synthesize, and correctly interpret the information obtained	[SU4] test/exam - oral or written
[HML3-W04] knows and understands, at an advanced level, the issue of measurements related to the exploration of sea basins and inland waters and tools allowing to describe, interpret and present the results of measurements	knows the most important research issues in the field of marine acoustics and their connections to other fields of oceanography and hydrography	[SW4] test/exam - oral or written
[HML3-W01] knows and understands, at an advanced level, selected facts, phenomena and processes, as well as methods and theories concerning them, explaining the complex relationships between them, constituting basic general knowledge in the field of scientific disciplines forming the theoretical foundations specific to the field of study	knows and understands, at an advanced level, the phenomena related to the propagation of acoustic waves in the sea, as well as their generation and reception, and the laws governing these processes	[SW4] test/exam - oral or written

Subject contents

1. Acoustic wave: definition, parameters characterizing an acoustic wave (spatial and temporal changes).

2. Propagation of acoustic waves: geometric spreading (traveling waves: plane, cylindrical, spherical waves), sound absorption in seawater.

3. Wave phenomena: wave interference, reflection and transmission of waves at the boundary of two media, refraction of acoustic waves, scattering of acoustic waves.

4. Hydroacoustic transducers: main operating principle, characteristics of transducers.

5. Operating principles of selected acoustic devices and their applications (single- and multi-beam echosounder, side-scan sonar, sub-bottom profiler, ADCP, USBL).

6. Acoustic data processing.

7. Selected applications of acoustic methods for studying marine ecosystems.

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Fundamentals of physics and mathematics</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>exam</td><td>51.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">1. CLAY C. S., MEDWIN H.: Acoustical Oceanography: Principles and Applications. Wiley, New York 1977.

2. MEDWIN H., CLAY C. S.: Fundamentals of Acoustical Oceanography. Academic Press, Boston 1998.

3. MEDWIN H.: Sounds in the Sea. From Ocean Acoustics to Acoustical Oceanography. Cambridge University Press, New York 2005.

4. ŚLIWIŃSKI A.: Ultradźwięki i ich zastosowania. Wyd. Nauk.-Tech., Warszawa 2001.</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">1. KOWALIK Z., ŁĘGOWSKI S., SZYMBORSKI S.: Podstawy hydroakustyki, Wydawnictwo Morskie, Gdynia 1965.
2. STEPNOWSKI A.: Systemy akustycznego monitoringu środowiska morskiego. Gd. Tow. Nauk., Gdańsk 2001.
3. http://hyperphysics.phy-astr.gsu.edu/hbase/sound/soucon.html
4. http://www.physicsclassroom.com/Class/sound/soundtoc.html
5. http://www.dosits.org/science/intro.html</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">1. Propagation of acoustic waves: geometric spreading (traveling waves: plane, cylindrical, spherical waves).

2. Transmission losses: spreading of the acoustic wavefront, sound absorption in seawater (as factors affecting the reduction of acoustic wave propagation range in the sea).

3. Wave phenomena: reflection and transmission of waves at the boundary between two media.

4.Sound speed in water.

5. Acoustic transducers: structure and main operating principle of hydroacoustic transducers.</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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