University of Gdańsk

Subject card

Subject name and code	Applied Acoustics, PG_00209958		
Field of study	Medical Physics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	Master's 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	2	Language of instruction	Polish polish
Semester of study	3	ECTS credits	3.0
Learning profile	academic	Assessment form	credit
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Stanisław Pogorzelski	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	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	0.0	30.0	75

Subject objectives	Gaining knowledge of the physical fundamentals of acoustic wave propagation, attenuation, and scattering in gaseous, liquid, and solid media. Understanding the operation of acoustic wave emission sources and acoustic systems for measuring physical environmental conditions. Gaining the ability to assemble and operate acoustic systems used in molecular acoustics, hydrogeoacoustics, room acoustics, ultrasonic flaw detection, medical ultrasonography, and clinical audiometry and phoniatrics. Gaining experience with modern methods of shaping the acoustic climate of rooms and the natural environment.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[FIZMEDMU2_U01] Can apply the scientific method in solving physical and medical problems, carrying out experiments and drawing conclusions in the field of physics, medical physics and other fields, based on in-depth knowledge, appropriate selection of sources, and mathematical and computer science methods and tools.	The student is able to design experimental studies in acoustics and ultrasonics, select appropriate measurement methods and research instrumentation, and formulate and verify hypotheses concerning acoustic wave propagation processes and their applications in medical diagnostics, ultrasonic flaw detection, materials characterization, and environmental studies.	[SU4] test/exam - oral or written [SU5] implementation of a problem task
[FIZMEDMU2_W04] Knows and understands in depth the theoretical foundations and principles of operation of measurement systems and research, diagnostic and therapeutic equipment specific to the field of physics and medicine.	The student knows and understands in depth the theoretical foundations and operating principles of instrumentation and measurement systems used in acoustics and ultrasonics, including electroacoustic transducers, acoustic field measurement systems, ultrasonic flaw detection equipment, medical diagnostic devices, audiometric and phoniatric systems, as well as hydroacoustic and geoacoustic instrumentation. The student understands the principles of selecting measurement parameters, the limitations of the applied methods, and the influence of experimental conditions on the quality and reliability of the obtained results.	[SW4] test/exam - oral or written [SW5] implementation of a problem task
[FIZMEDMU2_W01] Knows and understands in depth selected issues in the field of physics and medicine, the complex relationships between them, and development trends in the exact and natural sciences, health sciences, and others.	The student knows and understands advanced issues in acoustics and ultrasonics, including the mechanisms of acoustic wave propagation in various media, wave–matter interactions, and their applications in medical diagnostics, audiometry, phoniatrics, flaw detection, and environmental studies. The student understands the relationships between physical and biological processes utilized in modern acoustic techniques and is familiar with current trends in the development of acoustic measurement and diagnostic methods.	[SW4] test/exam - oral or written [SW5] implementation of a problem task

Subject contents

1. Sound Sources and Their Characteristics 2. Ultrasound Equipment and Methods for Sound Field Measurement 3. Investigating Physicochemical Properties of Mediums Using Acoustic Methods, Molecular Acoustics 4. Ultrasound Flaw Detection and Future Methods in Flaw Detection (Acoustic Emission, Sonoholography) 5. Ultrasound Diagnostics in Medicine 6. Acoustic Phonetics in Speech Phoniatrics and Hearing Audiometry 7. Other Applications of Ultrasound Waves (Meters, Acoustooptics) 8. Active Applications of Ultrasound (Coagulation, Dispersion, Physicochemical Effects) 9. Interior Acoustics (Modifying the Acoustic Properties of Interiors, Sound-Absorbing Materials and Structures) 10. Ultrasound in Geophysical Research (Depth Profiling of Water Depth, Characteristics of Underwater Noise, Meteorological Probing of the Lower Atmosphere Sodars)

Prerequisites and co-requisites

Completed the first year of studies in the basic course in Physics

Knowledge of the basic physics of wave motion, kinematics, oscillatory motion, transport phenomena, basics of thermodynamics and electromagnetism.

Assessment methods and criteria

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

Recommended reading	Basic literature	1. J.Eysymont, M. Górska, A. Piotrowska, J. Bieniuk, Ultradźwięki w chemii, PWN, Warszawa, 1968. 2. J.Wehr, Pomiary Prędkości i Tłumienia Fal Ultradźwiękowych,PWN,Warszawa,1972. 3. J.Obraz, Ultradźwięki w Technice Pomiarowej,WNT, Warszawa, 1983. 4. A.Matheson, Molecular Acoustics, Wiley, N.Y., 1973. 5. W.Mason, Physical Acoustics, tom I-XIV, Academic Press, N.Y., 1956-1979. 6. I.Malecki,Teoria Fal i Układów Akustycznych, PWN, Warszawa, 1964. 7. W.Nozdriew, N.Fedoriszczenko, Molekularna Akustika, Izdat. Wysszaja Szkoła, Moskwa,1974. 8. J.Blitz, Fundamentals of Ultrasonics,Butterworths, London,1963. 9. W.Schaaffs, Molecularakustik, Springer-Verlag, Berlin,1963. 10. J.Matauschek, Technika Ulradźwięków, WNT, Warszawa, 1961. 11. Encyklopedia Fizyki Współczesnej, PWN, 1983, Akustyka, s. 639-678. 12. K.Ilmuszyńska, Diagnostyka Ultrasonograficzna, PZWL, Warszawa, 1980.
	Supplementary literature	1. L.Filipczyński, Z.Pawłowski, J.Wehr, Ultradźwiękowe metody badania materiałów,WNT, Warszawa, 1963. 2. H.Medwin, C.Clay, Acoustical Oceanography. Principles and Applications, Wiley, N.Y., 1976. 3. J.Sadowski, Akustyka Architektoniczna, PWN, Warszawa, 1976. 4. J.Fortuna, E.Kozaczka, Review of acoustical methods of probing the atmospheric boundary layer, Archives of Acoustics, 17,453-510 (1992). 5. A.Kopel, Acousto-Optics, Marcel Dekker, NY,1988. 6. Ł.M. Bekhovskich, Akustika Okieana, Nauka, Moscow, 1974. 7. B. Szczepankowski, Fonetyka akustyczna, audytywna i wizualna: wybrane zagadnienia, Wydawnictwo Uniwersytetu Warszawskiego, W-wa, 1985. 8. R. Tadeusiewicz, Sygnał mowy, WK i Ł, W-wa, 1988. 9. D. Ostaszewska, J. Tambor, Fonetyka i fonologia współczesnego języka polskiego, PWN, W-wa, 2001. 10. W. Jassem, Podstawy fonetyki akustycznej, W-wa, 1973.
	eResources addresses	
Example issues/ example questions/ tasks being completed	characteristics of the generation and reception of acoustic waves in media, acoustic methods for testing physicochemical properties, methods for acoustic detection of material defects, diagnostic ultrasonic methods in medicine, acoustic methods in testing the speech and hearing organs, active applications of ultrasonic sounds, shaping the acoustic climate of rooms and noise hazards, acoustics of natural environmental conditions	
Work placement	Not applicable	

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