University of Gdańsk

Subject card

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| Subject name and code | Applied Acoustics, PG_00179183 | | |
| Field of study | Medical Physics | | |
| Date of commencement of studies | October 2024 | Academic year of realisation of subject | 2025/2026 |
| Education level | Master's studies | Subject group | Obligatory subject group in the field of study<br>Optional subject group |
| Mode of study | full-time studies | Mode of delivery | at the university |
| Year of study | 2 | Language of instruction | Polish<br>polish |
| Semester of study | 4 | ECTS credits | 6.0 |
| 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 | 30.0 | 0.0 | 0.0 | 0.0 | 60 |
| | 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 | 60 | 0.0 | 0.0 | 60 |

| Subject objectives | |
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| | 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_U06] is able to adapt the knowledge and methodology of physics as well as the experimental and theoretical methods used to related scientific disciplines | Students can apply methodology to characterize selected acoustic systems, determine the applicability limits of acoustic waves propagation models, and supplement formal descriptions with modeling and their own process simulations. Students formulate research hypotheses regarding the development of acoustic processes and supplement them with their own conclusions. Students understand the basic physical laws of wave motion and can apply them to solving problems related to acoustic phenomena in the natural environment of a community. | [SU2] presentation/project/paper/ report<br>[SU3] text preparation/written work<br>[SU4] test/exam - oral or written |
| [FIZMEDMU2_U05] has the ability to synthesize methods and ideas from various areas of physics and other natural sciences; is able to notice that distant phenomena are sometimes described by similar models | Student can recognize the interdisciplinary nature of acoustic processes in characterizing physical mediaand materials engineering, the natural environment , and medicine. They demonstrate creativity in developing innovative descriptions of acoustic phenomena. Students readily apply innovative ideas to describing physical phenomena, assuming leadership roles within research teams. They can design optimal acoustic systems and structures for flaw detection and room adaptation. They can adopt various formalisms and use themto solve problems presented in class. They are able to conduct research in the field of phoniatrics and hearing audiometry within the context of medical acoustics. | [SU2] presentation/project/paper/ report<br>[SU4] test/exam - oral or written<br>[SU5] implementation of a problem task |
| [FIZMEDMU2_W06] has knowledge of current directions in the development of physics, in particular within the chosen specialization | The student understands current methods for describing acoustic phenomena based on modern instrumentation, characterizes individual parameters for the quantitative description of acoustic processes and systems, analyzes data, and assesses the degree of risk. The student is aware of the limitations of acoustic systems used in real-world applications. He or she understands the importance of acoustic phenomena occuring in nature on the well-being of the human environment. | [SW4] test/exam - oral or written<br>[SW2] presentation/project/paper/ report<br>[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 |
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| exam | 51.0% | 100.0% |

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| Recommended reading | Basic literature | 1. J.Eysymont, M. Górska, A. Piotrowska, J. Bieniuk, Ultradźwięki w chemii, PWN, Warszawa, 1968.<br>2. J.Wehr, Pomiary Prędkości i Tłumienia Fal Ultradźwiękowych,PWN,Warszawa,1972.<br>3. J.Obraz, Ultradźwięki w Technice Pomiarowej,WNT, Warszawa, 1983.<br>4. A.Matheson, Molecular Acoustics, Wiley, N.Y., 1973.<br>5. W.Mason, Physical Acoustics, tom I-XIV, Academic Press, N.Y., 1956-1979.<br>6. I.Malecki,Teoria Fal i Układów Akustycznych, PWN, Warszawa, 1964.<br>7. W.Nozdriew, N.Fedoriszczenko, Molekularna Akustika, Izdat. Wysszaja Szkoła, Moskwa,1974.<br>8. J.Blitz, Fundamentals of Ultrasonics,Butterworths, London,1963.<br>9. W.Schaaffs, Molecularakustik, Springer-Verlag, Berlin,1963.<br>10. J.Matauschek, Technika Ulradźwięków, WNT, Warszawa, 1961.<br>11. Encyklopedia Fizyki Współczesnej, PWN, 1983, Akustyka, s. 639-678.<br>12. K.Ilmuszyńska, Diagnostyka Ultrasonograficzna, PZWL, Warszawa, 1980. |
| | Supplementary literature | 1. L.Filipczyński, Z.Pawłowski, J.Wehr, Ultradźwiękowe metody badania materiałów,WNT, Warszawa, 1963.<br>2. H.Medwin, C.Clay, Acoustical Oceanography. Principles and Applications, Wiley, N.Y., 1976.<br>3. J.Sadowski, Akustyka Architektoniczna, PWN, Warszawa, 1976.<br>4. J.Fortuna, E.Kozaczka, Review of acoustical methods of probing the atmospheric boundary layer, Archives of Acoustics, 17,453-510 (1992).<br>5. A.Kopel, Acousto-Optics, Marcel Dekker, NY,1988.<br>6. Ł.M. Bekhovskich, Akustika Okieana, Nauka, Moscow, 1974.<br>7. B. Szczepankowski, Fonetyka akustyczna, audytywna i wizualna: wybrane zagadnienia, Wydawnictwo Uniwersytetu Warszawskiego, W-wa, 1985.<br>8. R. Tadeusiewicz, Sygnał mowy, WK i Ł, W-wa, 1988.<br>9. D. Ostaszewska, J. Tambor, Fonetyka i fonologia współczesnego języka polskiego, PWN, W-wa, 2001.<br>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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