University of Gdańsk

Subject card

Subject name and code	Phonetical Acoustics, PG_00150590		
Field of study	Logopedics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	uniform Master's studies	Subject group	Obligatory subject group in the field of study Subject group related to practical vocational preparation
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish Polish
Semester of study	2	ECTS credits	1.0
Learning profile	practical	Assessment form	credit
Conducting unit	Division of Surface Physicochemistry and Interfacial Phenomena -> Institute of Experimental Physics -> Faculty of Mathematics, Physics and Informatics -> Rector		
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	10.0	0.0	0.0	0.0	0.0	10
	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	10	1.0	14.0	25

Subject objectives	
	Presentation of fundamental concepts in acoustics and the physical principles underlying sound generation, propagation, and perception, with a particular focus on the characteristics of speech sounds. Identification of modern speech signal analysis algorithms used in audiometric diagnostics. Presentation of the correlations between articulation and the acoustic form of speech, including a detailed description of the acoustic structure (temporal and spectral relationships) of specific Polish speech sounds. Illustration of the links between the articulatory description of speech sounds and their acoustic properties—quantified via spectral structure parameters such as formant frequencies, fundamental frequency (F0), autocorrelation functions, and the signal cepstrum. Presentation of speech acoustic characteristics in selected cases of articulatory system disorders. Demonstration of computer-based analyzers for speech signal visualization (using Praat and Audacity software) through the spectral analysis of selected speech sounds, highlighting distinctive signal parameters useful for diagnosing articulatory system anomalies.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[LOGJ5_K01] He is ready to critically evaluate his linguistic (including speech therapy) knowledge and modify and supplement it, as well as improve his professional skills; he is ready to formulate moral problems and ethical dilemmas related to his own and others' therapeutic work.	The student acquires knowledge of the fundamentals of physical acoustics and the quantitative description of acoustic signals—specifically speech signals—in terms of parameters derived from acoustic signal representations (such as spectrograms, autocorrelation functions, and cepstra).	[SK4] test/exam - oral or written
	[LOGJ5_U01] Able to distinguish methodological orientations in scientific research, search, analyze, evaluate, select and integrate information in the field of linguistics (including speech therapy) using various sources, selection and application of appropriate methods and tools, including advanced information and communication technologies (ICT) in order to formulate critical judgments on this basis, solve complex problems and carry out tasks in an innovative manner.	s familiar with the anatomical details and morphological characteristics of the vocal tract in relation to the acoustic structure of individual Polish speech sounds and their articulation.	[SU4] test/exam - oral or written
	[LOGJ5_W01] Has a structured, in-depth and extended knowledge and knows at an extended level the terminology of linguistics and speech therapy (including selected terminology in a foreign modern language).	skills in the methodology, measurement, and assessment of hearing loss within the field of medical audiology; knowledge regarding the structure of the ear and the assessment of auditory perceptual abilities.	[SW4] test/exam - oral or written
	[LOGJ5_W20] Understands in depth the phonetic-phonological system of the Polish language, including knowledge of orthophonic norms and linguistic correctness.	ability to use computer-based speech signal analyzers (Praat, Audacity) with selected speech sounds, focusing on distinctive signal features useful in diagnosing articulation anomalies	[SW4] test/exam - oral or written
	[LOGJ5_W21] He has an in-depth knowledge of the characteristics of the modern Polish language and its historical transformations, as well as issues in ethnolinguistics and sociolinguistics.	ability to represent the phonetic form of speech in observed cases of articulation disorders	[SW4] test/exam - oral or written
	[LOGJ5_U03] He has the ability to interpret, analyze the causes and course of linguistic and communicative processes and phenomena, substantively argue using his own views and those of other authors, formulate conclusions and create synthetic summaries using the appropriate terminology of linguistics, sociolinguistics and ethnolinguistics and medical sciences relevant to speech therapy.	proficiency in using speech signal acoustic analysis techniques, including the methodology for measuring selected parameters and generating a speech-language pathology description based on them.	[SU4] test/exam - oral or written

Subject contents	1. Physical principles of sound generation, propagation, and perception, with particular emphasis on speech sounds. Basic acoustic concepts, sound sources, directional radiation characteristics, wave propagation, resonators, interference, standing waves, frequency, wavelength, intensity, duration, spectrum, Fourier analysis. Characteristics of the speech signal: spectrum, pitch, loudness, timbre; description of sine waves, complex waves, noise, reverberation, threshold of hearing. Sound level, decibel (dB), acoustic power, ratios and octaves, sound pressure level measurement, filters. 2. Acoustic theory of speech signal generation. The relationship between articulation and the acoustic properties of speech sounds. Structure and functions of the speech production apparatus. Acoustic structure of linguistic units; generation of speech sounds, production of laryngeal tone, and the function of oral cavity resonators. Articulatory description of speech sounds and their relationship to spectral structure parameters (formant frequencies, fundamental frequency F0/laryngeal tone, autocorrelation and cepstrum functions). Vowel articulation: the vowel quadrilateral, isochrony. 3. Phonetic and acoustic characteristics of speech sounds. Acoustic properties of Polish speech sounds and their classification scheme. Phenomena of nasalization and coarticulation and their impact on the acoustic characteristics of speech sounds. Analysis of the acoustic form of normal and pathological speech. 4. Structure of the ear, its morphological and perceptual characteristics, and hearing (bone and air conduction pathways); the human ear and sound perception, ear sensitivity and anatomy, loudness, timbre, and the ear as an analyzer. Fundamentals of audiology, the audiometer, and methodology for assessing hearing loss. 5. Simulation, visualization, and analysis of the speech signal using Praat and Audacity software, based on selected speech sounds. Distinctive parameters in the diagnosis of articulatory system anomalies.
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Attendance at lectures and achieving a score of 51% on the test covering the lecture material.	51.0%	100.0%

Recommended reading	Basic literature	1 Sz. Szczeniowski, Fizyka doświadczalna, cz. 1, Mechanika i Akustyka PWN, 1980. 2 F. A. Everest, Podręcznik Akustyki, Katowice 2004 3 W. Jassem, Podstawy Fonetyki Akustycznej, Warszawa 1973. 4 G. Lindner, Podstawy audiologii pedagogicznej, Warszawa 1976. 5 J. Żera, Percepcja dźwięku przy prawidłowym i uszkodzonym funkcjonowaniu ucha wewnętrznego, 2001. 6 Henning Reeth & Allard Jongman, Phonetics, Transcription, Production, Acoustics & Perception, 2009. 7 R. Gubrynowicz, Podstawy Fonetyki Akustycznej, manuskrypt wykładu, 2007.

	Supplementary literature	1. B. Wierzchowska, Fonetyka i Fonologia Języka Polskiego, Ossolineum, Warszawa, 1980. 2. R. Gubrynowicz, Podstawy Fonetyki Akustycznej, manuskrypt wykładu, 2007. 3. F.A. Everest, Podręcznik Akustyki, PWN, Katowice, 2004. 4. B. Szczepankowski, Fonetyka Akustyczna, Audytywna i Wizualna: Wybrane Zagadnienia, Wydawnictwo Uniwersytetu Warszawskiego, Warszawa, 1985. 5. R. Tadeusiewicz, Sygnał Mowy, WK i Ł, Warszawa, 1988. 6. D. Ostaszewska, J. Tambor, Fonetyka i Fonologia Współczesnego Języka Polskiego, PWN, Warszawa, 2001. 7. G. Lindner, Podstawy Audiologii Pedagogicznej, PWN, Warszawa, 1976. 8. J. Żera, Percepcja Dźwięku przy Prawidłowym i Uszkodzonym Funkcjonowaniu Ucha Wewnętrznego, PWN, Warszawa, 2001. 9. Moore, Wprowadzenie do psychologii słyszenia, Wydawnictwo Naukowe, PWN, W-wa Poznań 1999. 10. Ozimek, Dźwięk i jego percepcja, Wydawnictwo Naukowe PWN, W-wa Poznań 2002. 11. M. Huckvale, Acoustics of Speech& Hearing, http://www.phon.ucl.ac.uk/courses/spsci/b214/week.htm 12. A. Kaczmarek, Analiza sygnału mowy w Foniatrii, Zeszyty Naukowe Wydziału E i A, Politechniki Gdańskiej, Nr 22, 85-92 (2006).
	eResources addresses	
Example issues/ example questions/ tasks being completed	Physical principles of sound generation, propagation, and perception, with a particular focus on the speech signal. Fundamental parameters of the sound field. Presentation of the correlations between articulation and the acoustic form of speech, including a detailed description of the acoustic structure (temporal and spectral characteristics) of specific Polish speech sounds. Examination of the relationships between the articulatory description of speech sounds and their acoustic properties—specifically formant frequencies, vocal fold vibration frequency (fundamental frequency), and signal autocorrelation and cepstrum functions. Overview of ear anatomy and morphology, with particular emphasis on speech sound perception. Introduction to the fundamentals of audiology and the acoustic characteristics of speech perception in the context of congenital or acquired hearing loss. Development of skills in applying computer-based tools for the objective analysis of normal and pathological speech in speech therapy practice. Mastery of the methodology required for documenting speech therapy cases.	
Work placement	Not applicable	

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