



Subject card

Subject name and code	Ultrasounds in Medicine, PG_00047927						
Field of study	Biomedical Engineering						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2027/2028		
Education level	first-cycle 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	3		Language of instruction		Polish		
Semester of study	5		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department Of Signals And Systems -> Faculty Of Electronics Telecommunications And Informatics -> Wydziały Politechniki GdańskieJ						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Lech Kilian				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	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		4.0		51.0	100
Subject objectives	The aim of the course is to acquaint students with physical properties of sound fields, energy of ultrasound, problems of transmitting, processing, and displaying ultrasonic signals, and with the structure of diagnostic and therapeutic ultrasonic equipment.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W03] knows and understands, to an advanced extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum		Student discusses methods of ultrasonic signal generation and echo signal processing in simple and complex diagnostic and therapeutic systems. Is able to point out and discuss important technical and functional parameters determining the value of a particular system.		[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation		
	[K6_U07] can apply methods of process and function support, specific to the field of study		Student discusses properties of acoustic waves and the specificity of their propagation in human body. He defines the concept of directivity of ultrasonic transducers and presents methods of scanning and multibeam systems. He discusses ultrasonic techniques used in medical ultrasound, Doppler methods and types of imaging. He uses basic diagnostic equipment, and analyses and interprets measurement data.		[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SK1] Assessment of group work skills		

Subject contents	<div>1. Introduction: Applications of ultrasound in medicine, nature of acoustic waves</div> <div>2. Physical units in scoustics</div> <div>3. Transmission of acoustic waves: attenuation, diffraction, reflection and penetration, Doppler effect.</div> <div>4. Directional effects in transmission of acoustic waves, energy in acoustic field, safety of ultrasound diagnostics and therapeutics</div> <div>5. Emission and reception of ultrasonic waves: electro-mechano-acoustic analogies, ultrasonic transducers and their match to transmitter and receiver</div> <div>6. Diagnostic equipment: types of ultrasonographs, frequency used</div> <div>7. Doppler diagnostic apparatus - types of measurements of blood flow, measurement methods of cardiac examinations</div> <div>8. Ultrasound therapy - fields of application, ultrasonic equipment and tools used</div> <div>9. Structure of ultrasonic apparatus, discussion of the importance of particular parameters of diagnostic and therapeutic equipment</div> <div>10. Types and structure of diagnostic probes</div> <div>11. Structure of transmitters and receivers</div> <div>12. Characteristic methods of signal processing in diagnostic apparatus</div> <div>13. Development of displays in diagnostic apparatus</div> <div>14. Organization of imaging. Multi-dimensional imaging.</div> <div>15. Development trends in medical ultrasound equipment. Ultrasounds in tomography and MRI</div>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	60.0%	60.0%
	Practical exercise	60.0%	40.0%
Recommended reading	Basic literature	<div>1. Śliwiński A. Ultradźwięki i ich zastosowania. WNT Warszawa 2001</div> <div>2. Nowicki A. Diagnostyka ultradźwiękowa. MAKmed Gdańsk 2001</div> <div>3. Iniewski K. Medical Imaging. Wiley Hobocen 2009</div> <div>4. Nowicki A. Podstawy ultrasonografii dopplerowskiej. PWN Warszawa 1995</div>	
	Supplementary literature	Nie ma wymagań	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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