



Subject card

Subject name and code	Ultrasounds in Medicine, PG_00047927						
Field of study	Biomedical Engineering						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2026/2027		
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 Marine Electronic Systems -> Faculty of Electronics, Telecommunications and Informatics						
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_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.			[SK1] Assessment of group work skills [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		
	[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.			[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge		

Subject contents	<ol style="list-style-type: none"> 1. Introduction: Applications of ultrasound in medicine, nature of acoustic waves 2. Physical units in acoustics 3. Transmission of acoustic waves: attenuation, diffraction, reflection and penetration, Doppler effect. 4. Directional effects in transmission of acoustic waves, energy in acoustic field, safety of ultrasound diagnostics and therapeutics 5. Emission and reception of ultrasonic waves: electro-mechano-acoustic analogies, ultrasonic transducers and their match to transmitter and receiver 6. Diagnostic equipment: types of ultrasonographs, frequency used 7. Doppler diagnostic apparatus - types of measurements of blood flow, measurement methods of cardiac examinations 8. Ultrasound therapy - fields of application, ultrasonic equipment and tools used 9. Structure of ultrasonic apparatus, discussion of the importance of particular parameters of diagnostic and therapeutic equipment 10. Types and structure of diagnostic probes 11. Structure of transmitters and receivers 12. Characteristic methods of signal processing in diagnostic apparatus 13. Development of displays in diagnostic apparatus 14. Organization of imaging. Multi-dimensional imaging. 15. Development trends in medical ultrasound equipment. Ultrasounds in tomography and MRI 		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Practical exercise	60.0%	40.0%
	Midterm colloquium	60.0%	60.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Śliwiński A. Ultradźwięki i ich zastosowania. WNT Warszawa 2001 2. Nowicki A. Diagnostyka ultradźwiękowa. MAKmed Gdańsk 2001 3. Iniewski K. Medical Imaging. Wiley Hobocen 2009 4. Nowicki A. Podstawy ultrasonografii dopplerowskiej. PWN Warszawa 1995 	
	Supplementary literature	Nie ma wymagań	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		