



Subject card

Subject name and code	Sensors and Measurement Converters, PG_00053564						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	October 2022	Academic year of realisation of subject				2022/2023	
Education level	second-cycle studies	Subject group				Obligatory subject group in the field of study 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	1	Language of instruction				Polish	
Semester of study	1	ECTS credits				2.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Department of Biomedical Engineering -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Paweł Kalinowski				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	30.0	0.0	0.0	30
	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	30		3.0		17.0	50
Subject objectives	Learning the metrological basics in the measurement of non-electrical quantities						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K7_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions					[SU3] Assessment of ability to use knowledge gained from the subject	
	[K7_U08] while identifying and formulating engineering tasks specifications and solving these tasks, can: - apply analytical, simulation and experimental methods, - notice their systemic and non-technical aspects, - make a preliminary economic assessment of suggested solutions and engineering work					[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task	
	[K7_W02] knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study					[SW1] Assessment of factual knowledge	

Subject contents	Basic concepts: measured quantity, measurement object, measuring transducer, measurement lines, measurement errors. 2. Measuring transducers, classification, metrological properties of sensors and their determination. 3. Dynamic properties of transducers. 4. Resistance sensors in measuring systems 5. Stress measurements - strain gauges 6. Limitations in strain gauge measurements, pressure measurements 7. Inductive sensors and their applications 8. Capacitive sensors and their applications 9. Measuring systems of impedance sensors 10. Force and pressure measurements 11. Flow measurements 12. Pulse and code converters 13. Optoelectronic converters - thermal detectors 14. Optoelectronic converters - photon detectors 15. Position and motion measurements 16. Seismic measurements 17. Vibration and vibration measurements 18. Piezoelectric accelerometers 19. Charge converters 20. Charge converters - limitations and measurement systems 21. Reference temperature measurements 22. Thermoresistors 23. Thermocouples 24. Semiconductor temperature sensors 25. Quartz and special purpose thermometers 26. Fundamentals of optical pyrometry 27. Monochromatic, radiation and multispectral pyrometers 28. Humidity measurements 29. MEMS microsystems, MEOMS 30. Microsystem em apps		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
Recommended reading	Basic literature	J. S. Wilson, Sensor Technology Handbook, Elsevier 2005, także wersja elektroniczna Materiały autorskie do wykładu	
	Supplementary literature	J. S. Wilson, Sensor Technology Handbook, Elsevier 2005.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		