



Subject card

Subject name and code	Sensors and Measurement Converters, PG_00053563						
Field of study	Biomedical Engineering						
Date of commencement of studies	October 2021	Academic year of realisation of subject			2022/2023		
Education level	first-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	2	Language of instruction			Polish		
Semester of study	4	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		dr inż. Paweł Kalinowski				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	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 of students the basic issues in the non-electrical measurements						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_K02] is ready to critically assess possessed knowledge and acknowledge the importance of knowledge in solving cognitive and practical problems		Student - can indicate the limitations of the selected measurement method and the elements used		[SK2] Assessment of progress of work		
	[K6_W05] Knows and understands, to an advanced extent, methods of supporting processes and functions, specific to the field of study		Student - defines the basic issues in measurements, classifies of measurement methods		[SU1] Assessment of task fulfilment [SK5] Assessment of ability to solve problems that arise in practice [SU4] Assessment of ability to use methods and tools		
	[K6_U08] while identifying and formulating specifications of engineering tasks related to the field of study and solving these tasks, can:n- apply analytical, simulation and experimental methods,n- notice their systemic and non-technical aspects,n- make a preliminary economic assessment of suggested solutions and engineering work n		Student - can choose, using the technical specifications of devices, the appropriate measurement method and appropriate electronic components, including sensors and measuring transducers for a given problem		[SU3] Assessment of ability to use knowledge gained from the subject		
	[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 - knows the structure and principle of operation of sensors and measuring transducers.		[SW1] Assessment of factual knowledge		

Subject contents	Basic concepts - measured quantity, measuring sensor and system, accuracy of measurements 2. Measuring sensors - classification, figures of merit 3. Determination of dynamic properties of transducers. 4. Resistance sensors in measurement circuits 5. Measurements of strain - strain gages 6. Basic limitations of strain gages, measurements of pressure 7. Inductance sensors and applications 8. Capacitance sensors and applications 9. Measurement circuits of impedance sensors 10. Force and pressure measurements 11. Flow measurements 12. Code transducers 13. Optoelectronic transducers - thermal detectors 14. Optoelectronic transducers - photon detectors 15. Position and motion measurements 16. Seismic measurements 17. Shock and vibration measurements 18. Piezoelectric accelerometers 19. Charge sensors 20. Charge transducers - limitations and measurement circuits 21. Temperature reference measurements 22. Thermoresistors 23. Thermocouples 24. Semiconductor temperature sensors 25. Quartz and special purpose thermometers 26. Introduction to optical pyrometry 27. Monochromatic, radiation and multispectral pyrometers 28. Humidity sensors 29. Microsystems MEMS, MEOMS 30. Microsystems - applications		
Prerequisites and co-requisites	No requirements.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
Recommended reading	Basic literature	J. S. Wilson, Sensor Technology Handbook, Elsevir 2005.	
	Supplementary literature	J. S. Wilson, Sensor Technology Handbook, Elsevir 2005.	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		