



## Subject card

Subject name and code	Sensors and Measurement Converters, PG_00047597						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	October 2021		Academic year of realisation of subject		2023/2024		
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	3		Language of instruction		Polish		
Semester of study	5		ECTS credits		1.0		
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	0.0	0.0	15.0	0.0	0.0	15
	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	15		1.0		9.0	25
Subject objectives	Learning of students the basic issues in the metrological..						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U03] can design, according to required specifications, and make a simple device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment		The student is able, following the instructions, to assemble the measuring system and to perform measurements of the characteristics of non-electric transducers and to analyze the obtained measurement results		[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools		
	[K6_U02] can perform tasks related to the field of study in an innovative way as well as solve complex and nontypical problems, applying knowledge of physics, in changing and not fully predictable conditions		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		[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information		
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. Quarz ans 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			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Self work	50.0%	80.0%
	Entrance exam	50.0%	20.0%
Recommended reading	Basic literature	J. S. Wilson, Sensor Technology Handbook, Elsevir 2005.	
	Supplementary literature	No recommendations.	
	eResources addresses	Adresy na platformie eNauczanie: Przetworniki wielkości nieelektrycznych 2023/2024 zima - Moodle ID: 30660 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30660">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30660</a>	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		