



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 2020	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	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_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			[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		
	[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			[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		
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			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Entrance exam	50.0%	20.0%
	Self work	50.0%	80.0%
Recommended reading	Basic literature	J. S. Wilson, Sensor Technology Handbook, Elsevir 2005.	
	Supplementary literature	No recommendations.	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		