



Subject card

Subject name and code	Metrology I, PG_00038336						
Field of study	Automation, Robotics and Control Systems						
Date of commencement of studies	October 2020	Academic year of realisation of subject			2020/2021		
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			e-learning		
Year of study	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Metrology and Information Systems -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Beata Pałczyńska				
	Teachers		dr inż. Beata Pałczyńska				
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: 30.0						
METROLOGIA I [2020/21] - Moodle ID: 11738 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=11738							
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	10.0		60.0		100
Subject objectives	Acquiring fundamental knowledge on the theory of measurement as well as methods and measurement systems used in automatics						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K6_W03	The student configures the measuring equipment for automation systems.			[SW3] Assessment of knowledge contained in written work and projects		
	K6_U04	The student correctly selects standard analog and digital instruments.			[SU1] Assessment of task fulfilment		
	K6_K02	The student makes designs of measuring systems for electrical and non-electrical quantities.			[SK5] Assessment of ability to solve problems that arise in practice		
Subject contents	LECTURE Definitions of measurement, sensor, transducer, measurement standard. Measurement errors and their types. Inaccuracy: systematic, random, insensibility. Definition of uncertainty type A and type B. Elaboration of experimental measurement results. The static and dynamic transducers properties. Principles of analog measurements of current, voltage, power, energy, RLC, frequency. Standards of base electrical quantities. Bridge and compensation methods. ADC methods. Digital measurements of voltage, frequency and time. Digital multimeters. The basis of electrical measurements of non-electrical quantities. Analog and digital oscilloscope. Smart transducers. The virtual instruments. Compensation and elimination of disturbances.						
Prerequisites and co-requisites	Basic electrical circuits analysis and physics theory knowledge.						
Assessment methods and criteria	Subject passing criteria	Passing threshold		Percentage of the final grade			
	Written exam	60.0%		100.0%			
Recommended reading	Basic literature	1. Chwaleba A., Poniński M., Siedlecki A.: Metrologia elektryczna. WNT, 2. Stabrowski M.: Miernictwo elektryczne. Cyfrowa technika pomiarowa. Warszawa: Oficyna Wydawnicza Politechniki Warszawskiej. 3. Nawrocki W.: Sensory i systemy pomiarowe. Poznań: Wydawnictwo PP. 4. Miłek M.: Pomiar wielkości nieelektrycznych metodami elektrycznymi. Wyd. Pol. Ziel.					
	Supplementary literature	1. Praca zbiorowa.: Przetworniki cyfrowe sygnałów elektrycznych. Podstawy teoretyczne. Warszawa: WNT.					
	eResources addresses						

<p>Example issues/ example questions/ tasks being completed</p>	<ol style="list-style-type: none"> 1. Causes of errors: systematic, random and thick. Ways to reduce these errors. 2. How is the measurement uncertainty type A and type B defined? 3. Enter the diagram and method of balancing a Wheatstone bridge. 4. What is a two-channel oscilloscope phase measurement by comparison? 5. Introduce systems for measurement of active and reactive power in three-phase four-wire unbalanced circuit. 6. Introduce systems for measurement of active and reactive power in three-phase three-wire balanced circuit. 7. Describe the principle of operation of an effective transmitter of multiply-dividing system. 8. Introduce the construction of the measuring signal acquisition module. 9. Discuss the requirements for proper measurement of earth resistance. 10. Introduce a technical method of determining the normal magnetization curve.
<p>Work placement</p>	<p>Not applicable</p>