



## Subject card

Subject name and code	Metrology I, PG_00038336						
Field of study	Hydrogen Technologies and Electromobility						
Date of commencement of studies	October 2022		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	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	partment of Metrology and Information Systems -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Marek Wołoszyk				
	Teachers		dr inż. Marek Wołoszyk				
			dr inż. Michał Ziółko				
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		10.0		60.0	100
Subject objectives	Acquiring fundamental knowledge on the theory of measurement as well as methods and measurement systems used in electrical engineering.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_K01] is aware of the need for continuous education and self-improvement in the field of the profession of an electrician and knows the possibilities of further education		Student correctly selects standard measuring instruments. Student is able to use current literature sources in order to supplement and to develop his or her knowledge.		[SK5] Assessment of ability to solve problems that arise in practice		
	[K6_W05] has structured knowledge of measuring electrical and non-electrical quantities, documenting their results and calculating measurement uncertainty		Student selects appropriate measurement tools for testing of various electrical and nonelectrical parameters. Student describes the methods of evaluation of measurement faults and calculates measurement uncertainty.		[SW3] Assessment of knowledge contained in written work and projects		
	[K6_U02] can work individually and in a team, can communicate using various techniques in a professional environment, as well as document and analyze the results of their work, can estimate the time needed to perform the entrusted task		Student is able to work individually and in a group, knows how to estimate the time needed to carry out the task, and is able to implement the work schedule.		[SU2] Assessment of ability to analyse information		

Subject contents	LECTURE: Meaning and tasks of Metrology. Measurement services. Units in measurement. Elaboration of experiment measurement results. Measurement error theory. Measurement uncertainty definition. Analog electric meters. DC and AC measurement bridges. RLC measurements. Compensation methods. Power measurements of 1 and 3-phase devices in electric power engineering. Reactive power measurements. Electrical energy measurements. Digital and analog measurement of electronic systems. Principles of measurement of electronic systems (amplifier, standardizing devices, basic transducers and analog filters). Principles of ADC and DAC methods. Digital measurement of voltage, frequency and time. The basics of nonelectrical measurement. Principles of operational tests in electrical engineering.		
Prerequisites and co-requisites	Basic knowledge of electrical engineering and electrical circuit analysis.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Exam	60.0%	100.0%
Recommended reading	Basic literature	1. Chwaleba A., Poniński M., Siedlecki A.: Metrologia elektryczna. WNT, 2014.  2. Turmański S.: Technika pomiarowa. WNT, 2016.	
	Supplementary literature	1. Stabrowski M.: Miernictwo elektryczne. Cyfrowa technika pomiarowa. Oficyna Wydawnicza Politechniki Warszawskiej, 1999.  2. Piotrowski J.: Podstawy miernictwa. WNT, 2002.	
	eResources addresses	Adresy na platformie eNauczanie:	
	Example issues/ example questions/ tasks being completed	1. Discuss the measurement of error band Wheatstone bridge.  2. Provide a system for the measurement of reactive power in a 3-wire electrical network.  3. Discuss the operation of the A / D converter type compensation.  4. Discuss the requirements for proper measurement of earth resistance.	
Work placement	Not applicable		

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