



## Subject card

Subject name and code	Electrical Measurements of Non-Electrical Values, PG_00038351						
Field of study	Electrical Engineering						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2023/2024		
Education level	second-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	Part-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department 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. Michał Ziółko				
			dr inż. Marek Wołoszyk				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	10.0	0.0	10.0	10.0	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		5.0		40.0	75
Subject objectives	Acquiring knowledge on the theory of aquisition and processing measurement signals as well as methods and measuring instruments used for nonelectrical measurements.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K7_K03		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.		[SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills		
	K7_U05		Student matches appropriate tools for specific measurement tasks. Student designs measurement systems for determining non-electrical quantities. Student analyzes the received measurement results.		[SU1] Assessment of task fulfilment		
	K7_W02		Student recognizes methods and equipment used in measurement of non-electrical quantities. Student matches appropriate tools for specific measurement tasks. Student applies the rules to eliminate the impact of external factors on the measurement accuracy. Student calibrates sensors and measurement circuits. Student analyzes the received measurement results.		[SW3] Assessment of knowledge contained in written work and projects		

Subject contents	<p>LECTURE Classification of sensors and converters used in non-electrical quantities measurement. Static and dynamic properties of measurement sensors and converters. Sensors out-signal standards and rules of matching the signals with measurement systems. Elimination of external noises that disturb work of measurement sensors. Electrical measurement of temperature. Geometrical quantities measurement (dimension, displacement, level...). Movement parameters measurement (linear and rotational speed, vibration...). Electrical measurement of forces and stresses. Measurement of pressure, flow and volume. Electrical measurement of physical and chemical parameters of materials (conductivity, pH, viscosity, turbidity...).</p> <p>PROJECT During the project the student should develop a fragment of a measurement system for some industrial installation containing the measurement of at least four non-electrical quantities. The project should include a detailed selection of sensors including the development of ways of communicating these sensors with primary system and should contain an overall concept of a measurement system.</p> <p>LABORATORY Principles of development and documentation of measurement results. Elimination of the influence of external factors on the sensor - auto-calibration and linearization of characteristics. Water level measurements. Inclinometric measurements. Temperature measurements.</p>		
Prerequisites and co-requisites	Basic metrology knowledge.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory exercises	60.0%	30.0%
	Written test	60.0%	30.0%
	Project	60.0%	40.0%
Recommended reading	Basic literature	1. Praca zbiorowa pod red. J. Piotrowskiego: Pomiaru czujniki i metody pomiarowe wybranych wielkości. Warszawa, WNT, 2009.	
		2. Zakrzewski J.: Przetworniki i czujniki pomiarowe. Wyd. Politechniki Śląskiej, Gliwice 2004.	
		3. Nawrocki W.: Sensory i systemy pomiarowe. Wyd. Politechniki Poznańskiej, 2006.	
	Supplementary literature	1. Miłek M.: Pomiaru wielkości nieelektrycznych metodami elektrycznymi. Wyd. Politechniki Zielonogórskiej, 1998.	
	eResources addresses	Adresy na platformie eNauczanie: POMIARY ELEKTRYCZNE WIELKOŚCI NIEELEKTRYCZNYCH [ET] [II][Niestacjonarne][2023/24] - Moodle ID: 36129 <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=36129">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=36129</a>	
Example issues/ example questions/ tasks being completed	1. Project of measurement system used to control the chosen parameters of the Jet Grouting drilling rig.		
	2. Project of measurement system used to monitor environmental conditions of breeding fish pond.		
Work placement	Not applicable		