



## Subject card

Subject name and code	Metrology I, PG_00038336						
Field of study	Automation, Robotics and Control Systems						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2024/2025		
Education level	first-cycle studies	Subject group					
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	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						
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 automatics						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U04] has the ability to self-educate, among other things, in order to improve professional qualifications		The student correctly selects standard analog and digital instruments.		[SU4] Assessment of ability to use methods and tools		
	[K6_W03] has structured knowledge of tools and methods for measuring electrical quantities, documenting their results and assessing errors and uncertainties		The student configures the measuring equipment for automation systems.		[SW3] Assessment of knowledge contained in written work and projects		
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.						
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	<ol style="list-style-type: none"> <li>1. 1. Chwaleba A., Poniński M., Siedlecki A.: Metrologia elektryczna. WNT, warszawa 2014</li> <li>2. 2. Stabrowski M.: Miernictwo elektryczne. Cyfrowa technika pomiarowa. Warszawa: Oficyna Wydawnicza Politechniki Warszawskiej</li> <li>3. 3. Maśnicki R., Mindykowski J., Metrologia, Wydawnictwo Akademii Morskiej w Gdyni, Gdynia 2015</li> <li>4. 4. Nawrocki W.: Sensory i systemy pomiarowe. Poznań: Wydawnictwo PP</li> <li>5. 5. Miłek M.: Pomiary wielkości nieelektrycznych metodami elektrycznymi. Wyd. Pol. Ziel.</li> </ol>
	Supplementary literature	<ol style="list-style-type: none"> <li>1. 1. Praca zbiorowa.: Przetworniki cyfrowe sygnałów elektrycznych. Podstawy teoretyczne. Warszawa: WNT</li> <li>2. 2. Skubis T., Podstawy metrologicznej interpretacji wyników pomiaru, Wydawnictwo Politechniki Śląskiej, Gliwice 2004</li> <li>3. 3. Świsulski D., Komputerowa technika pomiarowa, Agenda Wydawnicza PAK, Warszawa 2005</li> </ol>
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Causes of errors: systematic, random and thick. Ways to reduce these errors.</li> <li>2. How is the measurement uncertainty type A and type B defined?</li> <li>3. Enter the diagram and method of balancing a Wheatstone bridge.</li> <li>4. What is a two-channel oscilloscope phase measurement by comparison?</li> <li>5. Introduce systems for measurement of active and reactive power in three-phase four-wire unbalanced circuit.</li> <li>6. Introduce systems for measurement of active and reactive power in three-phase three-wire balanced circuit.</li> <li>7. Describe the principle of operation of an effective transmitter of multiply-dividing system.</li> </ol>	
Work placement	Not applicable	