



## Subject card

Subject name and code	Metrology - laboratory, PG_00047562						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	October 2020		Academic year of realisation of subject		2021/2022		
Education level	first-cycle studies		Subject group		Obligatory subject group in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish The Laboratory Regulations and Health and Safety Regulations are presented to Students before the start of practical classes. Both regulations must be accepted before starting practical classes. Marks from lab classes, homework, reports and tests cannot be improved. In the event of a justified absence, the method of obtaining a credit is in accordance with the Laboratory's Regulations.		
Semester of study	3		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Sylwia Babicz-Kiewlicz				
	Teachers		dr inż. Sylwia Babicz-Kiewlicz  dr inż. Stanisław Galla				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	30.0	0.0	0.0	30
	E-learning hours included: 0.0						
	Adresy na platformie eNauczanie:						
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		2.0		18.0	50
Subject objectives	The aim is to teach: performing measurements of basic electrical quantities: voltage, current, frequency, resistance, capacitance, inductance; operating and making measurements with an analogue and digital oscilloscope; setting up, making measurements, processing of measurement data on computer-controlled measurement systems.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U06] can analyse the operation of components, circuits and systems related to the field of study, measure their parameters and examine technical specifications	Student understands the concept of the measurement system. Can improve the measurement system. It measures basic electrical values: voltage, current, resistance, power and electricity. It measures high and low resistances and impedance parameters of RLC elements.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
	[K6_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions	Student calibrates analogue and digital electric meters. Measures basic electrical values: voltage, current, resistance, power and electricity. Examines the measuring capabilities of an analog and digital oscilloscope. Measures signal parameters: time, frequency, phase shift. Student measures parameters of selected a / c converters. Measures high and low resistances and impedance parameters of RLC elements. Analyzes the measurement results and evaluates the accuracy of the measurement.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
Subject contents	1. Introduction: syllabus, characteristic of lab ( one student - one stand, computer monitoring of student"s activity), principles of work and re-ports 2. Familiarization with basic instruments 3. Investigation and calibration of basic measuring instruments of electrical quantities, analog and digital having a PC link 4. Measurements of basic electrical quantities: voltage, current, resistance, power and electrical energy (using electronic P/f converter) 5. Study of analog and digital storage oscilloscope 6. Use of oscilloscopes to measure basic electrical quantities: voltage, pulse parameters, observation of device characteristics, observation of waveforms in digital circuits 7. Investigation of electronic timer-counter features 8. Use of digital methods and oscilloscope for measurements of time, frequency and phase 9. Investigations of properties and modes of operation of measuring sys-tem: bench multimeter, arbitrary function generator, hand-held multimeter 10. Investigation of dual slope integration ADC and voltage to frequency converter in above mentioned system 11. Investigation and calibration of AC/DC transducers: average-responding, peak-responding, AC low and high frequencies 12. Measurement of the RMS value of different types of waveforms with true RMS/DC conversion technique, average-responding instrument and with DSP method 13. Measurements of high and very low resistances with Wheatstone and Thomson bridges as well as using DMM with 4-wire Kelvin connectors 14. Measurements of impedance parameters of RLC components		
Prerequisites and co-requisites	The Laboratory Regulations and Health and Safety Regulations are presented to Students before the start of practical classes. Both regulations must be accepted before starting practical classes. Marks from lab classes, homework, reports and tests cannot be improved. In the event of a justified absence, the method of obtaining a credit is in accordance with the Laboratory's Regulations.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Preliminary tests and reports for each exercise	50.0%	100.0%
Recommended reading	Basic literature	1. Stabrowski M.: Cyfrowe przyrządy pomiarowe. PWN. 2. Nawrocki W.: Komputerowe systemy pomiarowe, WKiŁ 3. Materiały pomocnicze do wykładu na <a href="http://www.eti.pg.gda.pl/katedry/kmoe/dydaktyka">www.eti.pg.gda.pl/katedry/kmoe/dydaktyka</a>	
	Supplementary literature	1. Dusza J. i inni: Podstawy miernictwa. Wyd. Politechniki Warszawskiej 2. Guide to the Expression of Uncertainty in Measurement. Wydanie polskie:Wyrażenie niepewności pomiaru, Przewodnik, Główny Urząd Miar	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		