



Subject card

Subject name and code	METROLOGY, PG_00044540						
Field of study	Transport						
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		
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			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Electrical Engineering of Transport -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Sławomir Judek					
	Teachers	dr hab. inż. Jacek Skibicki dr inż. Sławomir Judek					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	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	5.0		40.0		75
Subject objectives	Achievement by the student: • knowledge in the field of modern measuring methods, in particular with regard to the transport system; • skills engineering approach to the problem of metrology, and in particular the use of basic methods and procedures for the organization and operation of the measuring systems.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_U06] able to plan and conduct simple laboratory and operational experiments and simulations in the area of transport; able to interpret the results and formulate conclusions	Student is able to perform the measurement procedure according to the instructions, develop results, prepare a report.			[SU2] Assessment of ability to analyse information		
	[K6_W14] has basic knowledge of measurement techniques used to describe the phenomena which occur in transport structures and when means of transport are operated	Student is able to use the acquired experience to solve measurement problems.			[SW1] Assessment of factual knowledge		
	[K6_U09] able to, when formulating and solving engineering problems in transport, use the right methods and devices to carry out measurements of basic values and parameters used in transport, carry out stress tests of structures, select the right materials, select elements of devices	Student defines the quantities and units. Makes the measurement of selected physical quantities of direct and indirect methods. Uses a conventional analog, digital instruments and oscilloscopes. Justifies the selection of the class, scope and type of instrument for measuring task. Estimated measurement uncertainty.			[SU4] Assessment of ability to use methods and tools		

Subject contents	<p>LECTURE Quantity, unit, value, the system of units. Basic terms the theory of measurement uncertainty. Interval of uncertainty. General and specific procedures for estimating uncertainty. Measurement methods and tools. Signal processing and measurement transducers. Characteristic parameters. Standards. Analog measurements. Analog-digital converters. Digital measurements. Measurements of electrical quantities. Measurements of geometrical quantities, motion parameters, forces and stresses, pressure and flow, temperature, vibration, noise. Measurements using GPS technology and SRTM. Vision method 2D and 3D. LABORATORY</p> <p>Measurements: direct, indirect, single and multiple. Measurements of electrical quantities. Observations, imaging and oscilloscope measurements. Measurements of light intensity. Temperature measurements. Motion parameters measurements. Speed measurements. Checking the measuring equipment by comparison with the standard.</p>		
Prerequisites and co-requisites	Basic knowledge on mathematics and physics.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium.	60.0%	60.0%
	Reports of the laboratory experiments.	60.0%	40.0%
Recommended reading	Basic literature	<p>Piotrowski J.: Podstawy miernictwa. WNT, Warszawa, 2002. Parchański J.: Miernictwo elektryczne i elektroniczne. Warszawa: WSiP, 1995. Chwaleba A., Poniński M., Siedlecki A.: Metrologia elektryczna. WNT, Warszawa, 2003. Czajewski P., Poniński M.: Zbiór zadań z metrologii elektrycznej. Warszawa: WNT, 2000. Raghavendra N. V., Krishnamurthy L.: Engineering Metrology and Measurements. Oxford University Press, 2013. Judek S., Skibicki J.: Metrologia w transporcie. Laboratorium. Gdańsk: Wydawnictwo Politechniki Gdańskiej, 2015.</p>	
	Supplementary literature	<p>Pr. zb.: Poradnik Inżyniera Elektryka, t. I. Warszawa: WNT, 2005. Pr. zb.: Elektrotechnika i elektronika dla nieelektryków. Warszawa: WNT, 2007. BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML. Guide to the Expression of Uncertainty in Measurement. International Organization for Standardization, Geneva 1995. BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML. International Vocabulary of Basic and General Terms in Metrology Second Edition 1993. International Organization for Standardization, Geneva.</p>	
	eResources addresses	<p>Adresy na platformie eNauczenie: Metrologia [2022/2023], stud. I stopnia, Transport, sem. 2 - Moodle ID: 29600 https://enauczenie.pg.edu.pl/moodle/course/view.php?id=29600</p>	
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Determine the uncertainty in single, direct measurement with an analog instrument. 2. Determine the uncertainty in single, direct measurement with a digital instrument. 3. Determine the uncertainty in indirect single measurement. 4. Present the measurement result in accordance with applicable standards, including its uncertainty. 		
Work placement	Not applicable		