GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	METROLOGY, PG_00044540		
Field of study	Transport		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2023/2024
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_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
[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 to use the acquired experience to solve measurement problems.	[SW1] Assessment of factual knowledge
[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

<table>
<tr><td>Subject contents</td><td>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
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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic knowledge on mathematics and physics.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Reports of the laboratory experiments.</td><td>60.0%</td><td>40.0%</td></tr>
<tr><td>Midterm colloquium.</td><td>60.0%</td><td>60.0%</td></tr>
</table>
</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>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.</td></tr>
<tr><td>Supplementary literature</td><td>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.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:
Metrologia [2023/2024], stud. I stopnia, Transport, sem. 2 - Moodle ID: 36212
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36212</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Determine the uncertainty in single, direct measurement with an analog instrument.
2. Determine the uncertainty in single, direct measurement with an digital instrument.
3. Determine the uncertainty in indirect single measurement.
4. Present the measurement result in accordance with applicable standards, including its uncertainty.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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