

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Podstawy metrologii**
 Name in English: **Basics of Metrology**
 Main field of study (if applicable): **Industrial Control Engineering**
 Specialization (if applicable):
 Level and form of studies: **1st level, full-time**
 Kind of subject: **obligatory**
 Subject code: **APR013301**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30		15		
Number of hours of total student workload (CNPS):	90		60		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	3		2		
including number of ECTS points for practical (P) classes :			2		
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10		1.40		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Has knowledge in the field of mathematics and physics, is aware of the need for education.

SUBJECT OBJECTIVES

- C1. To acquire basic knowledge in the scope of physical quantities measurement.
- C2. To become aware of the need to use measurement methods, techniques and tools in order to understand natural phenomena.
- C3. To acquire the ability to perform basic measurements of electrical quantities.
- C4. To acquire the ability to qualitatively understand, interpret and quantitatively analyze measurement results.

SUBJECT LEARNING OUTCOMES*relating to knowledge:*

- PEU_W01 Has basic knowledge in the scope of measurement uncertainty assessment.
 PEU_W02 Knows measurement methods and the metrological properties of basic measurement tools.
 PEU_W03 Has a knowledge in the scope of the basis measurements of electrical quantities.

relating to skills:

- PEU_U01 Has the ability to plan and safely perform measurements, formulate measurement results and estimate uncertainty of measured quantities.
 PEU_U02 Has the ability to perform measurements of basic electrical quantities using analogue and digital instruments, as well as the oscilloscope. Has the ability to present the obtained results in numerical, tabular and graphical form, make their interpretation and draw proper conclusions.

relating to social competences:

- PEU_K01 Shows concern for the performance of assigned tasks.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Basic concepts of metrology. SI.	2
Lec 2	Division of measurement methods. Measurement result. Error and uncertainty.	2
Lec 3	Calculation of type A, type B uncertainty in direct measurements.	2
Lec 4	Calculations of indirect measurement uncertainty. Analogue meters.	2
Lec 5	Analogue instruments.	2
Lec 6	Standards of selected electrical units.	2
Lec 7	Resistance measurements. DC bridges.	2
Lec 8	Inductance and capacity measurements. AC bridges.	2
Lec 9	One and three-phase active power measurements.	2
Lec 10	Reactive power measurements. Energy measurements.	2
Lec 11	Introduction to digital instruments.	2
Lec 12	Registration of measurement information. Oscilloscope and DAQ card.	2
Lec 13	Chosen transducers. Smart sensors.	2
Lec 14	Fundamentals of measurement systems.	2
Lec 15	Test	2
Total hours:		30

Form of classes - laboratory		Number of hours:
Lab 1	Health and Safety Regulations, laboratory of assessment rules. Writing of the measurement result rules.	1
Lab 2	Analogue instrument measurements.	2
Lab 3	Digital instrument measurements.	2
Lab 4	Oscilloscope measurements.	2
Lab 5	Resistance measurements, ohmmeter, indirect method of measurement.	2
Lab 6	Indirect measurements of inductive components parameters.	2
Lab 7	Assessment of random errors.	2
Lab 8	Credit laboratory.	2
Total hours:		15

TEACHING TOOLS USED

- N1. Traditional lectures using audiovisual techniques.
 N2. Laboratory conducted in student training groups.
 N3. Office hours.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation <i>F - forming (during semester)</i> <i>P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEU_W01 PEU_W02 PEU_W03	Test
P(W)	P = F1	
F1(L)	PEU_U01 PEU_U02 PEU_K01	Check preparation for classes
F2(L)	PEU_U01 PEU_U02 PEU_K01	Substantive activity in the classroom
F3(L)	PEU_U01 PEU_U02 PEU_K01	Assessment of reports of the measurements
P(L)	P = 0,2F1 + 0,2F2 + 0,6F3	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

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| <p>1] Chwaleba A., Poniński M., Siedlecki A.: Metrologia elektryczna., WNT Warszawa, 2003</p> <p>[2] Koczela Danuta (red.), Miernictwo elektryczne. Ćwiczenia laboratoryjne, (elektrotechnika) dydaktyka, Oficyna Wydawnicza Politechniki Wrocławskiej, 2001</p> <p>[3] Marcyniuk A. , Podstawy Metrologii elektrycznej, WNT, Warszawa, 1994</p> <p>[4] Derlecki S., Metrologia elektryczna i elektroniczna, Podręczniki Akademickie- Pol. Łódzka, 2010</p> <p>[5] Kalus-Jęcek B., Wzorce wielkości elektrycznych i ocena niepewności pomiarów, Wyd. Pol. Łódzkiej, Łódź, 2000</p> <p>[6] www.imnipe.pwr.edu.pl</p> |
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SECONDARY LITERATURE:

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| <p>[1] Piotrowski J., Podstawy miernictwa, WNT, Warszawa, 2002</p> <p>[2] Sydenham P.H., Podręcznik Metrologii, WKiŁ, Warszawa, 1990</p> <p>[3] Tumański S. Technika Pomiarowa, WNT, Warszawa, 2007</p> <p>[4] Lisowski M., Podstawy metrologii, Of. Wyd. Pol. Wrocławskiej, Wrocław, 2011</p> <p>[5] Czajewski J., Podstawy metrologii elektrycznej, OW Pol. Warszawskiej, Warszawa, 2008</p> |
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SUBJECT SUPERVISOR

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