

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Podstawy metrologii**  
 Name in English: **Basics of Metrology**  
 Main field of study (if applicable): **Control Engineering and Robotics**  
 Specialization (if applicable):  
 Level and form of studies: **1st level, full-time**  
 Kind of subject: **obligatory**  
 Subject code: **ARR043301**  
 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 EDUCATIONAL EFFECTS***relating to knowledge:*

- PEK\_W01 Has basic knowledge in the scope of metrology and units of measurement  
 PEK\_W02 Knows the metrological properties of basic measurement tools.  
 PEK\_W03 Knows calculation methods used in formulating measurement results.

*relating to skills:*

- PEK\_U01 Has the ability to plan and safely perform measurements, formulate measurement results and estimate uncertainty of measured quantities.  
 PEK\_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:*

- PEK\_K01 Shows concern for the performance of assigned tasks.

## PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Basic concepts of metrology - object, measurement, SI	2
Lec 2	Elements of the analysis of metrological - measurement errors, examples	2
Lec 3	Measurement uncertainty, characteristics of the measurement signal processing	2
Lec 4	Measurement uncertainty, analog measuring instruments, part I	2
Lec 5	Analog measuring instruments, part II	2
Lec 6	Patterns of selected units of physical quantities, signal sources	2
Lec 7	Static and dynamic properties of the instruments and measuring transducers	2
Lec 8	Digital measuring instruments	2
Lec 9	Measurements of basic physical quantity	2
Lec 10	Measurements of energy power	2
Lec 11	Registration and visualization of measurement results, analog and digital oscilloscope	2
Lec 12	Standards in metrology, measuring digital bridge	2
Lec 13	Smart transducers	2
Lec 14	Fundamentals of measurement systems - definitions, structure, examples of systems for measuring electrical quantities and non- electrical	2
Lec 15	Test	2
Total hours:		<b>30</b>

Form of classes - laboratory		Number of hours:
Lab 1	Health and Safety Regulations, laboratory of assessment rules. Rules for the transcription the results of measurement	1
Lab 2	Measuring of analog device	2
Lab 3	Measurements of digital instrument	2
Lab 4	Oscilloscope - structure, properties, measurements of selected quantities	2
Lab 5	Resistance measurements, ohmmeter, indirect method of measurement	2
Lab 6	Inductive components - indirect method of measurement	2
Lab 7	Assessment of random errors	2
Lab 8	Summary of activities	2
Total hours:		<b>15</b>

## TEACHING TOOLS USED

- N1. Traditional lectures using audiovisual techniques  
 N2. Laboratory test conducted exercises in student groups  
 N3. Consultation

## EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation <i>F - forming (during semester) P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEK_W01 PEK_W02 PEK_W03	Test
P(W)	P = F1	
F1(L)	PEK_U01 PEK_U02 PEK_K01	Check preparation for classes
F2(L)	PEK_U01 PEK_U02 PEK_K01	Substantive activity in the classroom
F3(L)	PEK_U01 PEK_U02 PEK_K01	Assessment of reports of the measurements
P(L)	P = 0,2F1 + 0,2F2 + 0,6F3	

<b>PRIMARY AND SECONDARY LITERATURE</b>
---

<b>PRIMARY LITERATURE:</b>
----------------------------

- |   |
|---|
| <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> |
|---|

<b>SECONDARY LITERATURE:</b>
------------------------------

- |   |
|---|
| <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> |
|---|

<b>SUBJECT SUPERVISOR</b>
---------------------------

Krzysztof Podlejski, krzysztof.podlejski@pwr.edu.pl
---

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**ARR043301 - Basics of Metrology**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1AiR_W19	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.3
PEK_W02	K1AiR_W19	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.3
PEK_W03	K1AiR_W19	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.3
PEK_U01	K1AiR_U05	C.3 C.4	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8	N.2 N.3
PEK_U02	K1AiR_U17	C.3 C.4	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8	N.2 N.3
PEK_K01	K1AiR_K05	C.1 C.2 C.3 C.4	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8	N.1 N.2 N.3