

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Pomiary elektryczne wielkości nieelektrycznych**  
 Name in English: **Electrical Measurement Nonelectrical Values**  
 Main field of study (if applicable): **Electrical Engineering**  
 Specialization (if applicable): **Industrial Electrical Engineering**  
 Level and form of studies: **2nd level, full-time**  
 Kind of subject: **obligatory**  
 Subject code: **ELR053307**  
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15		15		
Number of hours of total student workload (CNPS):	60		30		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	2		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40		0.70		

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. He has basic knowledge in the field of linear circuits with sinusoidal signal. He knows the rules of the modeling of electrical circuits and their mathematical description.
2. He has basic knowledge of metrology.  
He knows the measuring systems for high values of voltage and current measuring transducers, transmitters rms bridge
3. circuits for measuring resistance, reactance and impedance compensating voltage measurement circuits. He knows the metrological characteristics of digital voltmeters
4. He Has a basic skills in the implementation, analysis and design of electrical measurements

**SUBJECT OBJECTIVES**

- C1. Learning the methods and non-electrical measuring systems,
- C2. Proficiency in standard measuring instruments
- C3. Knowing the non-electrical sensors structures
- C4. Acquisition and consolidation of social skills including emotional intelligence skills involving the cooperation of a group of students with a view to effective problem solving. Responsibility, honesty and fairness in the procedure observance force in academia and society

**SUBJECT LEARNING OUTCOMES***relating to knowledge:*

- PEU\_W01 He knows the design, operation and performance of processing the most common transducers  
 PEU\_W02 He has a broad knowledge of the methods and systems for measuring various non-electrical quantities. He knows the physical quantities of the processing of the electrical quantities  
 PEU\_W03 He or she can assess the impact of external factors affecting the essential elements of measurement circuit on the result

*relating to skills:*

- PEU\_U01 He can to choose the measuring tool for measuring non-electrical values  
 PEU\_U02 Can use the tools to measure temperature, pressure, stress, vibration - vibration, moisture content, chemical composition, flow rates of gases and liquids  
 PEU\_U03 He or she can assess the impact of external factors affecting the essential elements of measurement circuit on the result

*relating to social competences:*

- PEU\_K01 He or she is aware of their own responsibility for their work and a willingness to comply with the principles of teamwork. He searches information and its critical analysis, properly identifies and resolves the dilemmas of working in the profession

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Processing of non-electrical quantities into electrical signals - general issues	2
Lec 2	Temperature measurements: the scale of temperature, measurement methods. Resistance thermometers and thermocouples	2
Lec 3	Methods for measuring the temperature of solids, liquids and gases, Temperature measurements in industrial engineering	2
Lec 4	Flow measurement of gases and liquids	2
Lec 5	Measurement of pressure. Humidity Measurement.	2
Lec 6	Strain gauge transducers, torque measurement, force measurement	2
Lec 7	pH and conductivity measurements	2
Lec 8	Test	1
Total hours:		<b>15</b>

Form of classes - laboratory		Number of hours:
Lab 1	Presentation of the safety rules and principles of assessment laboratory. Presentation of laboratory	2
Lab 2	Measurements of the gas flow	2
Lab 3	Determination characteristics of the sensors and pressure transmitters	2
Lab 4	Measurements of strain - the characteristics of transducers, force transducers study	2
Lab 5	Temperature measurement - determining the characteristics of transducers	2
Lab 6	Measurements of pH and conductivity of liquid	2
Lab 7	Optical Measurement. Study on the contrast of outdoor lighting	2
Lab 8	summary	1
Total hours:		<b>15</b>

TEACHING TOOLS USED
N1. Traditional Lecture with audio-visual techniques
N2. Laboratory run in the traditional manner of exercises + student groups, a report

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation <i>F - forming (during semester) 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_U03 PEU_K01	Average assessment of reports done laboratory activities
P(L)	P=F1	

PRIMARY AND SECONDARY LITERATURE
<b>PRIMARY LITERATURE:</b> [1] Miłek M., Metrologia elektryczna wielkości nieelektrycznych, Uniwersytet Zielonogórski 2006. [2] Janiczek R., Elektryczne miernictwo przemysłowe, Wydawnictwo politechniki częstochowskiej 2006. [3] Rząsa M., Kiczma B., Elektryczne i elektroniczne czujniki temperatury, WKŁ Warszawa 2005. [4] Romer R., Miernictwo przemysłowe, PWN, Warszawa, 1970 <b>SECONDARY LITERATURE:</b> [1] Stryburski W. Przetworniki tensometryczne - konstrukcja, projektowanie, użytkowanie, WNT, Warszawa 1971. [2] Editors: Erika Kress-Rogers and Christopher J. B. Brimelow - Instrumentation and sensors for the food industry, second edition, CRC Press 2001

SUBJECT SUPERVISOR
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