

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Czujniki i przetworniki**  
 Name in English: **Sensors and Transducers**  
 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: **APR013304**  
 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:	examination		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 modelling of electrical circuits and their mathematical description.
2. He has basic knowledge of metrology.
3. He Has a basic skills in the implementation, analysis and design of electrical measurements

**SUBJECT OBJECTIVES**

- C1. Knowledge of static and dynamic properties of sensors, transducers,  
 C2. Learning practical metrological characteristics of sensors and measuring transducers  
 C3. Knowledge of mathematical models of transducers  
 C4. ability to optimize and enhance the dynamic properties of transducers  
 C5. 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 or she knows rules for processing physical quantities on the electrical parameters.  
 PEU\_W02 He or She has a basic knowledge of the dynamic properties of sensors and transducers.  
 PEU\_W03 Know the mathematical models of sensors and transducers

*relating to skills:*

- PEU\_U01 Can take measurements of static and dynamic characteristics of sensors and transmitters.  
 PEU\_U02 Can present the results in numerical and graphical form.  
 PEU\_U03 He has ability to assess the impact of external factors 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	Sensors and transducers in measurement chain. Types of sensors	2
Lec 2	Models of real transducers, transducers zero, first and second order. Static and dynamic properties of sensors.	1
Lec 3	Basic blocks of measuring transducers.	2
Lec 4	Voltage and current measuring transducers	2
Lec 5	Power and energy transducers	2
Lec 6	Displacement transducers. Resistive, capacitive, inductive transducers	2
Lec 7	The measurement systems of passive and active sensors.	2
Lec 8	Encoders. Optical sensors	2
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 test stand	1
Lab 2	Investigation of dynamic transducers - response to unity step	2
Lab 3	Determination of amplitude and phase characteristics for input circuit of transducer.	2
Lab 4	Determination of the frequency characteristics of current transducers	2
Lab 5	Rms converter	2
Lab 6	Determination of the characteristics of the light sensor	2
Lab 7	Determination of the characteristics of proximity (distance).	2
Lab 8	Discussion of Report. The reserve term	2
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	Exam
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Assessment of reports done laboratory activities
P(L)	P=F1 Average value of laboratory evaluation	

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE:

- [1] Zajda Z., Żebrowski L., Urządzenia i układy automatyki PWr. Wrocław, 1993
- [2] Miłek M., Metrologia elektryczna wielkości nieelektrycznych, Uniwersytet Zielonogórski 2006.
- [3] Janiczek R., Elektryczne miernictwo przemysłowe, Wydawnictwo Politechniki Częstochowskiej 2006.
- [4] Rząsa M., Kiczma B., Elektryczne i elektroniczne czujniki temperatury, WKŁ Warszawa 2005.
- [5] Romer R., Miernictwo przemysłowe, PWN, Warszawa, 1970

### SECONDARY LITERATURE:

- [1] Stryburski W. Przetworniki tensometryczne - konstrukcja, projektowanie, użytkowanie, WNT, Warszawa 1971.
- [2] [www.czujniki.pl](http://www.czujniki.pl)
- [3] Editors: Erika Kress-Rogers and Christopher J. B. Brimelow - Instrumentation and sensors for the food industry, second edition, CRC Press 2001
- [4] Nestor O. Shpak, Vadim P. Deynega Nikolay V. Kirianaki and Sergey Y. Yurish - Data Acquisition And Signal Processing For Smart Sensors, John Wiley & Sons 2002

<b>SUBJECT SUPERVISOR</b>
Grzegorz Kosobudzki, grzegorz.kosobudzki@pwr.edu.pl