

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Czujniki i przetworniki**
 Name in English: **Sensors and Transducers**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable):
 Level and form of studies: **1st level, part-time**
 Kind of subject: **optional**
 Subject code: **ELR051268**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	10		10		
Number of hours of total student workload (CNPS):	30		30		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	1		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70		0.70		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Has knowledge of basics of physics and electronics.
2. Knows basic of electrical metrology.
3. Ability to use basic electrical measurement devices

SUBJECT OBJECTIVES

- C1. Learn physical basics of sensors and converters.
 C2. Learn most important parameters of sensors and converters, which influence their work.
 C3. Ability to use sensors and converters. in measurement systems.

SUBJECT LEARNING OUTCOMES*relating to knowledge:*

- PEU_W01 Is able to describe basic laws, construction, and properties of sensors and converters.
 PEU_W02 Is able to describe application of sensors and converters in various physical quantities measurements and measurement systems.
 PEU_W03 Is able to select sensors and converters for certain applications.

relating to skills:

- PEU_U01 Has ability to perform measurements with sensors and converters.
 PEU_U02 Has ability to determine usefulness of sensor and converters in measurement system based on their parameters.
 PEU_U03 Is able to design and make measurement system with sensors and converters and evaluate processing errors.

relating to social competences:

- PEU_K01 Is aware of responsibility for own work and is ready to subordinate the rules of team work.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Information about the subject, requirements educational effects and grading system. Classification of sensors and converters and their role in measurement chain.	2
Lec 2	Static and dynamic parameters of sensors and converters.	2
Lec 3	Temperature sensors: resistive, diodes, capacitive. Thermoelectric temperature sensors, optical fiber and pyrometric sensors, thermographic cameras.	2
Lec 4	Mechanical quantities sensors: inductive, tensometric and other. Gas sensors. Humidity and pH sensors.	2
Lec 5	Analogue converters, and their tasks in measurement systems. Test	2
Total hours:		10

Form of classes - laboratory		Number of hours:
Lab 1	Introduction.	1
Lab 2	Investigation of measurement amplifiers properties.	3
Lab 3	Sensors in measurements of mechanical strain and pressure and their signal processing. Investigation of temperature sensors properties.	3
Lab 4	Sensors in measurements of displacement and fluid level and their signal processing. Investigation of A/D converters properties.	3
Total hours:		10

TEACHING TOOLS USED

- N1. Lecture of problem.
 N2. Lecture with use of audio-visual technique and multimedia presentation.
 N3. Measurement laboratory realized in traditional students groups.

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 PEU_K01	Written test.
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Preparation to the classes
F2(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Activity during classes.
F3(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Reports from classes.
P(L)	$P=0,4 \cdot F1 + 0,3 \cdot F2 + 0,3 \cdot F3$	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

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| <ul style="list-style-type: none">[1] Walt Kester, Przetworniki A/C i C/A: teoria i praktyka, Wydawnictwo BTC, Legionowo 2012.[2] Lisowski Michał Podstawy metrologii, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2011.[3] Nawrocki Zdzisław, Wzmacniacze operacyjne i przetworniki pomiarowe, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2008.[4] Sławomir Tumański, Technika pomiarowa, Warszawa WNT 2007,[5] Nawrocki, Waldemar, Sensory i systemy pomiarowe, Wyd. Politechniki Poznańskiej, Poznań 2001[6] Miłek Marian, Metrologia elektryczna wielkości nieelektrycznych, Oficyna wydawnicza Uniwersytetu Zielonogórskiego, Zielona Góra 2006[7] Gajek Andrzej, Juda Zdzisław, Czujniki, WKŁ, Warszawa 2011[8] Kaczmarek Zdzisław, Światłowodowe czujniki i przetworniki pomiarowe, Agenda wydawnicza PAK, Warszawa 2006 |
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SECONDARY LITERATURE:

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| <ul style="list-style-type: none">[1] Patrick F. Dunn, Fundamentals of sensors for engineering and science, Boca Raton CRC/Taylor & Francis, 2011[2] Gardner J. W.: Microsensors. Principles and applications. John Wiley and Sons. Chichester, 1995.[3] Wagner E. i inni: Sensors. A comprehensive survey. Vol. 6. Optical sensors. VCH Weinheim 1992.[4] Ohba R. i inni: Intelligent sensor technology. John Wiley and sons, Chichester 1992.Fraden J.: AIP hadbook of modern sensors. Physics, designs and applications. AIP, New York 1993.[5] Rylski A.: Sensory i przetworniki wielkości nieelektrycznych. Skrypt Pol. Rzeszowskiej, 1994[6] Vetelino J., Reghu A., Introduction to sensors, Boca Raton : CRC Press/Taylor and Francis Group, 2011.[7] Fraden J., Handbook of modern sensors: physics, designs, and applications, New York [etc.] Springer, 2010. |
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SUBJECT SUPERVISOR

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