FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Mikroprocesorowe przetworniki pomiarowe**
Name in English:	**Microprocessor measuring transducers**
Main field of study (if applicable):	**Industrial Control Engineering**
Specialization (if applicable):	**Automation of Machines, Vehicles and Apparatus**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**obligatory**
Subject code:	**APR013307**
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):	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. Has a basic knowledge of the industrial measurement. Knows the principles of operation and the design of sensors, as well as methods and measuring systems used in the measurement of non-electrical quantities.
2. Has organized knowledge in the scope of microprocessor system architectures, addressing modes, numerical codes, memory types, typical internal circuits of microprocessors (AC transducers, counters, interrupt systems).
3. Has the ability to perform measurements of static and dynamic characteristics of sensors and transducers.

SUBJECT OBJECTIVES

C1. To broaden and organize knowledge in the scope of microprocessor transducers and devices for measuring the electrical and non-electrical quantities used in standard and special measuring systems.

C2. To acquire the ability to formulate and solve problems related to modelling, designing and studying real and virtual measuring systems.

C3. To acquire the ability to integrate knowledge in the fields of metrology, control engineering, electronics and data transmission.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01	Has broadened and organized knowledge in the scope of structure and architecture of smart transducers of electrical and non-electrical quantities.
PEU_W02	Has deepened knowledge in the scope of data transmission and acquisition in the devices and systems for measuring the electrical and non-electrical quantities.
PEU_W03	Has organized knowledge in the scope of smart measuring transducer usage

relating to skills:

PEU_U01	Has the ability to formulate and solve problems related to modelling, designing and studying real measuring systems
PEU_U02	Has the ability to integrate knowledge in the fields of metrology, control engineering, electronics and measurement data transmission

relating to social competences:

PEU_K01	K01 Has the ability to think and act in a creative and entrepreneurial manner. Has the ability to adequately assign priorities related to implementation of a given task.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Introductory lecture. Microprocessor measuring transducers. Smart devices and their features.	2
Lec 2	Conditioning of measuring signals. Basic structures of conditioning systems, examples of solutions.	4
Lec 3	Measurement amplifiers - basic systems and their features.	2
Lec 4	A/C and C/A converters. Principle of operation and properties.	2
Lec 5	Measurement interfaces. Basic definitions, example solutions.	4
Lec 6	Measurement systems using DAQ cards.	2
Lec 7	Graphical environment for the design of instruments and measuring systems.	2
Lec 8	Basic elements of programming virtual measuring systems in the LabVIEW environment.	3
Lec 9	The use of virtual measuring instruments in the design of measuring systems in LabVIEW.	3
Lec 10	Examples of applications of measuring systems for monitoring and diagnostics of selected systems.	4
Lec 11	Final test.	2
	Total hours:	**30**

Form of classes - laboratory		**Number of hours:**
Lab 1	Health and Safety Regulations, laboratory of assessment rules. Introduction to Programming in LabVIEW.	1
Lab 2	Virtual digital-to-analog converter (DAC).	2
Lab 3	Virtual measuring of temperature part I - creating SubVI.	2
Lab 4	Virtual measuring of temperature part II - graphics.	2
Lab 5	Plotting waveform functions, modify charts.	2
Lab 6	Transducer communication with LabVIEW and other environments.	2
Lab 7	Acquisition and analysis of measurement data.	2
Lab 8	Complementary tasks, summary of classes, credit.	2
	Total hours:	**15**

TEACHING TOOLS USED
N1. Traditional lectures using audiovisual techniques
N2. Laboratory test conducted exercises in student groups
N3. Consultation
N4. Lecture - credit.
N5. Laboratory - credit.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**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	Rating tasks performed during laboratory classes
P(L)	P=F1	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Lysik P.T., Inteligentna technika pomiarowa. Politechnika Radomska,Wydawnictwo Radom 2001
[2] Nawrocki W., Rozproszone systemy pomiarowe. WKiŁ sp. z oo., Warszawa 2006
[3] Tłaczała W., Środowisko LabVIEW w eksperymencie wspomaganym komputerowo, WN-T, Warszawa

SECONDARY LITERATURE:

[1] Nawrocki W., Komputerowe systemy pomiarowe. WKiŁ sp. z oo., Warszawa 2002, 2006
[2] Świsulski D., Komputerowa technika pomiarowa. Oprogramowanie wirtualnych przyrządów pomiarowych w LabVIEW. Agenda Wydawnicza PAK-u, Warszawa, 2005
[3] Chruściel M., LabVIEW w praktyce, Wydawnictwo BTC, Legionowo 2008
[4] http://www.LabVIEW.pl
[5] http://www.modbus.pl
[6] http://www.ni.com
[7] http://www.profibus.org.pl

SUBJECT SUPERVISOR
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