

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Mikroprocesorowe przetworniki pomiarowe**
 Name in English: **Microprocessor measuring transducers**
 Main field of study (if applicable): **Control Engineering and Robotics**
 Specialization (if applicable): **Automation of Machines, Vehicles and Apparatus**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **obligatory**
 Subject code: **ARR043307**
 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 EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 Has broadened and organized knowledge in the scope of structure and architecture of smart transducers of electrical and non-electrical quantities.
- PEK_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.
- PEK_W03 Has organized knowledge in the scope of smart measuring transducer usage

relating to skills:

- PEK_U01 Has the ability to formulate and solve problems related to modelling, designing and studying real measuring systems
- PEK_U02 Has the ability to integrate knowledge in the fields of metrology, control engineering, electronics and measurement data transmission

relating to social competences:

- PEK_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	Smart Transducer - definitions, structure, standardization, applications	2
Lec 2	Static and dynamic characters	2
Lec 3	Signal Conditioning - OPAMP	2
Lec 4	Signal Conditioning - processing of A/D and D/A	2
Lec 5	Microcontrollers in Smart Transducer	2
Lec 6	Model ISO/OSI, Wireless Transmission	2
Lec 7	Data Acquisition	2
Lec 8	Environmental graphic design of instruments and measurement systems	2
Lec 9	Microprocessors in industrial measuring systems - standard CAN	2
Lec 10	Microprocessors in industrial measuring systems - standard MODBUS, physical layer	2
Lec 11	Microprocessors in industrial measuring systems - standard PROFIBUS, HART	2
Lec 12	Microprocessors in industrial measuring systems - standard LonWorks, PLC - transmission	2
Lec 13	Smart Transducer - examples of applications of systems for measuring electrical quantities and non- electrical, part I	2
Lec 14	Smart Transducer - examples of applications of systems for measuring electrical quantities and non- electrical, part II	2
Lec 15	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	Get 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	Smart transducer - communication (LabVIEW, etc,)	2
Lab 7	Acquisition and analysis of measurement data	2
Lab 8	Summary of activities	2
Total hours:		15

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	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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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **ARR043307 - Microprocessor measuring transducers** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics** AND SPECIALIZATION **Automation of Machines, Vehicles and Apparatus**

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	S2AMPU_W03	C.1	Lec1 Lec2 Lec3 Lec4	N.1 N.3
PEK_W02	S2AMPU_W03	C.1	Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12	N.1 N.3
PEK_W03	S2AMPU_W03	C.1	Lec13 Lec14	N.1 N.3
PEK_U01	S2AMPU_U02	C.2 C.3	Lab1 Lab2 Lab5 Lab6	N.2 N.3
PEK_U02	S2AMPU_U02	C.2	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7	N.2 N.3
PEK_K01	K2AiR_K01	C.1 C.2 C.3	Lec15 Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8	N.1 N.2 N.3