FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Komputerowe systemy sterowania pomiarami**
Name in English:	**Computer Control of Measurement Systems**
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:	**APR013308**
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):	90		30		
Form of crediting:	examination		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	3		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10		0.70		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. He or she has a basic knowledge of metrology and measurement units, knows basic metrological characteristics of measuring instruments, are knowledgeable about the design of measurement known calculation methods used in developing the measurement results
2. He has a basic knowledge of the measurement technique. He knows measurement systems for high currents and voltages, rms converters, bridge systems for measuring resistance, reactance and impedance, circuits compensating voltage measurement. He knows the metrological characteristics of digital voltmeters
3. He or she knows the concepts of programming in C / C + + and object programming technique. He or she can write C/C++ program
4. He is able to do basic measurements of electrical devices using analog and digital oscilloscope. Can set on the basis of measurements of nonlinear characteristics of the elements. Able to present the results in the form of numerical tables and graphics to make their interpretations and draw conclusions.
5. He or she has knowledge of the measurement phiscal quantities (temperature, force, pressure, displacement ...) that are used at industrial automation systems.

SUBJECT OBJECTIVES

C1. Acquisition of extensive knowledge in the field of architecture test and measurement systems, in particular the underlying hardware and software systems in high-level languages.

C2. Understanding the methodology for designing a control and measurement systems with different degrees of complexity.

C3. Extensive knowledge of practical implementation of measurement systems computer managed by an integrated software environment and includes standard interfaces and measuring instruments

C4. Acquiring the knowledge needed to design the sensor signal conditioners of physical quantities.

C5. Acquiring the parameterization ability of elements used at the measuring chain.

C6. 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 has extensive knowledge in the structure area of the hardware layer and programming of control and measurement systens in high-level languages.
PEU_W02	He knows and understands the design methodology of control and measurement systems. He has the knowledge to design components of the measurement system
PEU_W03	He knows algorithms for processing measurement data.
relating to skills:	
PEU_U01	He has extensive skills practical implementation of measurement systems computer managed by an integrated development environment and standard intarfaces and instruments
PEU_U02	He or she is able to apply selected mathematical methods of measuring signal processing.
PEU_U03	He or she has skills practical implementation of virtual measurement systemsrelating to social competences
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	Metrology and Measurement Systems Computer elementary functions. The structure and organization of measurement systems	2
Lec 2	Structure and Operation of digital measuring instruments - multimeter, oscilloscope	2
Lec 3	Logic analizer.	2
Lec 4	Direct Digital Synthesis Generator and arbitrary waveform generator	2
Lec 5	Serial Interfaces in Measurement systems	2
Lec 6	GPIB (IEEE-488) Interface	2
Lec 7	Wireless network in measurement systems, USB and FireWire (IEEE 1394),	2
Lec 8	Mathematical methods of measuring data processing.	2
Lec 9	Software of measurement systems - an integrated software environment, discussion of the workings of graphical interfaces	2
Lec 10	VME, VXI and PXI Standard	2
Lec 11	SCPI model of instrument. Programming measurement systems using a dedicated library VISA and SCPI commands.	2
Lec 12	Distributed measurement and control systems	2
Lec 13	Data acquisition board – block diagram and programming	2
Lec 14	Sensors and signal transducers	2
Lec 15	Spectrum analizer	2
	Total hours:	**30**

Form of classes - laboratory		**Number of hours:**
Lab 1	Presentation of the safety rules and principles of assessment laboratory. Presentation of laboratory	1
Lab 2	Introduction to the programming environment, VISA and window that allows you to send and receive messages from the measuring devices. Construction of the device ID. Grammar and statement SCPI commands	2
Lab 3	Introduction to the SCPI command tree of oscilloscope and generator or DMM and Power supply. Control the instruments using a instrument Driver or Direct I / O	2
Lab 4	The SCPI status reporting system of devices. Setting masks and registers - handling of oscilloscope and generator or DMM and power supply errors	2
Lab 5	Implementation of the task - automatic determination of filter frequency characteristics or voltage-current characteristic of electronic devices	2
Lab 6	Programming the daq board- part 1. use Daq assistant for data acquisition from the analog-to-digital converter	2
Lab 7	Programming the daq board – part2: setting parameters of data acquisition, triggering sampling result caching, write data to the file	2
Lab 8	Programming a multifunction dac board: Use counters, digital inputs and outputs and analog outputs	2
	Total hours:	**15**

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 *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/exam
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Assessment of task dane during laboratory activities
P(L)	P=F1	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Winiecki W., Organizacja komputerowych systemów pomiarowych, Oficyna wydawnicza Politechniki Warszawskiej, Warszawa 1997.
[2] Mielczarek W.- Urządzenia pomiarowe i systemy kompatybilne ze standardem SCPI – Helion 1999
[3] Nawrocki W.- Rozproszone systemy pomiarowe- WKŁ 2006
[4] Świsulski D- Komputerowa technika pomiarowa. Oprogramowanie wirtualnych przyrządów pomiarowych w LabVIEW – PAK 2005
[5] Świsulski D- Komputerowa technika pomiarowa w przykładach – PAK 2002
[6] Tłaczała W.: Środowisko LabVIEW w eksperymencie wspomaganym komputerowo. WNT, Warszawa 2002

SECONDARY LITERATURE:

[1] Winiecki W., Nowak J., Stanik S.: Graficzne zintegrowane środowiska programowania do projektowania komputerowych systemów pomiarowo-kontrolnych. Wyd. Mikom, Warszawa 2001.
[2] Bogusz J..: Lokalne interfejsy szeregowe w systemach cyfrowych – Wydawnictwo BTC, Warszawa 2004
[3] Mielczarek W. Szeregowe interfejsy cyfrowe, Helion, Gliwice 1993;
[4] Mielczarek W -USB : uniweralny interfejs szeregowy, Helion, Gliwice 2005.
[5] Mielczarek W - Szeregowy interfejs cyfrowy FireWire : standardy IEEE 1394,. Wydawnictwo Politechnik Śląskiej, Gliwice 2010
[6] Daniluk A.- USB : praktyczne programowanie z Windows API w C++ Helion, Gliwice 2009

SUBJECT SUPERVISOR

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