COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electronic measuring systems

Course

Field of study
Electronics and Telecommunications

Year/Semester
IV/VII

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
15	15	
Tutorials	Projects/seminars	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
dr hab. inż. Maciej Wawrzyniak
(maciej.wawrzyniak@put.poznan.pl)

Responsible for the course/lecturer:
dr inż. Jakub Pająkowski
(jakub.pajakowski@put.poznan.pl)

Prerequisites

A student starting this course should have a basic knowledge of data structures, algorithms and programming techniques used in high-level languages. Knows the basics of electronics, electrical metrology, computer measurement system and LabVIEW programming.

Course objective

To provide students with knowledge about the construction and use of modern electronic measuring systems. To acquaint with advanced programming methods in the LabVIEW environment. To learn the prototyping embedded systems using the myRIO platform.

Course-related learning outcomes

Knowledge

1. A student has knowledge of the operation and construction of electronic measuring systems.

2. Knows the advanced programming methods used in LabVIEW.

3. Has knowledge of prototyping embedded systems using the myRIO platform.

Skills

1. Student can obtain information from literature and other sources, can integrate obtained information, interpret it, draw conclusions and justify opinions. Can use catalogs to select appropriate components of the electronic measuring systems taking into account the given criteria.

2. Can use advanced programming methods in the LabVIEW environment and available library functions.

3. Can design and implement a simple measuring system with the MyRIO platform.

Social competences

1. A student is aware of the need for a professional approach to solved technical problems and taking responsibility for the proposed technical solutions.

3. Can work in a group in the laboratory and perform team tasks.

4. Recognizes the legal, environmental and utilitarian aspects of measurements. Has a sense of responsibility for the presented measurement results.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures passing based on one written and/or oral examt from content of the lectures. The written exam contains 8 open questions. The oral exam contains 4-6 questions. Passing threshold 50% of the sum of points for the test. The issues for the test (20) are sent to students by e-mail. Grading scale: <50% - 2.0 (ndst); 50% to 59% - 3.0 (dst); 60% to 69% - 3.5 (dst +); 70% to 79% - 4.0 (db); 80% to 89% - 4.5 (db +); 90% to 100% - 5.0 (bdb). The passing threshold may change depending on the results of the tests.

Laboratory passing based on grades for reports, preparation for classes, behaviour and commitment during classes and tests. Grading scale: Sw>4,75 - 5,0 (bdb); 4,25<Sw<=4,75 - 4,5 (db+); 3,75<Sw<=4,25 - 4,0 (db); 3,25<Sw<=3,75 - 3,5 (dst+); 2,75<Sw<=3,25 - 3,0 (dst); Sw<=2,75 - 2,0 (ndst) where Sw – the weighted arithmetic mean of all partial grades.

Programme content

Lecture

Classification of electronic measuring systems, block diagram of the electronic measurement system, parameters and characteristics of sensors, examples of sensors, intelligent sensors, signal conditioners, analog-to-digital converters, analog-to-digital conversion errors, multiplexers, sample and hold circuit, track and hold circuit. Data acquisition (DAQ) devices, basic parameters, types of tignal sources, floating signal sources, ground-referenced signal sources, nonreferenced single-ended mode (NRSE), referenced single-ended mode (RSE), differential mode (DIFF), programmable gain instrumentation amplifier (PGIA), analog trigger block diagram, above-high-level analog triggering mode, below-low-level analog triggering mode, high-hysteresis analog triggering mode, inside-region analog triggering mode, low-hysteresis analog triggering mode, first-in first-out memory buffer (FIFO), direct memory access modes, self and external calibration. Interfaces in electronic measuring systems, serial and parallel interfaces, RS

serial interfaces, serial data unit (SDU), asynchronous data transmission, synchronous data transmission, synchronization character, bit synchronization, parity bit, cyclic redundancy codes (CRC), 20mA current loop. IEEE 488 parallel interface, interface bus, interface management lines, physical and electrical characteristics, linear and star configurations, handshaking lines and handshake protocol, interface functions, uniline and multiline commands, address and unaddress commands, service request, serial and parallel polls, IEEE 488.2 and SCPI, SCPI instrument model, hierarchical structure of the SCPI command set, common command set, required common commands, different command sets, command separators, SCPI command variables, CompactDAQ platform, PXI, CompactRIO and MyRIO platforms. Embedded systems in electronic measuring systems, embedded systems architecture (data processing, concentrator and control blocks), programming of embedded systems, real-time operating system, event response time, clocking of the processor, input-output circuits. LabVIEW - advanced programming techniques, control structures, state machine, event handling, queue management, hierarchical programming, synchronization of subroutines, elements of object-oriented programming, error handling, library functions, project templates.

Laboratory

Data acquisition (DAQ) devices, basic parameters, types of tignal sources, floating signal sources, ground-referenced signal sources, nonreferenced single-ended mode (NRSE), referenced single-ended mode (RSE), differential mode (DIFF), programmable gain instrumentation amplifier (PGIA), analog trigger block diagram, above-high-level analog triggering mode, below-low-level analog triggering mode, high-hysteresis analog triggering mode, inside-region analog triggering mode, low-hysteresis analog triggering mode, first-in first-out memory buffer (FIFO), direct memory access modes, self and external calibration. Interfaces in electronic measuring systems, serial and parallel interfaces, RS serial interfaces, serial data unit (SDU), asynchronous data transmission, synchronous data transmission, synchronization character, bit synchronization, parity bit, cyclic redundancy codes (CRC), 20mA current loop. IEEE 488 parallel interface, interface bus, interface management lines, physical and electrical characteristics, linear and star configurations, handshaking lines and handshake protocol, interface functions, uniline and multiline commands, address and unaddress commands, service request, serial and parallel polls, IEEE 488.2 and SCPI, SCPI instrument model, hierarchical structure of the SCPI command set, common command set, required common commands, different command sets, command separators. MyRIO platform. Embedded systems in electronic measuring systems, embedded systems architecture (data processing, concentrator and control blocks), programming of embedded systems, real-time operating system, event response time, clocking of the processor, input-output circuits. LabVIEW - advanced programming techniques, control structures, state machine, event handling, queue management, hierarchical programming, synchronization of subroutines, elements of object-oriented programming, error handling, library functions, project templates.

Teaching methods

Lecture: traditional multimedia presentation (examples also on the blackboard) and conversational lecture.

Lab: traditional multimedia presentation (examples also on the blackboard) and performance of tasks given by the teacher - practical exercises.

Bibliography

Basic

1. Nawrocki W., Komputerowe systemy pomiarowe, Wydawnictwa Komunikacji i Łączności, Warszawa 2006.

2. Świsulski D., Komputerowa technika pomiarowa : oprogramowanie wirtualnych przyrządów pomiarowych w LabVIEW, Agenda Wydawnicza PAK, 2005.

3. Nawrocki W., Rozproszone systemy pomiarowe, Wydawnictwa Komunikacji i Łączności, Warszawa 2006.

4. Tumański S., Technika pomiarowa, Wydawnictwo Naukowo-Techniczne, Warszawa, 2007.

Additional

1. Winiecki W., Wirtualne przyrządy pomiarowe, Oficyna Wydawnicza PW, 2003.

2. Lesiak P. T., Świsulski D., Komputerowa technika pomiarowa w przykładach, Agenda Wydawnicza PAK, 2002.

3. Lesiak P. T., Inteligentna technika pomiarowa, Wydawnictwo Politechniki Radomskiej, Radom 2001.

4. Winiecki W., Organizacja komputerowych systemów pomiarowych, Oficyna Wydawnicza Politechniki Warszawskiej, 2006.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	31	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for the exam) [1]	44	1,0

[1] delete or add other activities as appropriate