COURSE DESCRIPTION CARD - SYLLABUS

Course name
Distributed Data Acquisition Systems [S1Teleinf1>RSAD]

Course

Field of study
Teleinformatics

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

A student who starts learning this subject should have basic knowledge in the field mathematical analysis, electronic circuits, measurement techniques, signals and systems and microprocessor technology, as well as the basics of ICT networks. He should skillfully use concepts and perform calculations in the field of mathematical analysis and signal theory, properly use the basic applications of analog and digital circuits and acquire information from the indicated sources. In addition, the student should understand the need for expansion their competences and present such attitudes as honesty, responsibility, perseverance, commitment, cognitive curiosity, manners and respect for other people.

Course objective

1. Providing students with basic knowledge in the field of acquisition of measurement signals and acquiring, processing and transmitting data in distributed systems. 2. Mastering the skills of analysis, design, programming and application by students simple data acquisition systems with territorially distributed units. 3. Understanding the importance of the problem of reliability of the transmitted measurement data, noticing and taking into account changes resulting from technological progress, continuous improvement professional competences and shaping the sense of responsibility for the developed projects.

Course-related learning outcomes

Knowledge:
1. The student has structured knowledge in the field of acquiring, processing and transmitting signals in data acquisition systems.
2. He has mastered the principles of operation of distributed acquisition systems and knows the technologies used for
data transmission.
3. Has basic knowledge of architecture, operating modes and embedded programming microprocessor ADC modules.

Skills:

1. The student is able to use source data, integrate new information, make them critical analysis and interpretation, and to formulate and justify opinions.
2. Can analyze variants of a distributed measurement system in terms of the choice of method measurement, division of tasks between hardware and software, selection of components, complexity of the solution
and costs.
3. Can program microprocessor data acquisition subsystems.
Social competences:
1. The student sees changes resulting from technological progress and understands the necessity updating knowledge and continuous improvement of professional competences.
2. Understands the importance of the problem of the reliability of measurement data obtained at the acquisition stage
signals.
3. Is aware of responsibility for own work and is able to follow the rules work in a team.
4. Can creatively join the design work on distributed systems measurement.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The final written and/or oral test verifies knowledge and understanding of the content of the lecture. It contains open problem questions with different scores. Final grade from the pass lecture: less than 50% of the number of points possible to obtain - 2.0; from 50% - 3.0; from 60% - 3.5; From
70% - 4.0; from 80% - 4.5; from 90% - 5.0.
The final grade from the laboratory is the arithmetic weighted average of the grades for completing the tasks basic and additional (including preparation for subsequent tasks, behavior, commitment, consolidating skills) and grades for individual or team reports, closing tasks. The weight and scale of grades are determined during introductory classes. Additional tasks verify skills when applying for passing a laboratory or increasing the grade. They can include a written or oral test. For the final grades, the following scale can be entered: to 2.75 inclusive - 2.0; over 2.75 - 3.0; above 3.25 - 3.5; above 3.75 - 4.0; above 4.25 - 4.5; above 4.75 - 5.0. The laboratory make-up includes a practical part and a colloquium written or oral.

Programme content

Lecture: Organization and configuration of measurement systems. System blocks and their functions. Sensors
smart. Territorially focused and distributed systems. System and task controller microprocessors in system blocks. Signal acquisition blocks and their properties. Sourcing and processing of analog and digital signals. Acquisition parameter settings and reliability measurement data. DAQ card architecture. Hardware resources of microcontrollers and their use in data acquisition systems. Parameters of built-in and external ADCs.
Support for external ADCs and data memory from the microcontroller level. Communication between the data acquisition system controller and subsystems and local stations.

Laboratory: Programming environment supporting the launch of the data acquisition system.

Acquisition of analog and digital signals using microcontroller resources.
Running embedded modules using simulation tools. programming
and running local microcontrollers in the target data acquisition system. Startup
acquisition system with evaluation kits. Starting signal acquisition
using the built-in ADC module. Microprocessor station communication
with the terminal and the host computer. Communication of the measuring station and the central station
using serial transmission modules. Starting wireless connectivity
in the data acquisition system using radio modules.

Course topics

Lecture: Organization and configuration of measurement systems. System blocks and their functions. Sensors
intelligent. Territorially focused and distributed systems. System and task controller
microprocessors in system blocks. Signal acquisition blocks and their properties. Sourcing
and processing of analog and digital signals. Acquisition parameter settings and reliability
measurement data. DAQ card architecture. Hardware resources of microcontrollers and their use
in data acquisition systems. Parameters of built-in and external ADCs.
Support for external ADCs and data memory from the microcontroller level. Communication
between the data acquisition system controller and subsystems and local stations.

Laboratory: Programming environment supporting the launch of the data acquisition system -
AVR Studio/Atmel Studio. Acquisition of analog and digital signals using resources
RISC microcontroller with 8-bit bus. Running built-in modules using
simulation tools. Programming and commissioning of local microcontrollers in the target
data acquisition system. Launching the acquisition system with evaluation kits.
Starting the acquisition of analog signals using the built-in ADC module.
Communication of the microprocessor station with the terminal and the master computer. Station communication
and the central station with the use of SPI and USART serial transmission modules.
Starting wireless communication in the data acquisition system using modules
radio.

Teaching methods

Lecture with multimedia presentation, supported by problem discussion and examples on the board.
Laboratory: performing problem tasks ordered by the teacher, preceded by
introduction, using the whiteboard, programming environment and audiovisual tools
and verification of results using the development environment and sets
runtimes, enabling team collaboration methods.

Bibliography

Basic:
1. Waldemar Nawrocki: Rozproszone systemy pomiarowe, WKiŁ, Warszawa 2006
2. Franco Maloberti: Przetworniki danych, WKił, Warszawa 2010
3. Rafał Baranowski: Mikrokontrolery AVR ATmega w praktyce, Wyd. BTC, Warszawa, 2005
4. ATmega16A. 8-bit AVR Microcontroller with 16K Bytes In-System Programmable Flash. Atmel Corporation 2014.

Additional:
1. Jacek Bogusz: Moduły GSM w systemach mikroprocesorowych, Wyd. BTC, Warszawa 2007
2. Piotr Lesiak, Dariusz Świsulski: Komputerowa technika pomiarowa w przykładach, Agenda Wydawnicza PAK, Warszawa 2002
3. ADuC 812. MicroConverter, Multichannel 12-bit ADC with Embedded Flash MCU. Analog Devices 2017
4. Krzysztof Wesołowski: Systemy radiokomunikacji ruchomej, WKiŁ, 2006. ECTS

Breakdown of average student's workload

	Hours	ECTS
Total workload	56	3,00
Classes requiring direct contact with the teacher	30	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	26	1,00