POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Microprocessor data acquisition systems [S2EiT1-ESPiO>MSAD]

Course

Field of study
Electronics and Telecommunications

Year/Semester
1/2

Area of study (specialization)
Programmable Electronic Systems and Optotelecommunications

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

The student has an ordered and mathematically based knowledge of the basics of circuit theory, necessary to understand, analyze and evaluate the operation of electrical circuits. Basic knowledge of electrical metrology, signal theory, analog and digital systems and microprocessor technology. Is able to use basic measuring instruments. Is able to obtain information from the literature in Polish and English. He understands the necessity to expand his own knowledge and is responsible. He is active in class and systematically solves the problems encountered.

Course objective

Presentation of methods of acquiring and processing signals in data acquisition systems. Getting to know the organization of signal acquisition blocks and their components, their functions and principles of operation. Discussion of the architecture and properties of A/D processing modules integrated in the structures of microprocessors. Understanding the possibilities and advantages of local and multi-level use of microprocessors in data acquisition systems. Mastering the ability to design, program and apply data acquisition systems with microprocessors and measurement-oriented microcontrollers.

Course-related learning outcomes

Knowledge:
Has ordered knowledge in the field of signal acquisition and processing in microprocessor data acquisition systems. He knows and understands the principles of operation of the components of the signal acquisition block. Basic knowledge of architecture, operating modes and programming of embedded microprocessor A/D processing modules. He knows the possibilities of using microprocessor resources in data acquisition systems. Has information about the development trends of measurement-oriented microprocessors.

Skills:
He can use source data and interpret and integrate new information about data acquisition systems, perform their critical analysis, as well as formulate and justify opinions. He can analyze the operation of data acquisition systems. He can design simple microprocessor data acquisition systems, using creatively built-in modules and the possibilities offered by new technologies. He can analyze variants of the designed system in terms of division of tasks between hardware and software, selection of elements, complexity of the solution and costs. He has the ability to create software for microprocessor data acquisition systems with the use of assembler.

Social competences:
Is able to work in a team and creatively participate in project work on microprocessor data acquisition systems. Notices changes resulting from technological progress and understands the need to update knowledge and constantly improve professional competences. Has a sense of responsibility for the developed projects. Understands the importance of the problem of reliability of measurement data obtained at the signal acquisition stage.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Final written and/or oral exam verifies knowledge and understanding of the content of the lecture. It contains open problem questions with different scores. Final exam grade: 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 laboratory grade is the weighted arithmetic mean of grades for the implementation of basic and additional tasks (preparation for subsequent tasks, behavior, commitment, skills consolidation) and grades for individual or team reports, closing tasks. The weight is determined in the introductory class. Additional tasks verify skills when applying for a laboratory pass or an increase in grade. They may include a written or oral test. Scale for final grades: up to 2.75 inclusive - 2.0; more than 2.75 - 3.0; more than 3.25 - 3.5; more than 3.75 - 4.0; more than 4.25 - 4.5; more than 4.75 - 5.0. Credit for the laboratory includes a practical part and a written or oral test.

Programme content

Lecture: Organization of microprocessor measurement systems. System controller and tasks of local microprocessors in subsystems and system blocks. Analog signal acquisition blocks and their properties. Basic systems of data acquisition subsystems. Acquisition and processing of analog and digital signals. Setting of acquisition parameters and reliability of measurement data. Hardware resources of RISC microcontrollers and their use in data acquisition systems. Architecture, operation modes and programming of embedded ADC modules Parameters of embedded and autonomous ADC converters Support for external ADC converters and data memory from the microcontroller level. Communication between the system controller and subsystems of data acquisition as well as local stations and measurement systems.
Laboratory: Development environment and tools for simulating the operation of modules in the structure of the AVR microcontroller. Initialization and running of embedded modules using simulation tools. Programming and commissioning of the microcontroller I/O modules in the target data acquisition system. Running the acquisition system with the use of evaluation kits. Acquisition of analog signals using the built-in ADC module. Receiving and transmitting digital data using the microcontroller ports. Support for sensors with analog and digital outputs. Acquisition system with data visualization.

Course topics

none

Teaching methods

A lecture with a multimedia presentation, supported by a problem-based discussion and examples on the blackboard.
Laboratory: implementation of the problem tasks given by the teacher and verification of the resultsusing the development environment and development kits, enabling team collaboration methods.

Bibliography

Basic
1. Rafał Baranowski: Mikrokontrolery AVR ATmega w praktyce.Wyd. BCT, Warszawa 2005
2. Franco Maloberti: Przetworniki danych. WKił, Warszawa 2010
3. ATmega16A. 8-bit AVR Microcontroller with 16K Bytes In-System Programmable Flash. Datasheet, Atmel Corporation 2014
4. ADuC 812. MicroConverter, Multichannel 12-bit ADC with Embedded Flash MCU. Analog Devices 2017
Additional
1. Paweł Hadam: Projektowanie systemów mikroprocesorowych. Wyd. BTC, Warszawa 2004
2. Steven W. Smith: Cyfrowe przetwarzanie sygnałów. Wyd. BTC, Warszawa 2007
3. ATmega128A. 8-bit AVR Microcontroller Datasheet Complete. Atmel Corporation 2015

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	70	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00