COURSE DESCRIPTION CARD - SYLLABUS

Course name

EC 2.2. Embedded structures

Course

Field of study

Electronics and Telecomunications

Area of study (specialization)

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

I/2

Profile of study

general academic

Course offered in

polish

Requirements

elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	30	
Tutorials	Projects/seminars	
0	0	

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

dr inż. Krzysztof Arnold

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Responsible for the course/lecturer:

dr inż. Sławomir Michalak

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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. Has basic knowledge of analog circuits as well as combinational and sequential digital circuits. He can 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 the directions and progress of integration of semiconductor systems in microprocessor structures. Knowing and understanding the organization of embedded systems. Getting to know the principle of operation, properties and development perspectives of built-in peripheral systems. Mastering the skills of programming system modules integrated in microcontrollers as well as the ability to start and use the hardware and software layer of microcontrollers.

Course-related learning outcomes

Knowledge

Has ordered knowledge of the integration and architecture of resources in microprocessor structures. Understands the principles of operation and operating modes of embedded system modules. Basic knowledge of programming, commissioning and use of resources of modern microcontrollers. Has information about development trends in microcontrollers.

Skills

Can use source data and interpret and integrate new information about modules and embedded systems. He can analyze the operation of built-in structures. He can design microprocessor systems, using creatively modules embedded in the structures of microcontrollers and the possibilities offered by new technologies. He can analyze variants of the designed application 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 and run modules and embedded systems using assembler.

Social competences

He can work in a team and creatively join design work on embedded systems. He notices changes resulting from technological progress and understands the necessity to update knowledge and constantly improve professional competences. Has a sense of responsibility for the developed projects.

Methods for verifying learning outcomes and assessment criteria

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. Integrated circuits LSI and VLSI. Resource integration in the structures of integrated circuits. AVR core architecture. Tasks of modules embedded in the structures of RISC microcontrollers with AVR core. Distribution of clock signals. Restart the CPU. Initialization of modules in the structure of the microcontroller. Organization, activation and maintenance of the interrupt system. Architecture and operating modes of built-in counters/timers. Architecture, operating modes and support for embedded USART modules. TWI and SPI interface modules. ADC module in the microcontroller structure. Communication of the built-in modules with the microcontroller environment.

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 microcontroller I / O modules in target systems. Use of microprocessor evaluation kits. Cooperation of the I / O modules of the microcontroller with the environment. Wired and wireless connectivity. Wired transmission on the TTL level and in the RS232C standard. Support for sensors with analog and digital outputs. Design and commissioning of simple control and measurement systems using the structure of AVR microcontrollers.

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. Andrzej Pawluczuk: Sztuka programowania mikrokontrolerów AVR. Przykłady. Wyd. BTC, Warszawa 2007

2. Rafał Baranowski: Mikrokontrolery AVR ATmega w praktyce. Wyd. BCT, Warszawa 2005

3. ATmega16A. 8-bit AVR Microcontroller with 16K Bytes In-System Programmable Flash. Datasheet, Atmel Corporation 2014

4. Jacek Bogusz: Lokalne interfejsy szeregowe w systemach cyfrowych. Wyd. BCT, Warszawa 2004

Additional

1. Paweł Hadam: Projektowanie systemów mikroprocesorowych. Wyd. BTC, Warszawa 2004

2. ATmega128A. 8-bit AVR Microcontroller Datasheet Complete. Atmel Corporation 2015

3. ATmega8A, mega AVR Data Sheet. 2020 Microchip Technology Inc.

4. ATtiny2313A-4313A. 8-bit AVR Microcontroller with 2/4K Bytes In-System Programmable Flash. Atmel Corporation 2014

5. Jacek Bogusz: Moduły GSM w systemach mikroprocesorowych. Wyd. BCT, Warszawa 2007

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4
Classes requiring direct contact with the teacher	70	3
Student's own work: analyzing, mastering and consolidating the material from lectures, literature studies, preparation for problematic laboratory tasks, preparation of reports laboratory tasks, preparation for the final test.[1]	30	1

[1] delete or add other activities as appropriate