SYLLABUS

Name: ***Embedded Systems (MakAu>SI6ES19)***
Name in Polish:
Name in English: ***Embedded Systems***

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science
Course for department: Silesian University of Technology

Default type of course examination report:

ZAL

Language:

English

Course homepage:

https://platforma.polsl.pl/rau2/course/view.php?id=762

Short description:

The primary goal of the course is to introduce key elements of microprocessors and embedded systems, including microprocessors, memories, buses, and peripheral devices. The process of embedded system development is presented with attention to the proper choice of hardware elements, operating system, and programming methods. Methods of hardware-software design with co-design are presented. Specification and documentation preparation according to standards is also presented as an important part of the system development process.
Form of classes: contact

Description:

Coursework: Lecture/Laboratory
ECTS: 3
Total hours: 75h (60h contact hours / 15h student's own work hours)
Lecture: 30h
Laboratory: 30h
Student's own work:
• Preparation for laboratory classes, preparation of a report from laboratory classes.

Lecture:
Introduction to microprocessors and embedded systems. Definition, classification and development methods of embedded systems. Elements of an embedded system: microprocessor, microcontroller, memories, and peripheral devices. Parallel and serial input and output devices, analogue to digital and digital to analogue converters, serial synchronous and asynchronous communication. Elements of a microcontroller: processor unit, RAM, Flash, EEPROM memories, timers, watchdog, brownout detector, communication devices, ports. Connecting external devices to microprocessors and microcontrollers. Interrupt controllers, DMA controllers. Examples of modern microcontrollers. Operating systems for embedded systems, RTOS, cooperative and preemptive multitasking. Writing applications without an operating system, superloop, interrupt-driven software, and a finite state machine.The examples of implementation. Stages of system development: requirements analysis, general design, subsystem design, subsystem implementation, integration, testing, documentation, and development errors. Methods of hardware-software partitioning, co-design, and selection of hardware elements. Hardware drivers.

Laboratory:
Serial synchronous data transmission. TWI, SPI.
Examples of 8-bit microcontrollers, eg AVR, writing programs in assembler and C.
Digital signal processors.
ARM-based computer system – Raspberry PI, STM32 and similar.
Examples of using the GPIOs.
Attendance at laboratory classes is mandatory.

Bibliography:

1. Embedded systems : architecture, programming and design / Raj Kamal. - Boston [etc.]: McGraw Hill Higher Education, cop. 2008.
2. Handbook of real-time and embedded systems / ed. by Insup Lee, Joseph Y-T. Leung, Sang H. Son. - Boca Raton ; London ; New York : Chapman & Hall/CRC, cop. 2008.
3. Networking and internetworking with microcontrollers / by Fred Eady. - Burlington, Ma ; Oxford : Newnes, cop. 2004.
4. Synthesis of arithmetic circuits : FPGA, ASIC and embedded systems / Jean-Pierre Deschamps, Géry Jean Antoine Bioul, Gustavo D. Sutter. - Hoboken, NJ : John Wiley & Sons, cop. 2006.
5. Specification and design of embedded systems / Daniel D. Gajski [et al.]. - Englewood Cliffs : PTR Prentice Hall, 1994.

Learning outcomes:

K1A_W07 - the student knows the issues of electronics including elements of microprocessor technology

K1A_W10 - the student knows the structure and architecture of embedded systems, principles of designing and implementing simple embedded systems.

K1A_W17 - the student knows the issues of designing and operating microprocessor systems, including embedded systems and their software

K1A_U21 - the student is able to implement algorithms for embedded systems using the programming language they have learned

Assessment methods and assessment criteria:

The final grade is calculated based on the grades from the laboratory exercises.

The grade from each laboratory exercise has the same weight.

In the case of an excused absence from the laboratory, the exercise must be made up.

The syllabus is valid from the academic year 2025/2026, and its content is not subject to change during the semester.

Course credits in various terms:

<without a specific program>			
Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	3	2021/2022-L	