



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Microcontrollers

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### Course

Field of study

Biomedical engineering

Area of study (specialization)

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Level of study

First-cycle studies

Form of study

full-time

Year/Semester

2/3

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

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### Number of hours

Lecture

15

Tutorials

0

Laboratory classes

15

Projects/seminars

15

Other (e.g. online)

0

### Number of credit points

4

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### Lecturers

Responsible for the course/lecturer:

prof. DSc. PhD. Eng. Andrzej Milecki

Responsible for the course/lecturer:

PhD. Eng. Dominik Rybarczyk

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### Prerequisites

Basic information on electronics, automation, computer science, digital circuit techniques. Design of discrete electronic circuits. C programming

### Course objective

Acquainting with the structure and operation of microprocessor systems. Design and programming of 8-bit microprocessor control systems for devices, based on the platform, eg Arduino.



### Course-related learning outcomes

#### Knowledge

He/She knows the structure and operation of 8-bit microcontrollers, their types, types, possibilities and technical parameters of hardware and software

He/She knows the handling of ports, AC and CA converters, counters and timers, serial transmission

He/She knows what they are and how to handle interrupts

He/She knows the rules of connecting external elements to microcontrollers

Has basic knowledge of 32-bit microcontrollers

#### Skills

Is able to design a mechatronic device driver using an 8-bit microcontroller, eg Arduino

Can program an Arduino microcontroller in C language

Can write a program for I / O, counters, interrupts and serial transmission

#### Social competences

Understands the need for lifelong learning; can inspire and organize the learning process of other people

He/She is aware of the role of microprocessor basec controllers in modern engineering and its importance for society and the environment

Can define priorities for the implementation of a specific task

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

EXAM: Passed on the basis of an examination consisting of 5 general questions (for a correct answer to each question - 1 point. Grading scale: less than 2.6 points - 2, 2.6 ÷ 3.0 - 3.0, 3.1 ÷ 3.5 points - 3.5, 3.6 ÷ 4.0 points - 4.0, 4.1 ÷ 4.5 points - 4.5, 4.6 ÷ 5.0 points - 5.0 very good)

Laboratory: Credit based on the correct implementation of exercises and reports on each laboratory exercise according to the instructions of the laboratory teacher. Before the exercises, short entrance tests, and after the exercises, a written final test. In order to pass the laboratories, all exercises must be passed (positive grade from the answers and the report).

### Programme content

1. Introduction to the construction of microprocessors and microcontrollers. Basics of their structure and programming.

2. Ports, construction and connection of simple elements, setting and programming.



3. Types and declarations of variables in microcontrollers. The use of conditional statements and loops in port handling.
4. Bidirectional serial communication, operation and programming
5. Counters and timers: construction and programming. PWM method
6. AC and CA converter in microcontrollers: construction, programming
7. Interrupts in microcontrollers and their programming
8. Microcontroller as a controller - examples. 32-bit microcontrollers

Lab:

Lab.

1. Basics. The environment and hardware for programming. The basics of programming a microcontroller, eg Arduino
2. Basics of I / O programming
3. I / O port support
4. Communication, serial transmission
5. Counters and timing systems
6. Interrupt handling programming

### Teaching methods

Lectures and presentations. Examples of programs and their implementation

### Bibliography

Basic

Exploring Arduino, Tools and Techniques for Engineering, Jeremy Blum

How to get started with Arduino in 1 day or less, Brian Jenkins 2018

Additional

C Programming with Arduino, A. Smith, 2013



### Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	55	2,0

<sup>1</sup> delete or add other activities as appropriate