



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Design of digitally controlled devices

### 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

3/6

Profile of study

general academic

Course offered in

Polish

Requirements

elective

### Number of hours

Lecture

15

Laboratory classes

30

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

### Number of credit points

3

### Lecturers

Responsible for the course/lecturer:

dr hab. inż. Witold Stankiewicz

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Wydział Inżynierii Mechanicznej

ul. Jana Pawła II 24, 60-965 Poznań

Responsible for the course/lecturer:

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Wydział Inżynierii Mechanicznej

ul. Jana Pawła II 24, 60-965 Poznań

### Prerequisites

KNOWLEDGE: the student has basic knowledge of mechanical engineering and electronics.

SKILLS: the student is able to write simple programs in any programming language

SOCIAL COMPETENCES: the student is able to interact and work in a group

### Course objective

Students learn the basics of working with popular programmable microcontrollers. Using elements such as stepper motors, servos, displays and various sensors, they design and build simple devices, including those controlled wirelessly using WiFi or Bluetooth technology (examples of projects: personal devices for diagnosis or rehabilitation, 3D scanning systems; control system for machine/vehicle).



## Course-related learning outcomes

### Knowledge

Has a basic knowledge of computer science that allows to use the basics of algorithmics, compilers and programming languages, procedural and object-oriented programming (including microcontrollers), computer-aided engineering systems in biomedical engineering and technology. Has knowledge of the basics of programming programmable controllers.

Has detailed knowledge of automation and robotics, thanks to which he can describe the elements of automation; knows the basic concepts such as the control device and the control object; has knowledge of selected sensors and actuators in biomedical applications.

Has basic knowledge of engineering design and engineering graphics, enabling the design of machines and devices with the use of computer aids.

### Skills

He can prepare documentation in Polish and English on the implementation of an engineering task in the field of mechanical engineering.

Has the ability to self-educate.

Can, in accordance with the given specification, design and manufacture a simple, digitally controlled: device (e.g. rehabilitation), object (e.g. implant), system (e.g. control) or process (e.g. technological), typical for biomedical engineering, using appropriate methods, techniques and tools.

Can obtain information from literature, databases and other properly selected sources (also in English or another foreign language recognized as the language of international communication); in particular, he can combine biomedical issues with technical issues and engineering design, he can integrate the obtained information, interpret it, as well as draw conclusions and formulate and justify opinions.

### Social competences

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

Can properly define priorities for the implementation of a task set by himself or others.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Oral and written tests. Assessment of individually made tasks.

## Programme content

Basics of programming microcontrollers (eg Arduino, Raspberry Pi).

Overview of sensors (motion, distance, temperature, light, reflection lines, accelerometers, etc.) and how to use them.

Review of actuators (motors, servos, stepper motors, etc.) and their drivers and how to use them.



Overview of extension modules - incl. communication (Bluetooth, WiFi, radio), data exchange and I/O (LCD screens, SD card readers). Basics of control and communication with the device via mobile devices (Android) and / or the web.

Overview of the possibility of making / selecting mechanical components (frame, shafts and axles, gears).

Design of a device (e.g. a vehicle, manipulator, robot) using elements of previously implemented issues.

### Teaching methods

problem lecture, case study, multimedia presentation, laboratory.

### Bibliography

Basic

S. Monk. Arduino dla początkujących. Podstawy i szkice. Helion, 2018. ISBN: 978-83-283-4909-4

S. Monk. Arduino. 36 projektów dla pasjonatów elektroniki. Helion, 2015. ISBN: 83-283-1158-5

S. Monk. Raspberry Pi. Przewodnik dla programistów Pythona. Helion, 2014. ISBN: 978-83-246-8709-1

Additional

R. Blum. Arduino Programming in 24 Hours, Sams Publishing, 2014. ISBN: 978-06-723-3712-3

J. Kwaśniewski. Sterowniki PLC w praktyce inżynierskiej. Helion, 2008. ISBN: 978-8-3602-3335-1

### Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests, project preparation) <sup>1</sup>	30	1,0

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