COURSE DESCRIPTION CARD - SYLLABUS

Course name
Design of digitally controlled devices [S1IBio1E>PUSC]

Course

Field of study
Biomedical Engineering

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

Lecturers

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:

Test / colloquium and evaluation of tasks performed during the laboratory classes. Points are awarded for both items. The condition for receiving a positive evaluation is obtaining at least 50% of the possible points.

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.

Course topics

none

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	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00