COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electronics and basics of automation [S1IBio1>EiPA]

Course

Field of study
Biomedical Engineering

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Physics in the field of the structure of matter and the phenomena of electricity. Basics of electrical engineering. Ability to calculate electrical circuits. Knowledge of properties and parameters of passive elements. Mathematics in the field of set theory, complex numbers, differential equations, Boolean algebra, Laplace and Fourier transforms. Ability to operate on complex variables, solve simple differential equations and apply transformations.

Course objective

Getting to know the structure, operation and characteristics of electronic components and learning the basics of designing and commissioning simple electronic circuits. Acquainting with the basics of automation, in particular with digital and analog automation systems

Course-related learning outcomes

Knowledge:
Methods of assembling electronics. Knowledge of the properties and parameters of passive electronic components
P-n junction, construction and operation of a diode, LED diode, photodiodes and others, diode circuits.

Knowledge of the structure, operation, characteristics and operation models of bipolar and unipolar transistors.
Knowledge about power supply, types and systems of operation of transistors.
Digital circuits: levels, signals, AC conversion, logic gates.
Knowledge of operational amplifiers (WO) and circuit design from WO
Knowledge of advanced integrated circuits.
Know what statics and dynamics of automation systems are and know the basic concepts, structure, construction and operation of automation systems
He/She knows the Laplacea transfer functions, step responses of basic elements. He/She knows what a classic PID controller is
He/She knows what frequency characteristics are and how to determine them.
He/She knows the concept and methods of stability testing
Knows what are binary functions, combinational and sequential circuits
He/She knows the methods of implementing binary functions on contact elements and using logic gates
He/She knows the basic digital blocks / circuits

Skills:
Can design and build circuits with different types of diodes
Can select elements, design and build basic transistor circuits
Can find, select and design an electronic circuit with operational amplifiers
Can design and connect simple digital circuits
Is able to analyse scheme of electronic circuit
Can describe the statics and dynamics of basic linear objects
Is able to define Laplacea transfer functions of basic automatics elements and determine their step responses
Is able to use the PID controller and determine the stability of the system
He/She can determine the frequency characteristics of basic elements
Is able to implement a given combinational and sequential binary function

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 electronics in the modern engeneering and its importance for society and the environment
He/She is aware of the role of automation in the modern economy 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. Structure and electrical properties of an atom, conductors, semiconductors, insulators. Passive components used in electronic circuits. Methods of assembling electronics
2. Semiconductors, p-n junction. Diodes, characteristics, rectifiers, types and parameters of diodes. LEDs, photodiodes, other diodes.
3. Bipolar transistors: structure, characteristics, parameters, working principles, types.
4. Transistor power supply configurations. JFET and MOSFET transistors. Thyrystor, triak
5. Integrated circuits, Operational amplifiers, comparators, integrated stabilizers,
6. AD converters. Advanced integrated circuits
7. Basics of digital technology: signal levels, gates and other elements.

8. Automation. Basic concepts and definitions. History of automation. Open and closed systems. Static and dynamic properties of elements and linear systems of automation. Laplacea transfer functions of basic linear elements. Creating and transforming block schemas of automation systems. Regulators PID and their selection. Evaluation of the operation of the automatic control system - quality of control.
9. Frequency characteristics. Stability. Basics of nonlinear systems. Two-position adjustment. Basics of Boolean algebra. Functions of two variables. Implementation of two-state systems (binary). Realization of any logical functions. Sequential systems. Basic digital elements.
Lab:
1. Study of diode systems
2. Investigation of bipolar transistors
3. Study of unipolar transistors
4. Testing of key systems and transistor amplifiers
5. Study of the operational amplifier.
6. Integrated circuits

Course topics

none

Teaching methods

Lectures and presentations of models and simulations of circuits

Bibliography

Basic:
1. The Art of Electronics Hardcover , 2015, Paul Horowitz , Winfield Hill
2. Modern Control Engineering (5th Edition) by Katsuhiko Ogata.

Additional:
1. Getting Started in Electronics Spiral-bound . 2000, III Mims, Forrest M
2. Control Systems Engineering By Norman S. Nise

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	62	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	38	1,50