



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Electronics in Medical Devices

### Course

Field of study

Biomedical engineering

Area of study (specialization)

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

Other (e.g. online)

Tutorials

Projects/seminars

15

### Number of credit points

3

### Lecturers

Responsible for the course/lecturer:

prof. DSc. PhD. Eng. Andrzej Milecki

Responsible for the course/lecturer:

MSc. Eng. Roman Regulski

### Prerequisites

Electrical engineering, knowledge of basic electronic elements and circuits. Ability to design and assemble electronic circuits. Basics of microprocessor controllers. Design of printed circuit boards. Understands the importance of electronics in medical devices.

### Course objective

Extending knowledge of electronics. Application of advanced IC. Acquainting with the construction, operation, design of electronic measuring systems and power systems used in medical devices.

### Course-related learning outcomes

Knowledge

Extended knowledge of various parameters and characteristics of electronic components

Knowledge of parameters and non-linearities of selected operational amplifiers and methods of their compensation

Knowledge of the construction and application of measuring amplifiers

Knowledge of high power components and high power amplifiers and power supply units



Examples of construction of chosen electronic circuits used in medical devices

#### Skills

Is able to design and build an electronic system based on operational amplifiers

Can select electronic components and design a circuit with an operational amplifier

Is able to design a power supply and a power amplifier

Is able to design systems cooperating with microprocessors

Is able to design and build an electronic system for medical applications

#### 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 medical devices and its importance for the health of the society

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. Electronic components - an extended overview of the types and their actual parameters. Signals and their transmission. Noise properties of active elements. Filtering.
2. Special diodes and transistors, voltage stabilizers and power supply units. Construction of transistor amplifiers.
3. Ideal and real operational amplifiers, nonlinearities and their compensation
4. Various circuits with operational amplifiers, including non-linear ones.
5. Advanced integrated circuits, power circuits, examples of controlling motors, valves, etc.
6. Instrumental amplifier, measuring circuits, application in ECG and other examples.



7. Electronics in exemplary medical devices.

### Teaching methods

Lecture with presentations and examples, explanations using the table

### Bibliography

Basic

1. The Art of Electronics Hardcover , 2015, Paul Horowitz , Winfield Hill
2. Career Paths. Electronics. Student's Book. Evans Virginia, Dooley Jenny, Taylor Carl
3. Getting Started in Electronics Spiral-bound . 2000, III Mims, Forrest M

Additional

Operational Amplifiers and Linear Integrated Circuits Publisher: Mohawk Valley Community College, James M. Fiore, 2018

### Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	40	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	35	1,5

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