

# Fundamentals of automation and electrical engineering - course description

General information	
Course name	Fundamentals of automation and electrical engineering
Course ID	06.9-WM-MaPE-P-FndAutElectEng-23
Faculty	<a href="#">Faculty of Mechanical Engineering</a>
Field of study	Management and Production Engineering
Education profile	academic
Level of studies	First-cycle studies leading to Engineer's degree
Beginning semester	winter term 2023/2024

Course information	
Semester	2
ECTS credits to win	4
Course type	obligatory
Teaching language	english
Author of syllabus	<ul style="list-style-type: none"><li>dr inż. Grzegorz Pająk</li><li>dr inż. Iwona Pająk</li></ul>

Classes forms					
The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	15	1	-	-	Credit with grade
Laboratory	30	2	-	-	Credit with grade

## Aim of the course

The aim of the course is to provide information on the basic laws of electrical engineering, developing the ability to analyze and measure basic parameters in simple electrical circuits. Obtaining basic knowledge in the field of control and automatic regulation of simple automation systems.

## Prerequisites

High school level physics

## Scope

### Lecture

1. Basic concepts, similarities between gravitational and electric fields, basic electrical quantities, measurements of electrical quantities.
2. Ohm's law, Kirchhoff's 1st and 2nd law, structure of an electric circuit.
3. Switching elements of industrial automation, logic functions, implementation of logic functions in relay technology.
4. Designing combinational circuits, minimizing logic functions.
5. Designing sequential circuits, the use of flip-flops.
6. Introduction to pneumatic systems, basic elements, used symbols, diagrams of pneumatic systems.
7. Introduction to control and regulation systems.
8. Final test.

### Laboratory

1. Occupational health and safety guidelines. Laboratory equipment: measuring devices, power supplies and auxiliary devices.
2. Wiring simple electric circuits.
3. Measurements of basic electrical quantities with analog and digital meters.
4. Study of Ohm's law in DC circuits.
5. Investigation of Kirchhoff's laws I and II in DC circuits.
6. Wiring simple switching systems in relay technology.
7. Implementation of logic functions in relay technology.
8. Design and implementation of simple combinational circuits in relay technology.
9. Design and implementation of complex combinational circuits in relay technology.
10. Design and implementation of simple sequential circuits in relay technology.
11. The use of flip-flops to implement simple sequential circuits in relay technology.
12. Basic elements of pneumatic systems.
13. Direct and indirect control of single and double acting actuators.
14. Implementation of logic functions using pneumatic elements.
15. Implementation of the selected automation system using the discussed pneumatic elements.

## Teaching methods

**Lecture:** a conventional lecture

**Laboratory:** practical classes in the laboratory

## Learning outcomes and methods of their verification

Outcome description	Outcome symbols	Methods of verification	The class form
basic knowledge of the principles of carrying out and processing the results of physical measurements, types of measurement uncertainties, ways of calculating and expressing them	<ul style="list-style-type: none"><li>• <a href="#">K_W04</a></li></ul>	<ul style="list-style-type: none"><li>• an observation and evaluation of the student's practical skills</li><li>• carrying out laboratory reports</li></ul>	<ul style="list-style-type: none"><li>• Laboratory</li></ul>
ability to apply mathematical methods and plan engineering activities in the field of mechanical engineering and to develop the results of those tests and engineering works, and to draw conclusions and formulate opinions on technical matters	<ul style="list-style-type: none"><li>• <a href="#">K_U02</a></li></ul>	<ul style="list-style-type: none"><li>• an observation and evaluation of the student's practical skills</li><li>• carrying out laboratory reports</li></ul>	<ul style="list-style-type: none"><li>• Laboratory</li></ul>
ability to prepare, document and elaborate in written form the issues related to mechanical engineering processes; document the course of work in the form of a test report or measurement report; ability to develop test results and present them in a clear report	<ul style="list-style-type: none"><li>• <a href="#">K_U05</a></li><li>• <a href="#">K_U15</a></li></ul>	<ul style="list-style-type: none"><li>• carrying out laboratory reports</li></ul>	<ul style="list-style-type: none"><li>• Laboratory</li></ul>
ability to interact or work in a group, taking various roles	<ul style="list-style-type: none"><li>• <a href="#">K_K03</a></li></ul>	<ul style="list-style-type: none"><li>• an ongoing monitoring during classes</li></ul>	<ul style="list-style-type: none"><li>• Laboratory</li></ul>
basic knowledge in the field of automation systems along with the selection of automation systems for technological processes as an engineering discipline related to Management and Production Engineering; ability to design a simple automation system using appropriate techniques, methods and tools	<ul style="list-style-type: none"><li>• <a href="#">K_W11</a></li><li>• <a href="#">K_U24</a></li></ul>	<ul style="list-style-type: none"><li>• activity during the classes</li><li>• an evaluation test</li><li>• an observation and evaluation of the student's practical skills</li></ul>	<ul style="list-style-type: none"><li>• Lecture</li><li>• Laboratory</li></ul>
basic knowledge of methods, techniques and tools used for solving simple engineering tasks related to Management and Production Engineering	<ul style="list-style-type: none"><li>• <a href="#">K_W39</a></li></ul>	<ul style="list-style-type: none"><li>• an evaluation test</li><li>• an ongoing monitoring during classes</li><li>• carrying out laboratory reports</li></ul>	<ul style="list-style-type: none"><li>• Lecture</li><li>• Laboratory</li></ul>

## Assignment conditions

**Lecture:** a positive result of the assessment via a written test

**Laboratory:** the average of grades obtained from written tests and lab reports.

**Final grade:** the condition for passing the course is to pass all its forms, the final grade for the course is the arithmetic mean of the grades for individual forms of classes.

## Recommended reading

1. Ebel F., Idler S., Prede G. , Scholz D., *Fundamentals of automation technology, Technical book*, Festo Didactic GmbH 2008.
2. Hacker V., Sumereder C., *Electrical Engineering : Fundamentals*, De Gruyter Oldenbourg, 2019.
3. Johnson C.D., *Process Control Instrumentation Technology*, Pearson Education Limited 2014.
4. Kories R., Schmidt-Walter H., *Electrical Engineering A Pocket Reference*, Artech House, 2007.
5. Rauf S. B., *Electrical Engineering for Non-electrical Engineers*, The Fairmont Press, Inc. 2016.

## Further reading

1. Bhattacharya S.K., Rastogi K. M., *Experiments in Basic Electrical Engineering*, NEW AGE International Publishers. 2017.
2. Love J., *Process Automation Handbook: A Guide to Theory and Practice*, Springer, 2007.
3. Manesis S., Nikolakopoulos G., *Introduction To Industrial Automation*, Taylor & Francis Inc, 2018.
4. Martin P., Gregory H., *Automation Made Easy : Everything You Wanted to Know About Automation and Need to Ask*, Research Triangle Park, NC: International Society of Automation [ISA], 2010.

## Notes

Modified by dr inż. Grzegorz Pająk (last modification: 03-05-2023 11:15)