

Subject programme

1. Subject name / subject module: **Programmable Logic Controllers**
2. Lecture language: English
3. The location of the subject in study plans:
 - Area or areas of the studies: **Computer Engineering and Mechatronics**
 - Degree of the studies: **1st degree studies**
 - Field or fields (implementation of effects standard): **Mechatronics**
4. Supervision of subject implementation:
 - The Institute / Another unit: **Institute of Informatics and Mechatronics**
 - The person responsible for the subject: **Ocetkiewicz Tomasz, mgr inż.**
 - People cooperating in the development of the programme of the subject:
5. The number of hours and forms of teaching for individual study system and the evaluation method:

Mode of study	Teaching activities with the tutor																								Total ECTS
	Form of classes																								
	...	SOW	ECTS	Laboratory work	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	
Full-time studies				22	28	2																			
Part-time studies																									
Credit rigor	Exam																								

6. Student workload – ECTS credits balance:
1 ECTS credit corresponds to 25-30 hours of student work needed to achieve the expected learning outcomes including the student's own work

Activity (please specify relevant work for the subject)	Hourly student workload (full-time studies/part-time studies)
Participation in lectures	-
Participation in laboratory classes	22
Preparation to laboratory classes	8
Independent study of the subject	10
Preparation to an exam test	8
Participation in an exam / graded assignment	2
Total student workload (TSW)	50
ECTS credits	2
* Student's workload related to trainings	50
Student's workload in classes requiring direct participation of academic teachers	22

7. Implementation notes: recommended duration (semesters), recommended admission requirements, relations between the forms of classes:
 - Recommended admission requirements – none.
 - Recommended duration of the subject is taken from the course plan.
8. Specific learning outcomes – knowledge, skills and social competence:

Specific learning outcomes for the subject		Form	Teaching method	Methods for testing of (checking, assessing) learning outcomes
Outcome symbol	Outcome description			
Knowledge				
K_W05	A student possesses sufficient knowledge of automation, electronics, and electrical engineering, necessary to understand, at an advanced level, the complex dependencies in mechatronic systems and to apply this knowledge in practice through the use of	Laboratory work	Inquiry methods	Exam Student learning activities
K_W08	A student possesses sufficient knowledge to select specific issues in the field of automation, electronics, and electrical engineering related to the design of control systems (including robotics) based on programmable logic controllers and practical			
Skills				
K_U15	A student is able to assess the suitability and choose the appropriate methods tools and materials to solve a simple engineering task in the field of Mechatronics.	Laboratory work	Inquiry methods	Exam Student learning activities
K_U16	A student possesses sufficient skills to select and use appropriate methods, techniques, and tools - in accordance with the given specification - to design			

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	and implement a simple device, object, system, or process, that requires the use of a programm			
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9. Assessment rules / criteria for each form of education and individual grades:

0% - 50%	ndst	80% - 86%	db
51% - 70%	dst	87% - 93%	db+
71% - 79%	dst+	94% - 100%	bdb

Activity	Grades	Calculation	To Final
Tasks done during laboratory classes	dst, db, bdb, db (3,4,5,4)	arithmetic mean (3,4,5,4) * 50%	2,0
Exam	bdb (5)	5.0 * 50%	2,5
Final result			4,5
Grade		4,5/5 = 90%	db+ (4,5)

10. The learning contents with the form of the class activities on which they are carried out:

(Laboratory work)

1. Architecture and operating principle of programmable controllers: PLC construction PLC block diagram; Programmable controller operating modes; Programmable controller specific times; Controller communication with timer; Driver memory map. Addressing Memory Areas;
2. Principles for linking programmable controllers to control objects: Power to programmable controllers; Types of PLC inputs Types of PLC outputs PLC inputs and outputs technical and performance specifications; Programmable device communication interfaces; Distributed Ethernet-based control configuration;
3. Ladder Language (LD) for Omron Drivers; Ticket Control Instructions. Logical instructions; timers and counters; Data transfer and copy operations. Arithmetic shifts and circular sets. Data comparison; subprograms. Program run control; Binary and BCD calculations. Data conversion;
4. Design and operation of programmable relays: Concept of programmable relay; Block diagram of programmable relay; Comparison of programmable relay with programmable controller; FBD language using the LOGO relay example;
5. Creating and software a user interface.

11. Required teaching aids:

- a. Lecture - multimedia projector
- b. Laboratory classes - specialist laboratory

12. Literature:

- a. Basic literature:
 1. D.H. Hanssen; Programmable Logic Controllers: A Practical Approach to IEC 61131-3 using CODESYS; ISBN 9781118949214; Wiley
 2. Automation Direct, PLC Handbook - cdn.automationdirect.com/static/eBooks/PLC%20Handbook.pdf
- b. Supplementary literature:
 1. Omron - Omron CP1L CPU Unit - Operation Manual
 2. Omron - Omron CP1H_CP1L CPU Unit - Programming Manual

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3. Omron - Technical Guide for PLC Basic
 4. Omron - CX-Programmer Introduction Guide R132-E1-04
 - c. Internet sources:
 1. Introduction to PLC Programming and Implementation - from Relay Logic to PLC Logic - www.industrialtext.com
 2. A Beginner's PLC Overview - www.automation.com/en-us/articles/2017/a-beginners-plc-overview-part-1-of-4-introduction
 3. PLC Tutorial - www.javatpoint.com/plc
13. Available educational materials divided into forms of class activities (Author's compilation of didactic materials, e-learning materials, etc.)
14. Teachers implementing particular forms of education:

Form of education	Name and surname
1. Lecture	
2. Laboratory classes	Ocetkiewicz Tomasz, mgr inż.
3. Training	
4. Project classes	
5. Workshop classes	
6. Simulation game	
7. Language classes	