

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Sterowniki programowalne**
 Name in English: **Programmable Logic Controllers**
 Main field of study (if applicable): **Control Engineering and Robotics**
 Specialization (if applicable):
 Level and form of studies: **1st level, full-time**
 Kind of subject: **obligatory**
 Subject code: **ARR043202**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15		30		
Number of hours of total student workload (CNPS):	30		60		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	1		2		
including number of ECTS points for practical (P) classes :			2		
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70		1.40		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It has a basic knowledge in the field of analog and digital electronic circuits.
2. It has a basic knowledge of electrical engineering (knows the basic rights and claims, understands and knows the control rules of the basic electrical devices).
3. Able to correctly read and interpret electrical circuit diagrams, knows how to design a simple control system using relays and contactors.
4. It can wire the control system on the basis of the attached schematic.

SUBJECT OBJECTIVES

- C1. Familiarize students with the structure of typical control systems and industrial automation.
 C2. Acquire basic knowledge about the structure and operation of PLCs.
 C3. Acquire skills PLC programming in FBD and LD languages for the implementation of typical control systems.
 C4. Acquiring skills: wiring, commissioning and testing of the control system.

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 It has knowledge of the structure of programmable controllers and understands their principles of operation.
 PEK_W02 He knows basic PLC programming languages.

relating to skills:

- PEK_U01 He can develop a control algorithm of the selected industrial process.
 PEK_U02 He can configure and program the PLC in the selected language, using dedicated software tools.

relating to social competences:

- PEK_K01 It has a sense of responsibility for their own work and a willingness to comply with the principles of teamwork.

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Introduction. Programmable controllers - historical outline, construction and working principle.	2
Lec 2	Introduction to IEC 61131-3 standard. PLC programming languages. Number systems. Basic logical operations.	2
Lec 3	Programming of logic functions, timers and counters in examples - Part 1.	2
Lec 4	Programming of logic functions, timers and counters in examples - Part 2.	2
Lec 5	Structure and programming of popular PLC - Part 1.	2
Lec 6	Structure and programming of popular PLC - Part 2.	2
Lec 7	Final test.	2
Lec 8	Industrial communication networks.	1
Total hours:		15

Form of classes - laboratory		Number of hours:
Lab 1	Introduction to the Rules and Regulations of internal safety lab. Establish rules for passing. General familiarization with laboratory equipment. Discussion of the laboratory exercises.	2
Lab 2	Practical learning of software tool for SIMATIC PLCs. Getting to know the software function library.	2
Lab 3	Programming of basic logic structures (functions: AND, OR, NOT, XOR, RS and SR flip-flops, edge detectors).	2
Lab 4	Programming of basic timers and counters (timers: TON, TOF, TP, counters: CTU, CTD, CTUD, comparators).	2
Lab 5	Programming of models of electric drives in various operating states - Part 1.	2
Lab 6	Programming of models of electric drives in various operating states - Part 2.	2
Lab 7	Programming of models of electric drives in various operating states - Part 3.	2
Lab 8	Programming of models of the various industrial processes - Part 1.	2
Lab 9	Programming of models of the various industrial processes - Part 2.	2
Lab 10	Programming of models of the various industrial processes - Part 3.	2
Lab 11	Programming of models of the various industrial processes - Part 4.	2
Lab 12	Programming models of industrial machinery and devices - Part 1.	2
Lab 13	Programming models of industrial machinery and devices - Part 2.	2
Lab 14	Programming models of industrial machinery and devices - Part 3.	2
Lab 15	Giving reports, summary and pass the lab.	2
Total hours:		30

TEACHING TOOLS USED
N1. Lecture using audiovisual techniques, multimedia presentations.
N2. The laboratory is carried out in the traditional manner in student groups. Laboratory is equipped with: PCs, PLCs and the models of machinery, equipment and industrial processes.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation <i>F - forming (during semester)</i> <i>P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEK_W01 PEK_W02	Final test.
P(W)	P = F1	
F1(L)	PEK_U01 PEK_U02	Assessment of prepare for laboratory exercises.
F2(L)	PEK_U01 PEK_U02 PEK_K01	Activity in laboratory classes.
F3(L)	PEK_U01 PEK_U02	Rating of reports of completed projects
P(L)	P = 0,3*F1+0,4*F2+0,3*F3	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] Kasprzyk J., Programowanie sterowników przemysłowych, WNT
- [2] Legierski T., Wyrwał J., Programowanie sterowników PLC, Wyd. Pracowni Komputerowej J. Skalmierskiego, Gliwice 1998
- [3] Pawlak M., Sterowniki Programowalne, e-skrypt, Wyd. Politechnika Wrocławska, Wrocław 2010, dostępny w Dolnośląskiej Bibliotece Cyfrowej

SECONDARY LITERATURE:

- [1] Janusz Kwaśniewski, Sterowniki PLC w praktyce inżynierskiej, BTC
- [2] Laboratory instruction set, auxiliary materials for lectures and technical documentation of PLCs.
- [3] Flaga S., Programowanie sterowników PLC w języku drabinkowym, BTC, Legionowo 2010
- [4] Sałat R., Korpysz K., Obstawski P., Wstęp do programowania sterowników PLC, WKŁ, Warszawa 2010

SUBJECT SUPERVISOR

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **ARR043202 - Programmable Logic Controllers** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1AiR_W30	C.1 C.2	Lec1 Lec5 Lec6 Lec8	N.1
PEK_W02	K1AiR_W30	C.1 C.2	Lec2 Lec3 Lec4 Lec5 Lec6	N.1
PEK_U01	K1AiR_U26	C.3 C.4	Lab5 Lab6 Lab7 Lab8 Lab9 Lab10 Lab11 Lab12 Lab13 Lab14	N.2
PEK_U02	K1AiR_U26	C.3 C.4	Lab1 Lab2 Lab3 Lab4	N.2
PEK_K01	K1AiR_K03	C.1 C.2 C.3 C.4	Lec7 Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab10 Lab11 Lab12 Lab13 Lab14 Lab15	N.1 N.2