FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Sterowniki programowalne**
Name in English:	**Programmable Logic Controllers**
Main field of study (if applicable):	**Industrial Control Engineering**
Specialization (if applicable):	
Level and form of studies:	**1st level, full-time**
Kind of subject:	**obligatory**
Subject code:	**APR013202**
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 LEARNING OUTCOMES

relating to knowledge:

PEU_W01 It has knowledge of the structure of programmable controllers and understands their principles of operation.
PEU_W02 He knows basic PLC programming languages.

relating to skills:

PEU_U01 He can develop a control algorithm of the selected industrial process.
PEU_U02 He can configure and program the PLC in the selected language, using dedicated software tools.

relating to social competences:

PEU_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.	1
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.	2
Lec 6	Use of additional standards based on PLC Open libraries: Motion Control, Rapid prototyping.	2
Lec 7	Development of industrial programmable controllers.	2
Lec 8	Final test.	2
	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 LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEU_W01 PEU_W02	Final test.
P(W)	P = F1	
F1(L)	PEU_U01 PEU_U02	Assessment of prepare for laboratory exercises.
F2(L)	PEU_U01 PEU_U02 PEU_K01	Activity in laboratory classes.
F3(L)	PEU_U01 PEU_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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