

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Układy peryferyjne programowalnych sterowników logicznych PLC**  
 Name in English: **Peripheral devices of Programmable Logic Controllers**  
 Main field of study (if applicable): **Electrical Engineering**  
 Specialization (if applicable): **Electrical Power Engineering**  
 Level and form of studies: **2nd level, full-time**  
 Kind of subject: **optional**  
 Subject code: **ELR042116**  
 Group of courses: **NO**

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

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. Basic knowledge of PLC and A/D and D/A conversion
2. Basic ability of PLC high level languages programming.
3. Ability of creative thinking and working. Ability of team working.

**SUBJECT OBJECTIVES**

- C1. Knowledge of structure, operation and programming rules Siemens S7-1200 PLCs family especially their peripheral circuits: input/output ports, keyboard, graphic touchscreen, timers/counters, A/D and D/A converters, Real Time Clock (RTC), Pulse Width Modulation (PWM), Pulse Train Outputs (PTO).
- C2. Ability of Siemens S7-1200 PLCs family peripheral circuits programming (high level languages), especially for practical implementation.
- C3. Ability of practical team working: algorithms creation and programming.

**SUBJECT EDUCATIONAL EFFECTS***relating to knowledge:*

PEK\_W01 Student has knowledge of architecture, working and peripheral circuits of Programmable Logic Controllers (PLC).

PEK\_W02 Student has knowledge of algorithms development, PLC and their peripheral circuits programming (high level languages), especially for practical implementation.

*relating to skills:*

PEK\_U01 Student has the ability to use and programming (in high level languages) PLC and their peripheral circuits.

PEK\_U02 Student can independently, based on an existing PLC and their peripheral circuits, execute a simple task, or part of a complex task from control systems.

*relating to social competences:*

PEK\_K01 Student can competently cooperate in the group that develops a complex project.

### PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Introduction. Establishing rules for credit. Description SIEMENS PLC family The construction of S7-1200 controller. Data types, memory structure, addressing modes, programming languages.	2
Lec 2	Boolean operations (digital inputs/outputs) in Siemens S7-1200 PLCs family. Logic operations. Arithmetic operations.	2
Lec 3	Timers and counters in Siemens S7-1200 PLCs family.	2
Lec 4	High speed counters (HSC) in Siemens S7-1200 PLCs family.	2
Lec 5	Interrupts handling in Siemens S7-1200 PLCs family.	2
Lec 6	Analogue inputs and outputs in Siemens S7-1200 PLCs family.	2
Lec 7	High speed outputs: PTO and PWM in Siemens S7-1200 PLCs family.	2
Lec 8	Real-Time Clock (RTC) in Siemens S7-1200 PLCs family.	1
Total hours:		<b>15</b>

Form of classes - laboratory		Number of hours:
Lab 1	Presentation of the Rules of Procedure Health and Safety Laboratory. Establish rules for passing. General knowledge of the laboratory stand. Discussion of the Siemens family PLCs software environment. Siemens S7-1200 PLCs hardware structure creating. Discussion of the structure of programme and memory in Siemens S7-1200 PLCs family.	2
Lab 2	Digital inputs and outputs handling in Siemens S7-1200 PLCs family.	2
Lab 3	Counting circuits in Siemens S7-1200 PLCs family: event counters, timers, real-time clock RTC.	2
Lab 4	Interrupts handling in Siemens S7-1200 PLCs family. Forming the digital output signal: PTO and PWM.	2
Lab 5	Management of analogue signals in Siemens S7-1200 PLCs family. Graphical touch screen handling.	2
Lab 6	The implementation of the passing project with use of selected peripheral circuits.	2
Lab 7	The implementation of the passing project with use of selected peripheral circuits. (continued)	2
Lab 8	The implementation of the passing project with use of selected peripheral circuits. (continued)	1
Total hours:		<b>15</b>

### TEACHING TOOLS USED

- N1. Informative lecture.  
 N2. PLC with graphical touch screen.  
 N3. Programming environment for editing, compiling and running programs for PLC.  
 N4. The presentation of the passing project.

### EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation <i>F - forming (during semester) P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEK_W01 PEK_W02	attendance on classes
F2(W)	PEK_W01 PEK_W02	assessment of the correctness of the algorithms used in the implementation of the final project
P(W)	$P = 0,1F1 + 0,9F2$	
F1(L)	PEK_U01 PEK_U02	activity
F2(L)	PEK_U01 PEK_U02 PEK_K01	check the quality of the final task
P(L)	$P = 0,3F1 + 0,7F2$	

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE:

- [1] Flaga S., „Programowanie sterowników PLC w języku drabinkowym”, BTC, Warszawa 2010
- [2] Legierski T., Kasprzyk J., Wyrwał J., Hajda J.: Programowanie Sterowników PLC, Wyd. Prac. Komp. J. Skalmierskiego, Gliwice 2008
- [3] Kwaśniewski J., Sterowniki PLC w praktyce inżynierskiej, BTC, Warszawa 2008
- [4] SIMATIC S7-1200 Programmable controller - User manual, Siemens 2009\*
- [5] SIMATIC HMI WinCC flexible - User manual, Siemens 2007\*

\*literature available from teacher

### SECONDARY LITERATURE:

- [1] Łukasik Z., Seta Z., Programowalne sterowniki PLC w systemach sterowania przemysłowego, Wydawnictwo Politechniki Radomskiej, Radom 2001
- [2] SIMATIC S7-1200 Micro Controller for Totally Integrated Automation, Siemens 2009\*
- [3] SIMATIC S7-1200 Getting Started, Siemens 2009\*

\*literature available from teacher

## SUBJECT SUPERVISOR

Janusz Staszewski, janusz.staszewski@pwr.edu.pl

### MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT ELR042116 - Peripheral devices of Programmable Logic Controllers AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering** AND SPECIALIZATION **Electrical Power Engineering**

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	S2EEN_W12	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8	N.1
PEK_W02	S2EEN_W12	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8	N.1
PEK_U01	S2EEN_U13	C.1 C.2	Lab1 Lab2 Lab3 Lab4 Lab5	N.2 N.3
PEK_U02	S2EEN_U13	C.1 C.2	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8	N.2 N.3 N.4
PEK_K01	K2ETK_K02 K2ETK_K07	C.3	Lab6 Lab7 Lab8	N.4