

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Sterowniki programowalne w automatyce**
 Name in English: **Programmable controllers in automation**
 Main field of study (if applicable): **Control Engineering and Robotics**
 Specialization (if applicable): **Automation and Control in Electrical Power Systems**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **optional**
 Subject code: **ARR042119**
 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. Relating to knowledge: Basic knowledge of digital circuits and A/D and D/A conversion. Relating to skills: Basic ability of high level languages programming. Relating to social competencies: Ability of creative thinking and working. Ability of team working.

SUBJECT OBJECTIVES

- C1. Knowledge of structure, operation and programming rules Programmable Logic Controllers.
 C2. Knowledge of PLC peripheral circuits.
 C3. Practical ability of PLC programming (high level languages FBD or LADDER), especially practical implementation in automation systems.
 C4. 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) and their peripheral circuits.
 PEK_W02 Student has knowledge of algorithms development and programming (high level languages FBD or LADDER), especially for automation systems.

relating to skills:

- PEK_U01 Student has the ability to use and programming (in LADDER or FBD language) PLC peripheral circuits.
 PEK_U02 Student can independently, based on an existing PLC, execute a simple task, or part of a complex task from automation systems.

relating to social competences:

- PEK_K01 Student can competently cooperate in the group that develops a complex project using PLC.

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. Boolean operations (digital inputs/outputs). Arithmetic operations	2
Lec 2	Timers and counters. Real-time clock	2
Lec 3	Interrupts: types, definitions, priorities.	2
Lec 4	Analogue inputs and outputs. A/D and D/A converters.	2
Lec 5	High speed outputs: PTO and PWM. PID controllers.	2
Lec 6	Practical advice on the application of PLC in automation systems for selected examples: - sorting system, - stepper motor control, - closed-loop control using a PID controller.	2
Lec 7	Practical advice on the application of PLC in automation systems for selected examples: - sorting system, - stepper motor control, - closed-loop control using a PID controller. (continued)	2
Lec 8	Practical advice on the application of PLC in automation systems for selected examples: - sorting system, - stepper motor control, - closed-loop control using a PID controller. (continued)	1
Total hours:		15

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 software environment. The rules for creating new projects. Documentation own programs. Hardware structure creating. Discussion of the structure of programme and memory. Simple programme creating . Compilation of the programme. Loading a programme into the PLC. Running the programme. Preview the variables, symbolic addressing.	2
Lab 2	Digital inputs and outputs handling. Boolean and arithmetic operations.	2
Lab 3	Counting circuits: event counters, timers, real-time clock RTC.	2
Lab 4	Emergency and accidental event handling: interrupts. Forming the digital output signal: PTO and PWM.	2
Lab 5	Management of analogue signals: A/D and D/A converters. Graphical touch screen handling.	2
Lab 6	The implementation of the passing project.	2
Lab 7	The implementation of the passing project. (continued)	2
Lab 8	The implementation of the passing project. (continued)	1
Total hours:		15

TEACHING TOOLS USED

- N1. Informative lecture.
 N2. PLC controllers 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 PEK_K01	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

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT ARR042119 - Programmable controllers in automation AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics** AND SPECIALIZATION **Automation and Control in Electrical Power Systems**

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	S2ASE_W12 S2ASE_W13	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5	N.1
PEK_W02	S2ASE_W12 S2ASE_W13	C.1 C.2 C.3	Lec6 Lec7 Lec8	N.1
PEK_U01	S2ASE_U12	C.1 C.2	Lab1 Lab2 Lab3 Lab4 Lab5	N.2 N.3
PEK_U02	S2ASE_U12	C.2 C.3	Lab6 Lab7 Lab8	N.2 N.3
PEK_K01	K2AiR_K06 K2AiR_K07	C.4	Lab6 Lab7 Lab8	N.4