FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Zastosowanie PLC w systemach energetyki odnawialnej**
Name in English:	**PLC application in renewable electrical power engineering systems**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	**Renewable Energy Sources**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**obligatory**
Subject code:	**ELR042117**
Group of courses:	**NO**

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

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 and their peripheral circuits related in applications in renewable electrical power engineering systems

C2. Practical ability of PLC programming (in high level languages), especially practical implementation in renewable energy systems.

C3. Ability of practical team working: algorithms creation and programming.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

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, execute a simple task, or part of a complex task from renewable energy systems.

relating to social competences:

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

PROGRAMME CONTENT		
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.	2
Lab 4	Interrupts handling in Siemens S7-1200 PLCs family.	2
Lab 5	Forming the digital output signal: PTO and PWM. Stepper motor control.	2
Lab 6	Management of analogue signals in Siemens S7-1200 PLCs family.	2
Lab 7	Siemens HMI graphical touch screen handling.	2
Lab 8	Monitoring of production equipment operating parameters.	2
Lab 9	Optimizing the position of the photovoltaic cell due to the position of the sun.	2
Lab 10	Optimization of small hydroelectric pumped - storage power plant.	2
Lab 11	Optimizing the location of the wind turbine due to the wind power and direction.	2
Lab 12	The implementation of the passing project in the field of renewable energy.	2
Lab 13	The implementation of the passing project in the field of renewable energy. (continued)	2
Lab 14	The implementation of the passing project in the field of renewable energy. (continued)	2
Lab 15	The implementation of the passing project in the field of renewable energy. (continued)	2
	Total hours:	**30**

TEACHING TOOLS USED
N1. Introductory, short informative lecture preceding each laboratory.
N2. Siemens S7-1200 PLC controller with graphical touch screen.
N3. Programming environment for editing, compiling and running programs for Siemens S7-1200 PLCs.
N4. The presentation of the passing project.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(L)	PEK_U01 PEK_U02	activity
F2(L)	PEK_U01 PEK_U02 PEK_K01	preparation of the final project with documentation
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] Lewandowski W., Proekologiczne odnawialne źródła energii , WNT, Warszawa, 2010
[4] Kwaśniewski J., Sterowniki PLC w praktyce inżynierskiej , BTC, Warszawa 2008
[5] SIMATIC S7-1200 Programmable controller - User manual", Siemens 2009*
[6] SIMATIC HMI WinCC flexible - User manual , Siemens 2007*

* literature available from teacher

SECONDARY LITERATURE:

[1] Klugmann-Radziemska E., Odnawialne źródła energii: przykłady obliczeniowe , Wydawn. Politechniki Gdańskiej, 2006
[2] Łukasik Z., Seta Z., Programowalne sterowniki PLC w systemach sterowania przemysłowego, Wydawnictwo Politechniki Radomskiej, Radom, 2001
[3] SIMATIC S7-1200 Micro Controller for Totally Integrated Automation , Siemens 2009*
[4] 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
ELR042117 - PLC application in renewable electrical power engineering systems
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Renewable Energy Sources**

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_U01	S2OZE_U05	C.1	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7	N.1 N.2 N.3
PEK_U02	S2OZE_U05	C.1 C.2	Lab8 Lab9 Lab10 Lab11 Lab12 Lab13 Lab14 Lab15	N.1 N.2 N.3
PEK_K01	K2ETK_K02 K2ETK_K07	C.3	Lab12 Lab13 Lab14 Lab15	N.4