

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: **ELR052117**
 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 LEARNING OUTCOMES*relating to knowledge:**relating to skills:*

- PEU_U01 Student has the ability to use and programming (in high level languages) PLC and their peripheral circuits.
- PEU_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:

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

| EVALUATION OF SUBJECT LEARNING OUTCOMES 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(L) | PEU_U01 PEU_U02 | activity |
| F2(L) | PEU_U01 PEU_U02 PEU_K01 | preparation of the final project with documentation |
| P(L) | $P = 0,3F1 + 0,7F2$ | |

| PRIMARY AND SECONDARY LITERATURE |
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| <p>PRIMARY LITERATURE:</p> <p>[1] Gilewski T., „Podstawy programowania sterowników PLC SIMATIC S7-1200 w języku LAD”, BTC, Legionowo 2017</p> <p>[2] Gilewski T., „Podstawy programowania sterowników PLC SIMATIC S7-1200 w języku SCL”, BTC, Legionowo 2015</p> <p>[3] SIMATIC S7-1200 Programmable controller - User manual, Siemens*</p> <p>[4] SIMATIC S7-1200 Getting Started”, Siemens*</p> <p>*literature available from teacher or Siemens WWW</p> <p>SECONDARY LITERATURE:</p> <p>[1] Kwaśniewski J., "Sterowniki SIMATIC S7-1200 w praktyce inżynierskiej", BTC, Legionowo 2013</p> <p>[2] Kwaśniewski J., "Język tekstu strukturalnego w sterownikach S7-1200 i S7-1500", BTC, Legionowo 2014</p> <p>[3] SIMATIC S7-1200 Micro Controller for Totally Integrated Automation, Siemens*</p> <p>[4] SIMATIC HMI WinCC flexible - User manual, Siemens*</p> <p>*literature available from teacher or Siemens WWW</p> |

| SUBJECT SUPERVISOR |
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