

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Fotowoltaika stosowana**
 Name in English: **Applied photovoltaics**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable): **Industrial Electrical Engineering**
 Level and form of studies: **2nd level, part-time**
 Kind of subject: **optional**
 Subject code: **ELR041373**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	22				
Number of hours of total student workload (CNPS):	54				
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 :					
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student should have basic knowledge of physics.
2. The student should be capable of implementing correctly and effectively the laws of physics to the qualitative analysis to problems related to the studied engineering discipline.
3. The student should understand the need for studying the selected discipline of study.
4. The student should understand the need and be aware of the opportunities resulting from the continuous education.
5. The student should understand the need for improvements of professional, personal and social skills.

SUBJECT OBJECTIVES

- C1. knowledge of the photovoltaic effect and physical models of the PV cells;
 C2. learning of the photovoltaic cells and modules technology, their characteristics and parameters.
 C3. understanding how the accumulation and processing of electricity from photovoltaic modules;
 C4. getting acquainted with legal conditionality of photovoltaic;

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 Have knowledge about the sun and its radiation and the photovoltaic effect and the structure and types of photovoltaic cells and have knowledge of the design and ways manufacture of photovoltaic modules and energy storage methods;
 PEK_W02 Knows the methods testing, calibration and the proper selection of indicators of photovoltaic system elements and familiar with the legal conditions and standards in photovoltaic.

*relating to skills:**relating to social competences:*

- PEK_K01 Ability to think and act creatively and resourcefully and be able to collaborate in a group and understanding the needs for following continuously the knowledge in the field of photovoltaics.

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Introduction of the subject, requirements and grading policy. Energy sources, the state's energy resources and their impact on the environment. Basic concepts and units of energy. Solar radiation and the Earth's atmosphere.	2
Lec 2	Photovoltaic cells. Description of the photovoltaic effect, current-voltage characteristics (I-V), Schottky barrier PV cells,	2
Lec 3	Technology and parameters of photovoltaic cells., Preparation, cleaning and crystallization of silicon.	2
Lec 4	Crystalline cells. Polycrystalline thin-film cells. cadmium tellurium cells. Cells based on amorphous silicon.	2
Lec 5	Parameters and characteristics of the photovoltaic modules. Influence of various factors on the efficiency of photovoltaic conversion., Photovoltaic modules construction.	2
Lec 6	Stand-alone photovoltaic systems and PV systems integrated with grid. Integrated systems with buildings and keep up with the sun systems.	2
Lec 7	Accumulation of electricity from photovoltaic modules, Hubs radiation.	2
Lec 8	Standardization in photovoltaic energy., Manufacturers of photovoltaic cells and modules. Testing and calibration of photovoltaic cells or modules.	2
Lec 9	Indicators of proper selection of photovoltaic system elements. Strategy of development photovoltaic technology.	2
Lec 10	Final test.	2
Lec 11	Summary of lectures and perspective of development of photovoltaics. Discussion of results of the final test.	2
Total hours:		22

TEACHING TOOLS USED
N1. Traditional lectures supplemented by audio-visual demonstrations. Multi-medial presentation.
N2. Final test,

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS 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(w)	PEK_W01 PEK_W02 PEK_K01	Final test.
P(w)	P=F1	

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE:
[1] E. Klugman-Radziemska - Fotowoltaika w teorii i praktyce , Wydawnictwo BTC , Legionowo 2008.
[2] M.T. Sarniak, Podstawy fotowoltaiki , Oficyna Wydawnicza Politechniki Warszawskiej, 2008.
SECONDARY LITERATURE:
[1] E. Klagmann, E. Klugman-Radziemska - Ogniwa i moduły fotowoltaiczne oraz inne niekonwencjonalne źródła energii, Fundacja Ekonomistów Środowiska i Zasobów Naturalnych, Białystok, 2005
[2] Z. Pluta - Słoneczne instalacje energetyczne, Oficyna Wydawnicza Politechniki Warszawskiej, 2008.

SUBJECT SUPERVISOR
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR041373 - Applied photovoltaics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Industrial Electrical 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	S2ETP_W12	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec10 Lec11	N.1 N.2
PEK_W02	S2ETP_W12	C.3 C.4	Lec6 Lec7 Lec8 Lec9 Lec10 Lec11	N.1 N.2
PEK_K01	K2ETK_K06 K2ETK_K07	C.1 C.2 C.3 C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11	N.1 N.2