

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Fotowoltaika**  
 Name in English: **Photovoltaic Cells**  
 Main field of study (if applicable): **Electrical Engineering**  
 Specialization (if applicable): **Renewable Energy Systems**  
 Level and form of studies: **2nd level, full-time**  
 Kind of subject: **obligatory**  
 Subject code: **ELR051337**  
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30		15		
Number of hours of total student workload (CNPS):	60		30		
Form of crediting:	examination		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	2		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40		0.70		

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

1. Basic knowledge in the field of electrical installations
2. Basic knowledge in the field of circuit theory
3. Basic knowledge of electrical properties of solids

**SUBJECT OBJECTIVES**

- C1. Transfer of the basic knowledge and skills in the field of photovoltaic engineering  
 C2. Training the practical skills associated with photovoltaic systems

**SUBJECT LEARNING OUTCOMES***relating to knowledge:*

- PEU\_W01 knows the photovoltaic system types and their characteristics  
 PEU\_W02 knows the rules how to select and attune elements of the PV system

*relating to skills:*

- PEU\_U01 Is able to characterize operational parameters of PV  
 PEU\_U02 is able to select PV system elements

*relating to social competences:*

- PEU\_K01 creativity in thinking and handling enabling an professional problem solving

## PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Basic terms and definitions: solar irradiation – spectral and energy characteristics	2
Lec 2	Photovoltaic cells – semiconductors types, additions, photovoltaic effect	2
Lec 3	Construction of photovoltaic cell – V-I characteristic	2
Lec 4	Technologies for PV cell production	2
Lec 5	Assembly of production steps of PV modules	2
Lec 6	PV systems – elements, characteristics	2
Lec 7	Energy storage devices dedicated for PV systems	2
Lec 8	Testing, calibration, normalization – selected issues	2
Lec 9	Island systems – rules for elements selection and sizing	2
Lec 10	Grid connected systems – elements selection and sizing, valuation of energy production	2
Lec 11	Monitoring and SCADA for PV systems	2
Lec 12	Computer aided design of PV system – software solutions	2
Lec 13	Standards and legal rules for PV systems	2
Lec 14	Policy and financing schemes supporting the development of PV systems	2
Lec 15	Summary, presentation of examination topics	2
Total hours:		<b>30</b>

Form of classes - laboratory		Number of hours:
Lab 1	Assessment of mean irradiation and energy production potential for different geographical localizations	2
Lab 2	Recording of V-I characteristics for different types of cell technologies	2
Lab 3	Statistical analysis of energy production correlated to meteorological data	2
Lab 4	Monitoring of a PV system	4
Lab 5	Simulation of faults in a PV system	2
Lab 6	Power Quality measurement and assessment in a PV system	3
Total hours:		<b>15</b>

## TEACHING TOOLS USED

- N1. Traditional lecture with multimedia presentations  
 N2. Laboratory adapted for activities in small groups

## EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation <i>F – forming (during semester) P – concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEU_W01 PEU_W02	written examination
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_K01	grading the students self-preparation to lab tasks
P(L)	P=F1	

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE:

- [1] S.R. Wenham, M.A. Green, M.E. Watt, R. Corkish,., Applied Photovoltaics, Earthscan, London 2009

### SECONDARY LITERATURE:

- [1] D. Myers, Solar Applications In Industry and Commerce, Prentice-Hall, New Jersey 1984  
 [2] V.D. Hunt, Handbook of Conservation and Solar Energy, Van Nostrand Reinhold, New York 1982

## SUBJECT SUPERVISOR

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