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:	**ELR031337**
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):	90		30		
Form of crediting:	examination		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	3		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10		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 EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 knows the photovoltaic system types and their characteristics
PEK_W02 knows the rules how to select and attune elements of the PV system

relating to skills:

PEK_U01 Is able to characterize operational parameters of PV
PEK_U02 is able to select PV system elements

relating to social competences:

PEK_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 sell – 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 finacing schemes supporing the developemnet of PV systems	2
Lec 15	Summary, presentation of examination topics	2
	Total hours:	**30**

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 corralled 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:	**15**

TEACHING TOOLS USED
N1. Traditional lecture with multimedia presentations
N2. Laboratory adapted for activities in small groups

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(W)	PEK_W01 PEK_W02	written examination
P(W)	P=F1	
F1(L)	PEK_U01 PEK_U02 PEK_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. Greek, 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 nad Solar Energy, Van Nostrand Reinhold, New York 1982

SUBJECT SUPERVISOR
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR031337 - Photovoltaic Cells
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Renewable Energy 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	S2RES_W08	C.1	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7	N.1
PEK_W02	S2RES_W08	C.1	Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1
PEK_U01	S2RES_U08	C.2	Lab1 Lab2 Lab3	N.2
PEK_U02	S2RES_U08	C.2	Lab4 Lab5 Lab6	N.2
PEK_K01	S2RES_K01	C.1 C.2	Lec1 Lec2 Lec3 Lec13 Lec14 Lec15 Lab1 Lab2 Lab5 Lab6	N.1 N.2