

WROCLAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

FACULTY OF FUNDAMENTAL PROBLEMS OF TECHNOLOGY

SUBJECT CARD

Course name in Polish: **Wstęp do fotowoltaiki**Course name in English: **Introduction into Photovoltaics**Course language: **English**

University-wide general course type:

1)basic course (mathematics, physics, chemistry, other)

Departmental course developing professional skills:

1)specialized course

Type of course -optional

Educational effects according to ZW 26/2017:**P8U_W** Graduate knows and understands the global scientific and creative and consequent implications for practice**P8S_WG** Graduate knows and understands the main trends of development of scientific disciplines relevant to the training programme**P8S_K O** Graduate has underestimated the need to develop contacts between scientific and socio-economic environmentSubject code **FTP009012W**

	Lecture	Laboratory	Seminar
Number of hours of organized classes in University (ZZU)	30	-	-
Number of hours of total student workload (CNPS)	60	-	-
Form of crediting	Assesment	-	-
Number of ECTS points	3		
including number of ECTS points for practical (P) classes			
including number of ECTS points for direct teacher-student contact (BK) classes			

*delete as applicable **In case of didactic courses also inspections and evaluation classes

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of physics

SUBJECT OBJECTIVES

C1	Knowledge of the principles, the basic parameters and characterization methods of solar cells
C2	To know the State of knowledge regarding cells I, II and III generation
C3	Knowledge of the market for renewable energy sources (RES)

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SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:

PEK_W01 Has a basic understanding of the principles of commercial and laboratory solar cells operation

PEK_W02

Has a basic knowledge of the latest trends in the field of photovoltaics, solar (photovoltaic) market and its prospects

Relating to skills:

PEK_U01

Can describe the operation of the solar I, II and III generation.

PEK_U02

Can discuss the latest trends in the field of photovoltaics and its importance for the world economy

Relating to social competences:

PEK_K01

Understands the need for development of alternative energy sources

III generation (organic, dye sensitized solar cells, perovskites, quantum dot solar cells, tandem solar cells and many more...).

Solar cells' R@D.

PROGRAM CONTENTS

Form of classes – lecture		Number of hours
Lec 1	Introduction into solar radiation. Black body radiation laws.	2
Lec 2	Semiconductors in photovoltaics. Statistics of electrons and holes in semiconductors. Doping of semiconductors.	3
Lec 3	Optical transitions in semiconductors. Generation and recombination of electron-hole pairs.	2
Lec 4	P-n junctions. Mechanisms of current transport in thermal equilibrium and for a biased p-n junction.	2
Lec 5	Fundamentals of a solar cell's working principle, parameters.	2
Lec 6	Methods of solar cells' and solar panels' characterization.	2
Lec 7	Metody charakteryzacji ogniw i paneli fotowoltaicznych	2
Lec 8	Heterozłącza, kontakt metal-półprzewodnik,	2
Lec 9	I generation solar cells (wafer based crystalline and multi-crystalline silicon and GaAs solar cells).	3
Lec 10	II generation (thin film solar cells: amorphous silicon, CdTe, CIGS and CIS solar cells, kesterites).	3
Lec 11	III generation (organic, dye sensitized solar cells, perovskites, quantum dot solar cells, tandem solar cells and many more...)	3
Lec 12	The current state of knowledge about the research in the field of photovoltaics and modern solutions. PV Market	2
Lec 13	Assessment	2
	Total hours	30

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TEACHING TOOLS USED	
N1	Traditional lecture with multimedia presentations complemented by demonstrations of physical phenomena.
N2	E-lecture materials posted online.
N3	Presenting a paper on a chosen topic
N4	Consultation and contact by email.
N5	Own work

EVALUATION OF ACHIEVED SUBJECT EDUCATIONAL EFFECTS		
Evaluation: F – forming (partial) C – concluding	Educational effect number	Way of evaluating achievement of educational effects
F1	PEK_W01, PEK_W02, PEK_U01, PEK_U02, PEK_K01	Activity on the lecture, presented paper
P= F1		

PRIMARY AND SECONDARY LITERATURE
<p><u>PRIMARY LITERATURE:</u></p> <p>1] Klaus Jäger, Olindo Isabella, Arno H.M. Smets, René A.C.M.M. van Swaaij, Miro Zeman <i>Solar Energy Fundamentals, Technology, and Systems</i>, ed. Delft University of Technology, 2014.</p> <p>[2] P.Wurfel, <i>Physics of Solar Cells: from Basic Principles to Advanced Concepts</i>, ed. Wiley-VCH 2009.</p> <p>[3]http://www.fulviofrisone.com/attachments/article/403/solar%20cell%20device%20physics.pdf</p> <p><u>SECONDARY LITERATURE:</u></p> <p>[1] http://www.pveducation.org/pvcdrom</p>

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
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