

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Photovoltaic systems		Code 1010314481010326975
Field of study Power Engineering	Profile of study (general academic, practical) (brak)	Year /Semester 4 / 8
Elective path/specialty Ecological Source of Electrical Energy	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) part-time	
No. of hours Lecture: 9 Classes: - Laboratory: 9 Project/seminars: 9		No. of credits 4
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 4 100% 4 100%
Responsible for subject / lecturer: Dr hab.inż. Grażyna Jastrzębska prof.nadzw. email: grazyna.jastrzebska@put.poznan.pl tel. 616652382 Elektryczny ul. Piotrowo 3A, 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Basic knowledge of renewable energy sources und unconventional sources.
2	Skills	Ability of effective self-education in a field related to the chosen course of study .
3	Social competencies	Is aware of the need to broaden their competence, is ready to work in a team .
Assumptions and objectives of the course: 1. Broaden the knowledge concerning the construction, technology and possible of application of solar cells. 2. Presentation of technological issues and their possible applications and exploitation parameters of solar cells. 3.Acquisition of knowledge concerning the application of photovoltaic solutions. 4. Characteristic of photovoltaic (autonomous, cooperating with the network, hybrid) components. 5. Explanation of standardization issues, legal, economic issues and recycling.		
Study outcomes and reference to the educational results for a field of study		
Knowledge: 1. Has a basic knowledge of solar cells (construction, technology and applications). Knows and understands the phenomena, processes and operation parameters of the devices converting solar energy into electricity - [K_W09+++] 2. Versed in the current state of review energy development and prospective trends in Poland and around the world. - [K_W20++]		
Skills: 1. Can gain information from literature, databases and other sources, can integrate the information, interpret them, as well as conclude, develop and justify opinions. - [K_U01++] 2. Can work individually and in team, can estimate the time needed for the requested task, can develop and implement a schedule of work to ensure deadlines. - [K_U02++] 3. Use a properly chosen methods and devices for electrical parameters and characteristics, interpret the results, draw conclusions. - [K_U10++]		
Social competencies:		

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| <p>1. Can use properly chosen methods and devices to perform the measurement of basic parameters characterizing components and systems. - [K_K02 ++]</p> <p>2. Is aware of responsibility for the own work and ready to comply with the principles of teamwork and accountability of collaborative tasks. - [K_K04 ++]</p> |
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Assessment methods of study outcomes

Lecture:

- Evaluate the listed knowledge and skills on the written exam.
- Continuous evaluation (rewarding the activity and the quality perception during classes).

Lab. classes:

- Test and rewarding of the knowledge necessary to carry out the fundamental problems in the area of laboratory tasks.
- Continuous evaluation (during each classe) rewarding the skills gained to use newly learned principles and methods.
- Evaluation of the knowledge and skills related to the laboratory task. Evaluation of the report of performed task.

Additional points for the activity, during classes, especially by:

- promoting discussion on the additional aspects of the subject.
- effective use of the knowledge gained during solving the given task.
- willingness to work in a team to solve the lab tasks.
- comments/suggestions related to the improvement of the teaching materials.
- esthetic accuracy of the reports and tasks-as a part of own study.

Course description

1. Sun Energy.
2. Photovoltaic conversion.
3. Solutions of materials construction, eksploataction of PV cells.
4. Selected material and operating parameters of photovoltaic cells.
5. Equivalent circuit Parameters and characteristics of PV cells .
6. Technology process.
7. PV installation.
8. Applications of PV cells.
9. Law, economic and social issues. Normalization. Recycling.
10. Photovoltaics in Poland.

Basic bibliography:

1. Jastrzębska G. "Ogniwa słoneczne, budowa, technologia, zastosowanie", WKiŁ Warszawa 2013

Additional bibliography:

1. Drabczyk K., Panek P. "Silicon-based solar cells. Characteristics and production process", PAN Kraków 2012
2. Castaner L., Silvestre S. "Modelling photovoltaic systems", John Wiley and Sons, England 2002
3. Messenger R., Ventre J "Photovoltaic systems engineering", CRC Press 2000
4. Lynn P.A. "Electricity from Sunlight", John Wiley and Sons, England 2010
5. Czasopisma Fotowoltaika, Globenergia

Result of average student's workload

Activity	Time (working hours)
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1. participation in lectures	9	
2. participation in laboratory classes	9	
3. participation in project classes	9	
4. participation in consulting (lectures)	4	
5. participation in consulting (project)	3	
6. participation in consulting (laboratory)	3	
7. preparation to test/exam	15	
8. test/exam	22	
9. preparation for the classes and preparation of the report	2	
10. preparation of the project	10	
Student's workload		
Source of workload	hours	ECTS
Total workload	96	4
Contact hours	40	2
Practical activities	56	2