STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Photovoltaic systems		**1010314481010326975**

Field of study	Profile of study (general academic, practical)	Year /Semester
Power Engineering	**(brak)**	**4 / 8**

Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Ecological Source of Electrical Energy	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**part-time**

No. of hours				No. of credits
Lecture: **9**	Classes: **-**	Laboratory: **9**	Project/seminars: **9**	**4**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**4 100%**
Technical sciences	**4 100%**

Responsible for subject / lecturer:

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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:

1. Can use properly chosen methods and devices to perform the measurement of basic parameters characterizing components and systems. - [K_K02 ++]
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 ++]

Assessment methods of study outcomes

Lekture:
- Evaluate the listed knowledge and skills on the writtten exam.
- Continous 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.
- Continous 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, eksploatation 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", WKŁ, 2013
2. Lewandowski W.: "Proekologiczne odnawialne źródła energii", WNT, Warszawa 2006.

Additional bibliography:

1. Paska J.: "Wytwarzanie energii elektrycznej", Oficyna Wydawnicza PW, Warszawa 2005.

Result of average student's workload

Activity	Time (working hours)
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)	4
6. participation in consulting (laboratory)	3
7. preparation to test/exam	15
8. test/exam	2
9. preparation for the classes and preparation of the report	22
10. preparation of the project	20

Student’s workload

Source of workload	hours	ECTS
Total workload	97	4
Contact hours	40	2
Practical activities	67	2