COURSE DESCRIPTION CARD - SYLLABUS

Course name
Photovoltaic systems [S1Energ2>SF]

Course

Field of study
Power Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

dr hab. inż. Grażyna Jastrzębska
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Lecturers

Prerequisites

Basic knowledge of renewable energy sources und unconventional sources. Ability of effective self-education in a field related to the chosen course of study . Is aware of the need to broaden their competence, is ready to work in a team .

Course objective

Broaden the knowledge concerning the construction, technology and possible of application of solar cells. Presentation of technological issues and their possible applications and exploitation parameters of solar cells. Acquisition of knowledge concerning the application of photovoltaic solutions: BIPV, BAPV, electric cars, stand alone (islands, lighthouses). Characteristic of photovoltaic (autonomous, cooperating with the network, hybrid) components. Explanation of standardization issues, legal, economic issues and recycling.

Course-related learning outcomes

Knowledge:
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.

Versed in the current state of review energy development and prospective trends in Poland and around the world.

Skills:
Can gain information from literature, databases and other sources, can integrate the information, interpret them, as well as conclude, develop and justify opinions.
Is able to work alone and in a team.
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.

Social competences:
Can use properly chosen methods and devices to perform the measurement of basic parameters characterizing components and systems.
Is aware of responsibility for the own work and ready to comply with the principles of teamwork and accountability of collaborative tasks.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The basis for assessing the knowledge and skills is a written exam.
Additional points (during lecture project and laboratory) are given for:
Continous evaluation (rewarding the activity and the quality perception during classes).
Control of the increase of skills In using the recognized principles and methods.
Effective use of the knowledge gained during solving the given task.
Evaluation of the degree of project task execution and evaluation of the report of the laboratory exercise.
Promoting discussion on the additional aspects of the subject.
Discussion of results, proposals of various solutions of the most favorable.
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.
Independence In the selection of complementary bibliography.

Programme content

Solar radiation energy, mathematical models, and optimization of the orientation of solar energy receivers to maximize energy gains. Aspects of solar energy conversion to electricity, photovoltaic cell parameters, materials, design, operation, and PV installations, including various configurations, applications, social and economic aspects, standards, recycling, installation, and maintenance of photovoltaic systems.

Course topics

Solar radiation (radiation components, models and mathematical relationships).
Discussion the spatial orientation of the solar energy receiver to optymalize the energy gains.
Photovoltaic conversion.
Selected materials and operating parameters of photovoltaic cells.
Equivalent circuit. Parameters and characteristics of PV cells.
Technology process.
PV installations (module, inverters, batteries, charge regulators, trackers, monitoring systems, wiring, carrier structures).
PV systems (types of configuration, network interaction, autonomous - hybryd systems).
Applications of PV installations. Examples of solutions.
Law, economic and social issues. Normalization. Recycling. Operation and maintenance.
Photovoltaics in Poland.
Test research results and own measurements.

Teaching methods

Learning methods include lecture, project and laboratory.
Lecture
Lecture with multimedia presentation (drawings, photos, animations and illustrations of own research).

A reference to content known to students in other subjects.
Project
Multimedia demonstration.
Project the power supply for selected object.
Analysis and discussion of various aspects (economic, environment al, legal and social), methods of problem solving. Detailed review of the project documentation. Discussion on the effects of work. Teamwork.
Laboratory
Detailed review of the report by the instruktor, including the evaluation of results and coclusions.Discussion of the effects of work. Teamwork.

Bibliography

Basic:
Jastrzębska G.: Ogniwa słoneczne Budowa, technologia, zastosowanie. WKŁ Warszawa 2013.
Jastrzębska G. :Energia ze źródeł odnawilnych i jej wykorzystanie. WKŁ Warszawa 2017.
Góralczyk I., Tytko R. : Fotowoltaika . Urządzenia instalacje fotowoltaiczne i elektryczne. Towarzystwo Słowaków w Polsce 2015.
Sibiński K., Znajdek K.: Przyrządy i instalacje fotowoltaiczne PWN Warszawa 2017.
Pluta Z.: Podstawy teoretyczne fototermicznej konwersji energii słonecznej Oficyna Wydawnicza Politechniki Warszawskiej, 2013.
Frydrychowicz-jastrzębska G., Bugała A.: Modeling the distribution of solar radiation on two - axis tracking plane for the photovoltaic conversion, ENERGIES, 2015, 1025-1041.

Additional:
Wacławek M., Rodziewicz T.: Ogniwa słoneczne. Wpływ środowiska naturalnego na ich pracę.WNT, Warszawa 2011.
Jastrzębska G.: Akumulator jako źródło energii w Poradniku Montera Elektryka, PWN, Warszawa 2016.
Luque A., Hegedius S.: Handbook of Photovoltaic Science and Engineering, John Wiley&Sons, England 2008.

Breakdown of average student's workload

	Hours	ECTS
Total workload	107	4,00
Classes requiring direct contact with the teacher	47	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00