COURSE DESCRIPTION CARD - SYLLABUS

Course name
Renewable energy source [S2ZE1E>OŹE]

Course

Field of study
Green Energy

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of physics, mathematics, thermodynamics and power engineering (general level). The ability to effectively self-educate in a field related to the chosen field of study. Awareness of the need to expand their competences, readiness to cooperate as part of the team.

Course objective

To familiarize students with the basic issues in the field of renewable energy, including renewable energy sources (sun, wind, biomass, water) and with the aspects of the impact of the operation of renewable energy sources on the power and fuel system.

Course-related learning outcomes

Knowledge:
The student has an orderly and theoretically founded knowledge of renewable energy sources.
Student knows and understands the phenomena and processes that allow for the conversion of energy from renewable energy sources into electricity.
Student knows the main directions of development of the energy industry, taking into account the economic and environmental requirements in the field of renewable energy .

Skills:
The student is able to work independently and in a team, use properly selected methods and devices in the field of electrical parameters and characteristics.
The student is able to interpret the obtained results, formulate conclusions.

Social competences:
The student is aware of the importance and understands the non-technical aspects and effects of an energy engineer's activity, including its impact on the environment and the related responsibility for own decisions.
The student is ready to fulfill social obligations, inspire and organize activities for the benefit of the social environment

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture
- evaluation of the knowledge and skills listed on the written exam,
Laboratory classes
- assessment of knowledge and skills related to the implementation of the tasks your practice, the assessment of report of performed exercise,

Programme content

The module programme includes:
- solar energy,
- wind energy,
- hydropower,
- geothermal energy,
- energy use of biofuels and synthetic fuels,
- energy use of hydrogen.

Course topics

The lecture programme includes:
- construction and operation of photovoltaic panels,
- performance characteristics of PV panels,
- inverters used in PV systems,
- cooperation of a PV installation with a battery energy storage system,
- classification, construction and operation of wind turbines,
- theoretical and real power of the wind turbine,
- characteristics of wind turbines,
- topologies of wind energy conversion systems,
- construction and operation of a hydroelectric power plant,
- classification of water turbines,
- calculation of the power and efficiency of a water turbine,
- cooperation of renewable sources with energy storage in the form of hydrogen
- thermal energy of the ground,
- classification and calculation of thermal and cooling power of ground heat exchangers,
- potential of biomass as a fuel, thermal processing of biomass and waste (torrefaction, pyrolysis, gasification),
- biomass combustion,
- devices for thermal processing of biomass,
- production and combustion of syngas,
- technologies for the valorization of gaseous fuels from thermal processes,
- production of synthetic fuels (green methane, ammonia) and hydrogen.

The laboratory classes programme includes:
- study of the energy characteristics of a wind power plant model,
- study of the energy characteristics of the Pelton water turbine model,

- study of the energy characteristics of photovoltaic panels,
- study of the operational characteristics of the electrolyzer and the fuel cell with an PEM membrane,
- determination of the characteristics and energy efficiency of the Kaplan water turbine model,
- energy efficiency tests of compressor heat pump,
- testing the combustion process of selected types of biomass in a low-power boiler,
- analysis of the pyrolysis process of selected types of biomass and waste fuels,
- analysis of the influence of operating parameters of the gasification process on the composition of syngas,
- analysis of the syngas / hydrogen combustion process in thermal devices.

Teaching methods

Lecture
Lecture with multimedia presentation supplemented with examples given on the board.
Laboratory classes
Laboratory measurements performed on physical devices

Bibliography

Basic:
1. Gasification, Second edition. Christopher Higman, Maarten van der Burgt, Gulf Professional Publishing, 2008
2. Biomass Gasification, Pyrolysis and Torrefaction. Prabir Basu, Elsevier, 2013
3. Renewable Energy Sources - Wind, Solar and Hydro Energy Revised Edition, Baby Professor, 2019
4. Wind Energy Handbook Autor Tony L Burton, Nick Jenkins, Ervin Bossanyi, John Graham, John Wiley & Sons, 2021
5. Solar Energy: The Physics and Engineering of Photovoltaic Conversion, Technologies and Systems , Arno Smets (Autor), Klaus Jager (Autor), Olindo Isabella (Autor), Rene van Swaaij (Autor)
6. Handbook of Distributed Generation: Electric Power Technologies Economics and Environmental Impacts, Ramesh Bansal Data wydania: 04.05.2018, Springer

Additional:
1. Synthesis gas combustion. Fundamentals and applications. Tim Lieuwen, Vigor Yang, Richard Yetter, CRC Press, 2009
2. Solar Electricity Handbook - 2021 Edition: A simple, practical guide to solar energy - designing and installing solar photovoltaic systems Michael Boxwell (Autor)

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50