# STUDY MODULE DESCRIPTION FORM

| Name of the module/subject | | Code |
|---|---|---|
| **Renewable energy sources** | | **1010324371010322822** |

| Field of study | Profile of study (general academic, practical) | Year /Semester |
|---|---|---|
| **Electrical Engineering** | **(brak)** | **4 / 7** |
| Elective path/specialty | Subject offered in: | Course (compulsory, elective) |
| **-** | **Polish** | **obligatory** |

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

| No. of hours | | | | | No. of credits |
|---|---|---|---|---|---|
| Lecture: **8** | Classes: **-** | Laboratory: **8** | Project/seminars: **-** | | **2** |

| 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** | **2 100%** |
| **Technical sciences** | **2 100%** |

## Responsible for subject / lecturer:

dr inż. Grzegorz Trzmiel
email: Grzegorz.Trzmiel@put.poznan.pl
tel. 616652693
Wydział Elektryczny
ul. Piotrowo 3A 60-965 Poznań

## Prerequisites in terms of knowledge, skills and social competencies:

| | | |
|---|---|---|
| 1 | **Knowledge** | Basic knowledge of physics, electrical engineering and mathematics (on a general level). |
| 2 | **Skills** | The ability to effectively self-education in a field related to the chosen field of study. |
| 3 | **Social competencies** | The awareness of the need to expand their competence, their willingness to cooperate within the team. |

## Assumptions and objectives of the course:

1. To acquaint students with the structure, principles of operation and application possibilities of renewable energy: photovoltaic, wind energy and water.
2. Reason the need to replace conventional sources for renewable, due to the depletion of the former and growing environmental pollution.
3. Presentation of new opportunities in the field of sourcing electricity.

## Study outcomes and reference to the educational results for a field of study

### Knowledge:

1. has ordered and theoretically founded knowledge in the field of renewable energy sources, he knows and understands the phenomena and processes that allow for the conversion of energy from RES in electricity - [K_W09+++]
2. orients itself in the current state of development of renewable energy sources and prospective trends in Poland and in the world - [K_W18++]

### Skills:

1. can obtain information from the literature, databases and other sources, analyze it and interpret, draw conclusions, justify opinions - [K_U05++]
2. can work independently and in a team, use a properly chosen methods and devices in terms of performance and electrical characteristics, interpret the results, draw conclusions - [K_U14++, K_U15++ ]

### Social competencies:

1. aware of the the importance and understanding of the non-technical aspects and impact of engineering activities, including its impact on environment and associated with this responsibility for decisions - [K_K02++]
2. can work individually and together in a group - [K_K03++]

## Assessment methods of study outcomes

Lecture:

- Assess the knowledge and skills shown on the written test.

Laboratory:

- Test and rewarding knowledge necessary to carry out the problems in the area of laboratory tasks.
- Continuous assessment for each course, rewarding the increase in the ability to use principles and methods have met.
- Assess the knowledge and skills of the tasks exercises +, the evaluation report on executed exercise.

Get extra points for activity in the classroom and in particular for:

- Proposing to discuss additional aspects of the subject,
- The effectiveness of applying knowledge when solving a given problem,
- Ability to work within a team performing specific tasks in the laboratory,
- Comments relating to the improvement of teaching materials,
- Aesthetic diligence reports and tasks of the self-study.

## Course description

Applied methods of education: lectures: 8 h., laboratories: 8 h.

Reason the need for renewable energy sources. Legal conditions. Characteristics of renewable energy sources. Characteristics of devices that enable the conversion and storage of energy from RES: photovoltaics, wind energy and water. The costs of generation, transmission and distribution of electricity. RES impact on the environment. Estimating the energy yield.

Application possibilities in various fields. Advantages, disadvantages, limitations of such solutions.

Updated 2017: Presenting innovative solutions in the field of the subject, applied in the latest practical solutions.

A multimedia presentation with figures, diagrams, photos, supplemented with practical examples on the board, slides and computer programs, facilitating the linking of theory to practice. Lecture supplemented with additional materials provided to students for self study.

Use students' knowledge of other subjects, initiate discussions, ask questions to increase student activity and autonomy.

## Basic bibliography:

1. Jastrzębska G., Odnawialne źródła energii i pojazdy proekologiczne, WNT, Warszawa 2009.

2. Jastrzębska G., Ogniwa słoneczne. Budowa, technologia i zastosowanie, Wydawnictwa Komunikacji i Łączności, Warszawa, 2013.

3. Wolańczyk F., Elektrownie wiatrowe, Wydawnictwo KaBe, Krosno, 2009.

4. Lewandowski W.: Proekologiczne źródła energii odnawialnej, WNT, Warszawa 2012.

5. Corkish R., Sproul A., and others, Applied Photovoltaics, 3rd Edition , Taylor&Francis eBooks, 2013.

6. Haberlin H, Photovoltaics system design and practice, Wiley, 2013.

7. Jenkins D., Renewable Energy Systems, Earthscan Expert, 2013.

8. White S., Solar Photovoltaic Basics, Taylor&Francis Ltd, 2015.

## Additional bibliography:

1. Ciok Z., Ochrona środowiska w elektroenergetyce, PWN, Warszawa 2001.

2. Zimny J., Odnawialne źródła energii w budownictwie niskoenergetycznym, Wydawnictwa Naukowo-Techniczne, Kraków-Warszawa, 2010

3. Paska J., Wytwarzanie energii elektrycznej, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005.

4. Lubośny Z, Farmy wiatrowe w systemie elektroenergetycznym, Wydawnictwo WNT, Warszawa, 2013.

5. Trzmiel G., Analiza metod regulacji mocy w elektrowniach wiatrowych, Computer applications in electrical engineering vol. 89/2017, Poznan University of Technology Academic Journals ? Electrical Engineering, Poznań, 2017, str. 395 ? 404.

6. Trzmiel G., Układy śledzące punkt maksymalnej mocy w inwerterach stosowanych w instalacjach fotowoltaicznych, Computer applications in electrical engineering vol. 87/2016, Poznan University of Technology Academic Journals ? Electrical Engineering, Poznań, 2016, str. 23 ? 36.

7. Trzmiel G., Problem niestabilności energetyki wiatrowej a magazynowanie energii, Computer applications in electrical engineering vol. 87/2016, Poznan University of Technology Academic Journals ? Electrical Engineering, Poznań, 2016, str. 83 ? 96.

8. Diploma theses.

9. Internet - the subject literature.

## Result of average student's workload

| Activity | Time (working hours) |
|---|---|

| | |
|---|---|
| 1. participation in class lecture | 8 |
| 2. participation in laboratory classes | 8 |
| 3. consultation on the lecture | 4 |
| 4. consultation on the laboratory | 4 |
| 5. preparation to pass | 12 |
| 6. pass | 2 |
| 7. preparation for laboratory exercises and prepare reports | 12 |

**Student's workload**

| Source of workload | hours | ECTS |
|---|---|---|
| Total workload | 50 | 2 |
| Contact hours | 26 | 1 |
| Practical activities | 24 | 1 |