STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
(-)	**1010311471010328881**

Field of study	Profile of study (general academic, practical)	Year /Semester
Power Engineering	**(brak)**	**4 / 7**
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	**full-time**

No. of hours					No. of credits
Lecture: **15**	Classes: **-**	Laboratory: **15**	Project/seminars: **15**		**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:

Dr hab. inż. Andrzej Tomczewski
email: andrzej.tomczewski@put.poznan.pl
tel. 616652788
Elektryczny
ul. Piotrowo 3A, 60-965 Poznań

Responsible for subject / lecturer:

Dr inż. Arkadiusz Dobrzxycki
email: arkadiusz.dobrzycki@put.poznan.pl
tel. 616652379
Elektryczny
ul. Piotrowo 3A, 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of mathematics, computer science, electrical engineering and power engineering.
2	**Skills**	Ability to use a spreadsheet and programming in high level language.
3	**Social competencies**	Broaden their awareness of the need for competence, willingness to work together as a team.

Assumptions and objectives of the course:

Knowledge of both theoretical and practical issues related to the design and testing of electrical systems in collaboration with renewable energy sources. Knowledge of modeling and simulation of power system components with particular emphasis on the presence of non-conventional sources.

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

Knowledge:

1. List and explain the basic mathematical models of non-conventional energy sources cooperating with the power system. - [K_W09 ++, K_W20+]
2. Present form of numerical models based on renewable energy sources for selected input parameters and environmental conditions. - [K_W10 ++]

Skills:

1. Use existing software for simulation and testing of renewable energy co-operation with the power system, develop computer programs which are specialized implementation of the selected models operating conditions renewable energy. - [K_U09++, K_U07+]
2. Selected ecological components of the generation of electricity designed to work with the power system, designed to develop a documentation system. - [K_U03++, K_U07+]

Social competencies:

1. Is aware of the need for advanced tools to increase energy efficiency engineer and understands the importance of social engineering activities undertaken in the field of renewable energy. - [K_K01 +, K_K02 +]

Assessment methods of study outcomes

Lecture:

?Assess the knowledge and skills listed on the written exam with a combined: test and problematic (check-solving skills discussion of basic issues related to the design and testing of power systems work with renewable energy sources).

Laboratory and Design:

?Test preparation classes,

?Rewarding practical knowledge gained during the previous laboratory,

?Assessment of knowledge and skills related to the implementation of renewable energy known analytical models,

?favoring systematic progress in the design,

?assessment of the form and content of the project.

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

?Ability to work within a team practice performing the task detailed in the laboratory,

?Use of elements and techniques that go beyond the material in the field of the lecture and laboratory exercises.

Course description

Analytical models of ecological energy sources, with particular emphasis on wind and solar , numerical implementation of selected models of renewable energy sources including stochastic conditions of their work, the types and patterns of energy storage analysis, design of renewable energy systems with selected energy storage tanks, the use of specialized software for the analysis and design of electrical systems, the creation of software and its documentation for specific engineering tasks - implementation of a mathematical model of renewable energy sources, the use of modern techniques in the development of numerical models of effective analysis of renewable energy sources.

Basic bibliography:

1. Lubośny Z. "Elektrownie wiatrowe w systemie elektroenergetycznym", WNT, Warszawa, 2006

2. Majchrzak E., Mochnacki B. "Metody numeryczne. Podstawy teoretyczne, aspekty praktyczne i algorytmy", Wyd. II, Wydawnictwo Politechniki Śląskiej, Gliwice, 1996.

3. "Odnawialne i niekonwencjonalne źródła energii. Poradnik", Praca zbiorowa pod red. M. Gałuszak, J. Paruch, , Wyd. TARBONUS, Tarnobrzeg, 2008.

4. Jastrzębska G. "Odnawialne źródła energii i pojazdy proekologiczne", Wydanie 2., WNT, Warszawa, 2009.

5. Klugmann-Radziemska E. "Fotowoltaika w teorii i praktyce", Wydawnictwo BTC, Legionowo, 2010.

Additional bibliography:

1. Dokumentacja programu NEPLAN - http://www.neplan.ch/html/e/e_video_tutorials.htm

2. Perry S. C. "C# i .NET. Core", Wyd. Helion, Gliwice 2006.

Result of average student's workload

Activity	Time (working hours)
1. participation in class lectures	15
2. participation in laboratory classes	15
3. participation in project activities	15
4. participate in the consultations on the lecture	5
5. participate in the consultations on the lab	5
6. part in the consultation on the design	5
7. implementation of the project	10
8. preparation laboratory	7
9. prepare for the exam	15
10. assessment of laboratory	5
11. prepare for the completion of laboratory	5
12. participation in the exam	2

Student's workload

Source of workload	hours	ECTS
Total workload	104	4
Contact hours	67	2
Practical activities	67	2