COURSE DESCRIPTION CARD - SYLLABUS

Course name

Selected issues in designing and testing of energy systems cooperating with RES

Course

Field of study

Power Engineering

Year/Semester

2/3

Area of study (specialization)

Ecological sources of electricity

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

polish

Form of study

part-time

Requirements

compulsory

Number of hours

Lecture

10

Laboratory classes

10

Other (e.g. online)

Tutorials

Projects/seminars

10

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

dr hab inż. Andrzej Tomczewski

email: andrzej.tomczewski@put.poznan.pl

tel. 616652788

Wydział Automatyki, Robotyki i Elektrotechniki

ul. Piotrowo 3A, 60-965 Poznań

Responsible for the course/lecturer:

dr inż. Arkadiusz Dobrzycki

email: arkadiusz.dobrzycki@put.poznan.pl

tel. 616652685

Faculty of Control, Robotics and Electrical Engineering

ul. Piotrowo 3A, 60-965 Poznań

Prerequisites

The student starting this subject should have basic knowledge of electrical engineering, computer science, electrical power engineering and renewable energy sources, basic skills in programming in a high level language and should be ready to cooperate as part of a team

Course objective

Understanding selected issues related to the design and research of renewable energy sources working in the power system. Understanding how to use statistical methods and optimization in the design, research and analysis of renewable energy systems.

Course-related learning outcomes

Knowledge

1. has knowledge of the types of research used in controlling renewable energy sources operating in the power system

2. has knowledge about the importance of reliability theory in the design of electrical systems containing RES

3. has general knowledge about the application of optimization methods for renewable energy systems cooperating with the power system

Skills

1. knows how to develop specialized computer programs designed to optimize the operation of renewable energy sources in the power system

2. knows the choice of parameters and statistical methods describing the technical condition of renewable energy sources,

3. knows how to use specialized software to analyze the impact of connecting renewable sources to the power system

Social competences

1. is aware of the need to use advanced computer techniques in the work of the power industry

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired as part of the lecture is verified during a combined exam: test and problem (checking the ability to solve selected discussion issues in the field of designing and testing power systems cooperating with RES).

Skills acquired as part of the laboratory classesare verified on the basis of: assessing activity during each class, rewarding the increase in the ability to use known methods and computer systems, verification of skills during the course.

Projects are assessed on the basis of: project implementation and presentation, cooperation skills within a team practically carrying out a project task, presentation of current progress in project implementation.

Programme content

Lecture: Research methods for renewable energy sources operating in the power system. Elements of reliability theory in the process of designing renewable energy sources. Analysis of the impact of renewable energy on the environment, including the power system, as well as issues of electromagnetic compatibility in the functioning of renewable energy sources. Using optimization in the design process of electrical systems and systems. Examples of the use of random optimization methods in the selection of wind turbines for geographical location and matching the structure of hybrid systems with energy

storage to the load curve. Economic aspects in the optimization of hybrid generation systems with renewable energy and energy storage.

Laboratory classes: application of specialized software, e.g. NEPLAN, ETAP, DIgSILENT PowerFactory to analyze the impact of connecting renewable energy sources on the quality of electricity, stability of the power system. e.t.c.

Projects: Development of a computer system supporting the process of designing renewable energy generation systems cooperating with the electro-energy system. Subsequent issues are:

- development and creation of basic input data structures,

- using a wind and photovoltaic system model and statistical data to determine the amount of electricity generated,

- implementation of an electrochemical model of energy storage in a hybrid system,

- implementation of the optimization module implementing the selection of the hybrid system structure with energy storage for geographical location and load profile - Monte Carlo method.

After each project class, the application team completes the current stage at home.

Teaching methods

Lecture: lecture with multimedia presentation (including drawings, photos, animations, sound, films) supplemented by examples given on the board, lecture conducted in an interactive way with the formulation of questions for a group of students or specific students indicated, initiating discussions during the lecture, taking into account various aspects of the issues presented, including: economic, ecological, legal, social, etc., presenting a new topic preceded by a reminder of related content known to students in other subjects;

Laboratories: demonstrations, independent performance of tasks in the field of simulation of cooperation between renewable energy systems and the power system.

Projects: analysis of various technical solutions and aspects of solved problems, including: economic, ecological, legal, social etc., detailed review of project documentation by the project leader and discussion on comments, case study, team work.

Bibliography

Basic

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

2. Lubośny Z.: Elektrownie wiatrowe w systemie elektroenergetycznym, WNT, Warszawa, 2006.

3. Klugmann-Radziemska E.: Fotowoltaika w teorii i praktyce, Wydawnictwo BTC, Legionowo, 2010.

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

5. Machczyński W.: Wprowadzenie do kompatybilności elektromagnetycznej, Wydawnictwo Politechniki Poznańskiej, Poznań 2010

Additional

1. Perry S. C.: C# i .NET. Core, Wyd. Helion, Gliwice 2006.

2. Trojanowski K.: Metaheurystyki praktycznie, Wydawnictwo WIT, Warszawa, 2005

3. Paul C. R.: Introduction to electromagnetic compatibility, Wiley, New York 2006

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	35	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	40	2,0

[1] delete or add other activities as appropriate