COURSE DESCRIPTION CARD - SYLLABUS

Course name
Elective course F: Energy security

Course

Field of study
Electrical Engineering
Area of study (specialization)
Systems and electric power protection automatics
Level of study
First-cycle studies
Form of study
full-time

Year/Semester
4/7
Profile of study
practical
Course offered in
Polish
Requirements
elective

Number of hours

Lecture
15
Laboratory classes
15
Other (e.g. online)
0
Tutorials
0
Projects/seminars
15

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
mgr inż. Agnieszka Weychan
email: agnieszka.weychan@put.poznan.pl
tel. 61 665 2392
Faculty of Environmental Engineering and Energy
Piotrowo 3A, 60-965 Poznań

Responsible for the course/lecturer:
dr hab. inż. Jarosław Gielniak
email: jaroslaw.gielniak@put.poznan.pl
tel. 61 665 2024
Faculty of Environmental Engineering and Energy
Piotrowo 3A, 60-965 Poznań

Prerequisites

Basic knowledge in mathematics, physics, electrical circuits, electrical power engineering and electricity transmission and distribution. Basic knowledge in terms of design, construction and operation principles of power equipment. Ability to self-study effectively topics related to the chosen field of study and combine knowledge acquired in previous courses. Awareness of the need to extend competences, readiness to cooperate within a team.

Course objective

Gaining knowledge on shaping security of complex energy systems and familiarizing with the forecasts of changes in the energy sector concerning reliability of energy supply. Acquainting with issues related

to reliability of electricity supply, generation adequacy in the power system and system failures. Understanding indicators determining the reliability and adequacy of electricity supply. Getting to know types of back-up power supply systems and methods of their selection. Practicing calculation methods for the symmetrical and asymmetrical short-circuits in the power system. Acquainting with different types of earthing used in electrical networks and related constructions, earthing requirements, methods of their design and typical construction solutions.

Course-related learning outcomes

Knowledge

1. Student has knowledge in the field of safety of energy generation, reliability of electricity supply and related problems.

2. Student has knowledge in the field of short-circuit calculations and electric shock protection in electrical networks, as well as methods of providing backup power supply for consumers.

3. Student is able to define new development directions in the area of increasing reliability and adequacy of power systems.

Skills

1. Student is able to integrate data from various literature sources and assess energy security and reliability of electricity supply for the considered power system.

2. Student is able to prepare and deliver a presentation on security issues and power networks.

Social competences

1. Student is aware of the need to search for new solutions to improve reliability of electricity supply and power system's safety.

2. Student is aware of the need to take actions to increase energy security.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:
- knowledge and skills assessment through a problem-based written test,
- continuous assessment of student's skills and competences during each class (rewarding attendance and active participation in the classes).

Laboratory:
- assessing and rewarding student's preparation for classes and knowledge necessary to carry out laboratory exercises,
- assessment of reports on carried out laboratory exercises,
- assessment of knowledge and skills acquired in class by written test.

Project:
- assessment knowledge and skills concerning the project tasks, evaluation of the reports and presenations on completed tasks,

- additional points for active paritcipation during classes, in particular for the ability to cooperate within a team that handles that project task.

Programme content

Lecture:
Sustainableenergypolicy. Main security threats, system failures and methods to restore generation capacity in the power system in the event of a catastrophic failure. Role of ENTSO-E in ensuring energy security. Concepts of reliability, adequacy and energy security and related indicators. Short-circuit calculations for the power system - analysis of asymmetrical short-circuits with the method of symmetrical components, models of system elements for symmetrical components. Earthing in power networks, electric shock protection requirements, calculations and constructions of grounding systems. Ways to ensure local security of energy supply using backup power systems.

Laboratory:
Simulations of the power network using dedicated software (e.g. DIgSILENTPowerFactory) in order to determine the reliability of electricity supply and generation adequacy. Ways to increase reliability, adequacy and energy security. Analysis of asymmetrical short circuits with the method of symmetrical components, models of system elements for symmetrical components. Analysis of grounding installations in power networks.

Project:
Activities in the area of industrial plant. Ways of ensuring local security of electricity supply using backup power systems. Methods for increasing energy security. Calculations and design of earthing systems. Short-circuit calculations.

Teaching methods

Lecture: multimedia presentation - informational and problem lectures.

Laboratories: group work, performing laboratory exercises under the supervision of a teacher.

Project: solving project tasks in groups, case study and discussion; problem solving implemented with the help of a teacher / tutor at the workplace.

Bibliography

Basic

1. Gryz J., Podraza A., Ruszel M., Bezpieczeństwo energetyczne. Koncepcje, wyzwania, interesy. Wydawnictwo Naukowe PWN, Warszawa 2018
2. Hoppel W., Sieci średnich napięć, Wydawnictwo Naukowe PWN, Warszawa 2017
3. Kacejko P., Machowski J., Zwarcia w systemach elektroenergetycznych, WNT, Warszawa 2002
4. Kremens Z. , Sobierajski M., Analiza systemów elektroenergetycznych, WNT, Warszawa 1996
5. Markiewicz H., Bezpieczeństwo w elektroenergetyce, WNT, Warszawa 2009
6. Paska J., Niezawodność systemów elektroenergetycznych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005

7. Wiatr J., Orzechowski M., Poradnik projektanta elektryka: podstawy zasilania budynków mieszkalnych, użyteczności publicznej i innych obiektów nieprzemysłowych w energię elektryczną z przykładowymi projektami oraz przepisami prawnymi na płycie CD, Dom Wydawniczy Medium, Warszawa 2012
8. Żmuda K., Elektroenergetyczne układy przesyłowe i rozdzielcze. Wybrane zagadnienia z przykładami, Wydawnictwo Politechniki Śląskiej, Gliwice 2016

Additional

1. Dobrzyński K., Klucznik J., Malkowski R., Szczerba Z., Automatyka systemowa a bezpieczeństwo energetyczne kraju. Zabezpieczenia. Tom 2, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2013
2. Handke A., Mitkowski E., Stiller J., Sieci elektroenergetyczne, Wydawnictwo Politechniki Poznańskiej, Poznań 1982
3. Janusz P., Szczerbowski R., Zaleski P., Istotne aspekty bezpieczeństwa energetycznego Polski, Texter, Warszawa 2017
4. Kaszowska B., Kucharska B., Zbiór zadań z sieci i systemów elektroenergetycznych. Część II, Politechnika Opolska, Opole 2004
5. Kowalak R., Malkowski R., Szczerba Z., Zajczyk R., Automatyka systemowa a bezpieczeństwo energetyczne kraju. Węzły sieci przesyłowej i rozdzielczej. Tom 3, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2013

Breakdown of average student's workload

	Hours	ECTS
Total workload	109	4,0
Classes requiring direct contact with the teacher	70	3,0
Student's own work (literature studies, preparation for laboratories andtests, solving project tasks, preparing reports from laboratory exercises)[1]	39	1,0

[1] delete or add other activities as appropriate