COURSE DESCRIPTION CARD - SYLLABUS

Course name
Smart distribution grids [S2Elenerg1-ISD>ISR3]

Course

Field of study
Electrical Power Engineering

Year/Semester
2/3

Area of study (specialization)
Smart Grids

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Fundamental knowladge in electrical power engineering - short-circuit calculations, calculations of power flows, etc. Knowledge about the elements of a traditional power grid and knowladge about principles of operation of power grids. Knowledge about basic control systems and protection relays.

Course objective

Knowledge about principles of operation of smart grids, in particular advanced knowladge about local energy sources, regulation devices and moder loads - electric cars, energy storage systems. Ability to perform advanced short-circuit calculations in networks containing active elements. Ability to use power system optimization tools, e.g. optimization of power flows or estimation of electrical quantities. Knowladge about selected, advanced protection relay functions and control systems in the distribution network. Knowledge of measurement systems used in distribution networks. The ability to identify and solve problems with power quality and disturbances. Basics of network development planning and automation construction.

Course-related learning outcomes

Knowledge:

the student has a well-established knowledge of the construction of power grids, the phenomena occurring in them, operating states and methods of analyzing conventional and intelligent networks, including distributed generation and other active elements.
the student has knowledge of the elements of the power system and power system operation control, as well as the methods of using protection automation and ict technologies to protect the power grid and devices.

Skills:
the student is able to use modern it tools and numerical methods to design and analyze the operation of power systems and protection automation.

Social competences:
the student is aware of the problems related to energy security. the student is able to creatively solve problems related to power systems, taking into account economic issues and broadly understood entrepreneurship. the student understands the need to make the society aware of the development of modern power engineering and the dangers of development.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture
-assessment of knowledge and skills shown in the written test; the colloquium consists of 10 questions (test and open-ended questions) with different scores; pass mark 50% of points + 0.5 points;
- continuous assessment in each class (rewarding activity);
Laboratories
-- assessment of knowladge based on activity in the classroom
- assessment of knowladge on the basis of 2 tests
- assessment of knowladge on the basis of 3 prepared reports
Project
- project task report.

Programme content

Lecture
Algorithms for controlling the operation of local energy sources and other modern network elements. Advanced calculations of power networks taking into account many computer tools. Global optimization of equipment operation in the distribution network. Operation of distribution networks in the context of transmission networks, eg LVRT, participation in reactive power regulation. Measurements of power quality and disturbances. Methods of improvement of the quality of electrical energy. Advanced protection relays and automation functions in distribution networks. Selected issues related to current problems.
Laboratories
Examples and tasks related to lectures
Project
Selected issues related with the current problems of power networks, e.g. the integration of devices with the power grid or the design of power grid control systems

Teaching methods

Lecture: multimedia presentation, illustrated with examples given on the board and examples of computer simulations and other tools to support the operation of the power system
Laboratories: classes with the use of physical laboratory stations and classes in the computer laboratory
Project: multimedia presentation, illustrated with examples given on the board and examples of computer simulations, combined with students" independent work under the supervision of the teacher

Bibliography

Basic
1. Jan Machowski, Regulacja systemu elektroenergetycznego, Warszawa 2017
2. J. Machowski, Z. Lubośny, Stabilność systemu elektroenergetycznego, WNT 2018

3. A. Kanicki, Systemy Elektroenergetyczne
Additional
Nicolaie Fantana, Krzysztof Lowczowski, Radek Javora i inni, Substation servicing and supervision using moblie devices and smart sensing, CIGRE, grudzień 2020.
Józef Lorenc, Krzysztof Łowczowski, Bogdan Staszak, Earth fault protection supperted with adaptive admittance criteria, Przegląd Elektrotechniczny - 2018, R. 94, nr 8, s. 132-135
Krzysztof Łowczowski, Józef Lorenc, Józef Zawodniak, Grzegorz Dombek, Detection and Location of Earth Fault in MV Feeders Using Screen Earthing Current Measurement, Energies - 2020, vol. 13, no. 5, s. 1293-1-1293-24

Breakdown of average student's workload

	Hours	ECTS
Total workload	110	4,00
Classes requiring direct contact with the teacher	60	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	50	2,00