COURSE DESCRIPTION CARD - SYLLABUS

Course name

Selected issues of power network operation

Course

Field of study

Electrical engineering

Year/Semester

1/1

Area of study (specialization)

Power Networks and Electric Power Systems Protection

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Faculty of Environmental Engineering and Energy

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Responsible for the course/lecturer:

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Prerequisites

Knowledge in electrical engineering, electrical power engineering and operation of power grids. Ability to calculate load flows, short-circuit currents and select power network's elements. Awareness of the need to extend professional, personal and social competences and continuous training, willingness to assess the knowledge critically and its importance in solving analytical and practical problems.

Course objective

Understanding the principles of appropriately providing electricity distribution services and network operation taking into account the applicable legal regulations, as well as acquiring the ability to assess the phenomena disrupting the reliability and quality of electricty supply to the final consumers and

preventing such phenomena. Familizarizing with modern technologies and current problems related to the operation of electrical networks.

Course-related learning outcomes

Knowledge

1. Student has extensive knowledge on modelling power grids and systems, including reliability and quality of electricity supply and customer services.

2. Student has structured knowledge in the field of disturbances in power networks, management of power supply and consumption and principles of energy transmission in power grids.

Skills

1. Student can perform simulations of load flows and disturbances in a modelled power network using dedicated software (e.g. DIgSILENT PowerFactory).

2. Student is able to use presented mathematical methods and models, modifying them accordingly if necessary, to analyze specific phenomena in power distribution systems.

Social competences

1. Student is aware of the need to extend knowledge on distribution systems with the latest scientific and technological achievements and legal regulations.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

- determining knowledge and ability to assess significant factors affecting the quality of procesess implemented in the area of electricity distribution based on a study performed individually on a selected relevant issue to distribution systems' operation,
- continuous assessment of student's skills and competences during each class (rewarding attendance and active participation in the classes).

Laboratory:

- evaluation of knowledge and skills concerning the implementation on computer simulation tasks related to electricity distribution,
- assessment of reports on performed computer simulations,
- assessment of knowledge and skills acquired in class by written test.

Programme content

Lecture:

Obligations of distribution system operators and electricity suppliers in the process of electricity distribution based on the Energy Law and ordinances resulting from the act. The issue of safety of electricity supply in the aspect of system resources' adequacy and reliability of electricity supply from power grid. Obligations of network operators in the area of connecting renewable energy sources and providing services for renewable energy sources operators. Improving energy efficiency in electricity

distribution process by losees' reduction at network elements and compensating the reactive power flow, planning the distribution network's development, disturbances in the distribution networks caused maintenace services, damagees and by current and voltage harmonic distortions and prevention of such problems.

Laboratory:
Modelling and simulations of selected issues related to power grids using dedicated software (e.g. DIgSILENT PowerFactory) - reliability of electricity supply, connecting renewable energy sources to the power grid, reduction of energy losses, planning the development of distribution networks, disruption in the power grid operation.

Teaching methods

Lecture: multimedia presentation - informational and problem lectures

Laboratory: tasks related to modelling and simulation of electrical networks performed using dedicated software (e.g. DIgSILENT PowerFactory) in small groups, supplemented with analytical calculations.

Bibliography

Basic

1. Bućko P., Regulacyjne usługi systemowe w zakresie mocy czynnej, Oficyna Wydawnicza Politechniki Gdańskiej, Gdańsk 2011
2. Hanzelka Z. Handbook of electrical power reliability: selected issues. AGH, Kraków 2021
3. Kovalev G.F., Lebedeva L.M. Reliability of Power Systems. Springer 2019
4. Kujszczyk Sz., Elektroenergetyczne sieci rozdzielcze. Tom II, Wydawnictwo Naukowe PWN, Warszawa 1994
5. Marzecki J., Rozdzielcze sieci elektroenergetyczne, Wydawnictwo Naukowe PWN, Warszawa 2001
6. Paska J., Niezawodność systemów elektroenergetycznych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005
7. Pawełczyk M., Publicznoprawne obowiązki przedsiębiorstw energetycznych jako instrument zapewnienia bezpieczeństwa energetycznego w Polsce, Wydawnictwo Adam Marszałek, Toruń 2013
8. Żmuda K., Elektroenergetyczne układy przesyłowe i rozdzielcze. Wybrane zagadnienia z przykładami, Wydawnictwo Politechniki Śląskiej, Gliwice 2016

Additional

1. Andruszkiewicz J., Lorenc J., Staszak B., Weychan A., Zięba B. Overcurrent protection against multi-phase faults in MV networks based on negative and zero sequence criteria. International Jounal of Electrical Power & Energy Systems, vol. 134, 2022
2. Andruszkiewicz J., Lorenc J., Weychan A. Distributed generation as efficient measure to improve power generation adequacy. Archives of Electrical Engineering, vol. 68, 2019
3. Dołęga W., Planowanie rozwoju sieciowej infrastruktury elektroenergetycznej w aspekcie bezpieczeństwa dostaw energii i bezpieczeństwa ekologicznego, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2013
4. Enea Operator Sp. z o.o., Instrukcja Ruchu i Eksploatacji Sieci Dystrybucyjnej z dnia 1 stycznia 2014 r. z

późniejszymi zmianami
5. Enea Operator Sp. z o.o., Taryfa dla usług dystrybucji energii elektrycznej obowiązująca do dnia 31 grudnia 2021 r.
6. PowerFactory. User manual Digsilent GMBH 2017
7. Rozporządzenie Ministra Energii z dnia 6 marca 2019 r. w sprawie szczegółowych zasad kształtowania i kalkulacji taryf oraz rozliczeń w obrocie energią elektryczną (Dz.U. 2017 poz. 503)
8. Rozporządzenie Ministra Gospodarki z dnia 4 maja 2007 r. w sprawie szczegółowych warunków funkcjonowania systemu elektroenergetycznego (Dz.U. 2007 nr 93 poz. 623) z późniejszymi zmianami
9. Ustawa z dnia 10 kwietnia 1997 r. - Prawo energetyczne (Dz.U. 1997 Nr 54 poz. 348) z późniejszymi zmianami

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes, laboratory task preparation, preparation for tests) [1]	30	1,0

[1] delete or add other activities as appropriate