COURSE DESCRIPTION CARD - SYLLABUS

Course name

Power system operation

Course

Field of study

Power Engineering

Year/Semester

5/9

Area of study (specialization)

Electrical Power Engineering

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

part-time

Requirements

elective

Number of hours

Lecture

20

Laboratory classes

10

Other (e.g. online)

0

Tutorials

0

Projects/seminars

10

Number of credit points

6

Lecturers

Responsible for the course/lecturer:

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Wydział Inżynierii Środowiska i Energetyki

ul. Piotrowo 3A, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Knowledge: Has basic knowledge of the theory of electrical circuits, electrical machines, power engineering and electricity generation

Skills: Has the ability to effectively self-study in a field related to the chosen specialization, combine knowledge acquired in the course of previously completed subjects

Competences: Is aware of the need to expand their knowledge and competences, readiness to cooperate and cooperate in a group

Course objective

Acquaintance with the operation of the power system in steady operating states. By methods of

simulation calculations of power flows in closed high and high voltage networks. Optimization of power flows in market conditions. Calculations of symmetrical and asymmetrical steady-state short circuits in the power system. Practical operation of power flow calculation and short-circuit calculations.

Acquaintance with the operation of the power system in transient states of work. Problems of testing the power system stability at low disturbances and momentary large disturbances of the active power balance.

Course-related learning outcomes

Knowledge

Has basic knowledge in the field of energy security, in particular existing threats and ways to raise the level of energy security.

Has elementary knowledge of the basics of power engineering as well as power systems and networks.

Has elementary knowledge of the basics of control and automation of technological processes in the energy sector; understands the problems of stability in dynamic systems and knows the methods of their description.

Skills

Is able to use known methods and mathematical models, as well as computer simulations to analyze and evaluate the operation of energy elements and systems.

Is able to identify and formulate a specification of simple practical engineering tasks in the field of energy.

Social competences

Is aware of the importance and understands the various aspects and effects of electrical engineer activities, including environmental impact, and the associated responsibility for decisions.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: Assessment during classes (rewarding activity and quality of perception), assessment of knowledge and skills demonstrated during the written and oral exam.

Laboratory: Tests checking knowledge necessary in the field of laboratory tasks, assessment of knowledge and skills related to the implementation of the exercise task, evaluation of the report of the exercise.

Project: Ongoing assessment of preparation for the implementation of project tasks, assessment of the completed project task.

Programme content

Lectures: Steady states in the power system. Optimization of system operation in market conditions. Power flow calculations - the role of the nodal potential method. Application of Gauss and Newton-Raphson iterative methods to solve nonlinear nodal equations. Optimization of power flows. Estimation

of the power system state. Calculations of established short-circuit states in the power system - analysis of asymmetrical short-circuits by the method of symmetrical components, models of system elements for symmetrical components.

Transients in the power system, types of states, disturbances in the system. The scope of transient research and analysis. Models of system elements for transient analysis. Power system stability. Small oscillation of generator rotors - local angular stability. Angular power characteristics. Impact of voltage regulation on local stability. Stability with temporary large disturbance of active power balance - global angular stability. Voltage stability - voltage stability conditions.

Laboratory: includes exercises implemented using power distribution programs - PLANS and SCC short-circuit calculations on the issues discussed during lectures.

Project: includes project tasks carried out in accordance with the topics presented in the lectures

Teaching methods

Lecture: multimedia presentation supplemented with examples given on the board

Laboratories: performing tests on physical or digital models

Project: in groups of several people, students receive a project at home, difficulties are discussed in class, indicated data sources and evaluated (discussed) results.

Bibliography

Basic

1. Kremens Z. , Sobierajski M. : Analiza systemów elektroenergetycznych. WNT, Warszawa, 1996.

2. Kacejko P., Machowski J.: Zwarcia w systemach elektroenergetycznych. WNT, Warszawa, 2002.

3. Machowski J.: Regulacja i stabilność systemu elektroenergetycznego. OWPW, Warszawa 2007.

4. Poradnik Inżyniera Elektryka . t.3. WNT, Warszawa 2005

Additional

1. Cegielski M.: Sieci i systemy elektroenergetyczne. PWN, Warszawa, 1979.

2. Machowski J., Białek J., Bumby J. Power System Dynamics: Stability and Control. IEEE Wiley, 2008

Breakdown of average student's workload

	Hours	ECTS
Total workload	155	6
Classes requiring direct contact with the teacher	55	2
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam, project preparation) [1]	100	4

[1] delete or add other activities as appropriate