COURSE DESCRIPTION CARD - SYLLABUS

Course name
Power System Operation [S2Eltech2-SiAE>PSE]

Course

Field of study
Electrical Engineering

Year/Semester
2/3

Area of study (specialization)
Power Networks and Electric Power Systems Protection

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
15

Other
0

Tutorials
15

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The student has basic knowledge of the theory of electrical circuits, electrical machines, power engineering and electricity generation. Student has the ability to effectively self-educate in the field related to the selected specialization, combine the knowledge acquired within the so far completed subjects. Is aware of the need to expand his knowledge and competences. The student is ready to cooperate and collaborate in a group.

Course objective

Getting acquainted with the operation of the power system in transient states, the problems of testing the stability of the power system under small disturbances and large disturbances in the active and reactive power balance, means of improving stability. During the laboratory classes - familiarization with the practical operation of programs in the field of transient analysis at small and large disturbances, as well as during system failures.

Course-related learning outcomes

Knowledge:

1. Has knowledge of development trends, new achievements and problems of modern engineering, in particular related to the power industry.
2. Has in-depth knowledge of the construction and operation of the power system and its devices, as well as economic and legal issues related to the generation, distribution and processing of electricity.
3. Has extended knowledge of creating optimization and decision algorithms used in the power industry.

Skills:
1. Can make a critical analysis of complex electrical systems with the use of appropriate engineering tools.
2. Can design elements and complex electrical devices and systems, taking into account the given non-technical criteria (utility and economic), if necessary, adapting the existing or developing new methods, techniques and computer tools to support the design of electrical power systems and devices.

Social competences:
1. Is aware of the need for continuous development of professional achievements and compliance with the rules of professional ethics, fulfilling social obligations, inspiring and organizing activities for the benefit of the social environment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:
1. Assessment in class (rewarding activity and quality of perception).
2. Assessment of knowledge and skills demonstrated during the written exam.
Exercises:
1. 1. Assessment in class (rewarding activity and quality of perception).
2. Assessment of knowledge and skills demonstrated during the written exam.
Lab:
1. Tests checking the knowledge necessary in the field of laboratory tasks,
2. Assessment of knowledge and skills related to the implementation of the exercise task,
3. Assessment of reports on the exercises performed.

Programme content

Non normal conditions in the transmission system, types of power system operating states, disturbances in the operation of power systems.

Course topics

Transient state research and analysis. Models of system elements for transient state analysis. Power system stability. Small swings of generator rotors - local angular stability. Angular power characteristic, application of Lyapunov's first principle. Influence of voltage regulation on local stability. Stability with momentary large disturbance of active power balance - global angular stability. Application of direct Lyapunov method. Voltage stability - voltage stability conditions. Measures to improve stability conditions.

Exercises carried out using computer programs such as DAKAR, PowerFactory, or ATP in the field of analysis of transient states, discussed during lectures, occurring in the power system during disturbance states.

Teaching methods

Lecture: theory presented in close connection with practice, multimedia lecture with animations.
Tutorials: solving computational problems in the presence of the teacher, preceded by computational examples referring to the subject of the lectures
Laboratory: computational experiments, team work.

Bibliography

Basic:
1. Machowski J. : Stany nieustalone i stabilność systemu elektroenergetycznego. WNT, Warszawa, 1989.
2. Machowski J.: Regulacja i stabilnośćsystemu elektroenergetycznego. OWPW, Warszawa 2007.

3. Machowski J., Białek J., Bumby J. Power System Dynamics: Stability and Control. IEEE Wiley, 2008.
4. Poradnik Inżyniera Elektryka . t.3. WNT, Warszawa 2005

Additional:
1. Kremens Z., Sobierajski M.: Analiza systemów elektroenergetycznych. WNT, Warszawa, 1996.
2. Jasicki Z.: Elektromechaniczne stany przejściowe w systemach energetycznych. T.1 i 2. PWN, Warszawa, 1987
3. Kacejko P., Machowski J.:Zwarcia w systemach elektroenergetycznych . WNT, Warszawa, 2013

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,00
Classes requiring direct contact with the teacher	47	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	43	1,50