COURSE DESCRIPTION CARD - SYLLABUS

Course name

Control and automation in electric power system

Course

Field of study	Year/Semester
Electrical power engineering	1/1
Area of study (specialization)	Profile of study
-	general academic
Level of study	Course offered in
Second-cycle studies	polish
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	30	0
Tutorials	Projects/seminars	
0	15	

Number of credit points

5

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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Prerequisites

The student has knowledge of the basics of electrical engineering, power engineering, electrical metrology anc computer science. Knows issues related to the transmission and distribution of electricity. The student has knowledge in the field of modern current and voltage measuring systems and the ability of switchgear in power networks. Knows the basic solutions of electrical power protection automation. Is able to carry out the analysis of electrical circuits and occurring in short-circuit interference networks.

Course objective

Understanding the threats to the proper operation of the power system. Understanding how to counteract these threats and the regulatory capacity of the system. Getting to know the automation solutions and functions improving the working conditions of the power system.

Course-related learning outcomes

Knowledge

He has knowledge in the field of power system control and the use of power system protection. He can use the available ICT technologies.

Skills

He can use numerical methods and IT tools to design and analyze the operation of power protection automation systems. He can cooperate with other people as part of team work on solving an engineering problem, as well as take managerial functions in these teams.

Social competences

Correctly identifies and resolves dilemmas related to broadly understood energy security. Can think and work creatively and enterprisingly. Understands the need for actions to make the society aware of the development of the power industry, but also to reduce the risks it carries.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

1. Rewarding activity during classes in the form of a discussion.

2. Assessment of knowledge and skills demonstrated in the written exam.

Laboratories:

1. Checking theoretical knowledge related to the performed exercises.

2. Rewarding activity during the exercise.

3. Assessment of the reports from the exercises carried out.

Projects:

1. Assessment of activity during project implementation

2. Evaluation of the completed project

Programme content

Lecture:

The structure of the power system, introduction, concepts and definitions. Basics of optimization of steady states of the power system. Voltage regulation in the power system and voltage stability (local, global). Power system frequency regulation and SCO automation. Selected issues of control and protection automation in distribution and transmission networks (ARN, SPZ, SZR systems, ground fault tracking compensation, connection synchronization systems in networks). Power system protection (PSP) for power units. Active power transmission control (phase shifters, power electronic couplings). Power swings in the power system and loss of synchronism and anti-swing automation. Recording of disturbances and events as well as examples of analysis of saved waveforms. Controlling the network operation during defense against a catastrophic failure and after it.

Laboratories:

Laboratory tests in the field of: short-circuit phenomena in power grids, PSP systems, the use of the DAKAR program in the implementation of control and automation systems in the power system.

Projects:

Designing selected automation and control systems in power systems.

Teaching methods

Lecture: Multimedia presentations. Problem discussions

Laboratories:

Classes at didactic positions with the use of measuring apparatus for physical models of elements of the power system. Part of laboratory classes at computer workstations with the use of various simulation environments. Group working.

Projects:

Regular group and individual consultations with the support of catalogs, project documentation and devices. Theory presented in close connection with practice.

Bibliography

Basic

Jan Machowski: Regulacja i stabilność systemu elektroenergetycznego. OW Politechnik Warszawskiej, Warszawa 2017

W.Winkler, A. Wiśniewskii:Automatyka zabezpieczeniowa w systemach elektroenergetycznych. WNT, Warszawa 1999

Józef Żydanowicz: Elektroenergetyczna automatyka zabezpieczeniowa. tomIII. WNT, Warszawa 1987

Additional

W. Korniluk, K. Woliński:Elektroenergetyczna automatyka zabepieczeniowa. OW Politechniki Białostockiej, wyd.III, Białystok 2012

J. Wróblewski: Zespoły elektroenergetycznej aytomatyki zabezpieczeniowej. WNT, Warszawa 1999

Praca zepołowa pod redakcją Andzreja Demenki i Józefa Lorenca: Blackout a krajowy system elektroenergetyczny. Ośrodek Wyd. Naukowych ICHB PAN, Poznań 2014, Poznań 2016, Poznań 2018

Witold Hoppel: Sieci śrenich napięć. PWN, Warszawa 2013

E. Rosołowski: Komputerowe metody analizy elektroenergetycznych stanów przejsciowych. OW Politechniki Wrocławskiej, Wrocław 2019

J. Andruszkiewicz, J. Lorenc, B. Staszak: Wspomaganie bezpieczeństwa pracy siecy dystrybucyjnych SN przez program doboru nastaw zabezpieczeń ziemnozwarciowych. W: Cyberbezpieczestwo i bezpieczeństwo fizyczne obiektów w energetyce - wybrane aspekty badawcze (red. Robert Maciejewski). Fundacja na Rzecz Czystej Energii, Poznań, 2018, str. 178-191.

J. Andruszkiewicz, J. Lorenc, B. Staszak: Kompensacja nadążna pojemnościowych prądów ziemnozwarciowych w sieciach SN. Wiadomości Elektrotechniczne, nr 12, 2016, s. 37-42.

J. Handke, B. Olejnik, A. Schott: Algorytmy samoczynnego częstotliwościowego odciążania w świetle obowiązujących rozporządzeń Komisji Europejskiej. Przegląd Elektrotechniczny, R. 95, nr 2, 2019, s. 7-10.

I. Grządzielski, B. Olejnik, M. Zakrzewski: Modeling of transient states in the start-up path during voltage and start-up power application. Archives of Electrical Engineering, vol. 68, no. 4, 2019, s. 749-769.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	75	3,0
Student's own work (literature studies, preparation for laboratory classes, preparation of reports, pprteparation of project, reparation for the exam) [1]	50	2,0

[1] delete or add other activities as appropriate