COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of electrical power protection automation [N1Eltech1>PO-PA-PEAZ]

Course

Field of study
Electrical Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture
20

Laboratory classes
20

Other (e.g. online)
0

Tutorials
0

Projects/seminars
10

Number of credit points

6,00

Coordinators

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Lecturers

Prerequisites

Knowledge of basic physical electromagnetic phenomena related to electrical engineering, basic knowledge of the application of metrology in the measurement of electrical quantities, knowledge of operating states and interference occurring in the power system as well as the construction and operation of electrical machinery and equipment. Skills for calculating simple electrical circuits, mathematical modeling of components and power system work systems for different voltage levels. Commitment to expanding professional competence and readiness to start teamwork.

Course objective

Acquisition of competences regarding: identification of power system operating conditions, principles of power protection automation, construction of measuring and executive circuits in protection systems, influence of measurement errors on the correctness of protection operations, knowledge of the sources and causes of measurement errors and incorrect operation of protection automation systems, skills of analysis and interpretation of measurement results and recording of electrical quantities in normal and disturbed states of the power system.

Course-related learning outcomes

Knowledge:
Knows how the tasks of electrical preventive, elimination and restitution automation are carried out.
Knows the principles of operation, application and selection of protection systems in the power system.
Has theoretically founded knowledge on the identification of operating disturbances in each of the areas of the power system, the functioning of primary and secondary circuits in power protection automation systems.

Skills:
Is able to prepare technical documentation in accordance with applicable regulations and requirements, is able to use tools for analyzing waveforms of electrical quantities and tools for computer-aided design of electrical diagrams.
Is able to design and connect measuring secondary circuits for the purposes of electrical power protection automation, select the parameters of transformers depending on the purpose of the measuring system.
Is able to obtain information necessary from electronic catalogs and standards to perform short-circuit calculations and setting of protection systems, knows how to choose devices to protect elements of the power system based on the available technical data.

Social competences:
Acts in accordance with professional ethics while performing work, is able to carry out tasks independently and in a team while respecting the rights of other entities, is ready to accept responsibility for the tasks carried out, cultivates the tradition of reliability and professional integrity.
Is able to creatively apply acquired knowledge while implementing technical solutions in the field of power engineering.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: assessment of activity in class, assessment for homework, written exam at the end of the semester, exam includes test questions or problem tasks, written exam covering the subject of the subject assessed on a scale of 0 to 100%, final assessment for lectures conducted by more than one lecturer based on weighted average, final grade for more than one component grade based on weighted average.
Laboratory: verification of individual preparation for classes, including material from a single exercise or block of exercises, assessment of individual exercise reports made by the student, colloquium at the end of the semester, colloquium includes test questions or problem tasks, all grades on a scale of 0 to 100%, final grade based on the weighted average of all component ratings.
Project: assessment of the systematic implementation of the project task, assessment of creativity and commitment to the implementation of the project, assessment of the correctness of project implementation, all assessments on a point scale from 0 to 100%, final assessment based on the weighted average of all component assessments.

Programme content

Lecture: The role and requirements for protection automation in the power system, classification of short-circuits and overloads, work systems of current and voltage transformers, measurement signal processing path, filtration of phase signals and symmetrical components. Protection for lines, transformers, capacitor banks, rotating machines. Protection against short circuits and overloads. Measurement and decision algorithms in power protection automation, criteria of protection operation. Rules for selecting power protection settings. Analysis of disturbance waveforms.
Laboratory: Testing the correct operation of protections, testing auxiliary relays, testing current and voltage relays. Determination of start-up and time characteristics of protection operation. Investigation of earth-fault, differential, overload, thermal and impedance protection. Testing the operation of safeguards on laboratory models of power equipment. Security testing using specialized microprocessor testing systems.
Project: Determination of short-circuit currents, selection of protections for selected elements of the power network, selection of protection settings, design of secondary circuits, verification of correctness of calculations, preparation of documentation.

Teaching methods

Lecture: multimedia and interactive presentation presenting important issues related to the subject, didactic discussion based on the literature on the subject, informative lecture, problem lecture, case analysis, work on source materials.
Laboratory: performing exercises, connecting and verifying the correctness of circuits, using publicly available information and software tools to support the didactic process, encouraging students to solve problems by themselves.
Project: discussion of issues related to the implementation of the project, problem discussion, encouraging students to solve problems by themselves.

Bibliography

Basic
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Kacejko P., Machowski J., Zwarcia w systemach elektroenergetycznych, WNT, 2017.
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Additional
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Breakdown of average student's workload

	Hours	ECTS
Total workload	155	6,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	110	4,00