COURSE DESCRIPTION CARD - SYLLABUS

Course name
Disturbances in Electric Power Systems [N2Eltech2>ZwUE]

Course

Field of study
Electrical Engineering

Year/Semester
1/2

Area of study (specialization)
Lighting Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
10

Laboratory classes
10

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Student has a basic knowledge of electrical engineering, power engineering and metrology. Student can assemble the measurement system, can carry out measurements of basic physical quantities and elaborate obtained results. Student is able to work in a group and understands the importance of teamwork.

Course objective

Knowledge of both theoretical and practical problems associated with interference in electric power networks. Understanding the causes and effects of transients in power systems. Knowledge of standards of conduct consistent with the protection and coordination of power systems under disruptions.

Course-related learning outcomes

Knowledge:
1. Student can name and describe basic types of disturbances occurring in the power system.
2. Student is able to characterize and evaluate the resistance against disturbance of typical devices

operating in the power grid.
3. Student can determine the rules of procedure for reducing the impact of disturbances on devices operating in the power grid.

Skills:
1. Student can identify the cause of the disturbances and evaluate the risks resulting from for the proper operation of the power grid.
2. Student can examine and analyze the signals generated by various types of interferences, and assess the level of resistance to interference of selected electrical equipment.
3. Student can choose elements of overvoltage protection for selected electrical devices.

Social competences:
1. Student is aware of the need to disseminate knowledge about the dangers of electric shock as a result of disruption or failure of the power system components.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:
- assess the knowledge and skills demonstrated during written or oral tests.
Laboratory:
- tests and rewarding knowledge necessary for the accomplishment of problems in the area of laboratory tasks,
- continuous evaluation, on each course - rewarding skills gain in the range of use of the principles and methods have met during the course,
- assessment of knowledge and skills related to the implementation of the exercise, the assessment of the report from performed exercise.

Programme content

Classification of disturbance sources - intentional and unintended, definitions used; basics of analysis of disturbing signals occurring in electricity networks; transitional states; electromagnetic disorders; short - circuit disturbances; internal and external overvoltages; resistance to interference; overvoltage protection; coordination of power systems in disturbance conditions. Disturbances associated with deformation of the waveforms of voltage and currents.

Course topics

Lectures:
During lectures, the following issues are discussed: classification of interference sources - intentional and unintentional, definitions used; basics of analysis of disturbing signals occurring in electricity networks; transitional states; electromagnetic disorders; short -circuit disturbances; internal and external overvoltages; resistance to interference; surge protection measures; coordination of power systems in disturbance conditions.
Disturbances in MV networks, earth fault, basic earth fault parameters of the MV networks, quality of earth fault compensation, earth fault overvoltage in MV networks, ferroresonance phenomenon in MV networks. Examples of disturbance (earth fault, intermittent, with high fault resistance, with a simultaneous break in the phase from the power supply side). Disturbances in low voltage networks taking into account local generation and energy storage.

Laboratory:
Laboratory classes relate to: measurements and evaluation of the levels of interference, sensitivity tests and the levels of resistance of electrical devices to electromagnetic interference, methods of limiting the impact of interference on the power network. Study of surge strength of power equipment.
Determining selected eartf fault parameters on the laboratory model of the SN network. Transformer non-phase work. Inductive couplings in the power infrastructure. Disturbances accompanying the work of capacitor batteries in distribution networks.

Teaching methods

Lecture: multimedia presentation, illustrated with examples on the board
Laboratory: laboratory exercises, work in groups

Bibliography

Basic:
1. Hoppel W., Sieci średnich napięć: automatyka zabezpieczeniowa i ochrona od porażeń, Wydawnictwo Naukowe PWN, 2017.
2. Lorenc J., Admitancyjne zabezpieczenia ziemnozwarciowe, Wydawnictwo Politechniki Poznańskiej, Poznań, 2007.
3. Machczyński W., Wprowadzenie do kompatybilności elektromagnetycznej, Wydawnictwo Politechniki Poznańskiej, Poznań, 2004.
4. PN-EN 61000-6-1/2/3/4 standards, Electromagnetic compatibility (EMC) - Immunity and emissivity requirements.
5. Flisowski Z., Technika wysokich napięć, WNT, Warszawa, 2005.

Additional:
1. Charoy A., Kompatybilność elektromagnetyczna. Zakłócenia w urządzeniach elektronicznych, t. I-IV,WNT, Warszawa, 1999.
2. Boolen M. H., Gu I., Signal Processing of Power Quality Disturbances, John Wiley & Sons, 2006

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	20	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00