COURSE DESCRIPTION CARD - SYLLABUS

Course name
Overvoltages and insulation coordination in transmission systems [N1Energ2>PiKIwUP]

Course

Field of study
Power Engineering

Year/Semester
4/8

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
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 the occurrence of overvoltages in power networks. Understanding the causes and consequences of the overvoltage generations and ways for their limitation in electrical power systems. Knowledge of standards of conduct consistent with the principles and lightning surge protection and insulation coordination in power systems in terms of overvoltage disturbances.

Course-related learning outcomes

Knowledge:
1. The student knows the basic types of overvoltage disturbances and the relationships between these phenomena and the configuration of the power grid.
2. The student knows issues related to resistance to overvoltage exposure of typical devices operating in

the power grid.
3. The student knows the rules of conduct and measures to limit the impact of overvoltages on devices operating in the power grid.

Skills:
1. The student can examine and analyze the signals generated by different types of surges and assess the level of resistance to this type of distortion for selected electrical equipment.
2. The student can choose components and lightning surge protection for selected electrical equipment.

Social competences:
1. The 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 (at least 50% of total points required to pass).
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

The program content concerns the generation and propagation of surge waves in high-voltage transmission systems, the impact of surges on power equipment and general methods of counteracting the effects of these phenomena, also through appropriate insulation coordination procedures.

Course topics

Lecture:
The following topics are discussed during the lectures: classification, statistics and imitation of surges; surge waves in lines: reflections of waves in nodes, multiple reflections, attenuation, waves in multi-wire systems; surge waves in the windings of transformers and machines; atmospheric surges; internal overvoltages: dynamic, resonant, earth-fault and switching; devices for protection against overvoltages: spark gaps, surge arresters, air terminals and lightning conductors; traditional and statistical concept of insulation coordination; rules for overvoltage protection of lines and stations.

Lab:
Laboratory classes concern: the generation and propagation of overvoltages in power grids, measurements and assessment of the levels of overvoltage disturbances in the power system, and methods of limiting the impact of overvoltages on the power grid.

Teaching methods

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

Bibliography

Basic:
1. Flisowski Z., Technika wysokich napięć, WNT, Warszawa, 2017.
2. Duda D., Gacek Z., Przepięcia w sieciach elektroenergetycznych i ochrona przed przepięciami, Wydawnictwo Politechniki Śląskiej, Gliwice 2015.
3. Hasse P., Wiesinger J., Ochrona aparatury elektrycznej przed wyładowaniami atmosferycznymi. Analiza ryzyka, projektowanie i wykonanie według najnowszych norm., Centralny Ośrodek Szkolenia i

Wydawnictw SEP, Warszawa 2004.
4. Markowska R., Sowa A.W., Ochrona odgromowa obiektów budowlanych, Dom Wydawniczy MEDIUM, Warszawa 2009.
5. Norma PN-EN 62305, Ochrona odgromowa, Arkusz 1-4, Polski Komitet Normalizacyjny, Warszawa 2011/12.

Additional:
1. Schött-Szymczak A., Walczak K., Impact of Cable Configuration on the Voltage Induced in Cable Screen during Work with One-Sidedly Ungrounded Cable Screen, Energies - 2021, vol. 14, no. 14, s. 4263-1-4263-14
2. Walczak K., Zawodniak J.J., Nawrocki M., Surge Breakdown Voltage Study of Contaminated Medium Voltage Composite Insulators, Automatyka, Elektryka, Zakłócenia - 2023, vol. 14, nr 4 (54), s. 114-124
3. Lightning Protection Guide, Dehn, Germany, 2012

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