COURSE DESCRIPTION CARD - SYLLABUS

Course name
High voltage engineering fundamentals [S1MwT1>PTWN]

Course

Field of study
Mathematics in Technology

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Student has extended and in-depth knowledge of physics. He/She has ordered knowledge of measurements, data acquisition and data analysis. He/She has basic knowledge of the principles of ergonomics, health and safety at work, and risks in industry. He/She is able to use mathematical tools and methods, including numerical ones, to solve engineering problems. He/She can formulate an engineering problem, conduct detailed research using analytical or simulation or experimental methods, interprets the results obtained and draw conclusions. He/She can choose the appropriate method and use measuring apparatus to measure the basic measurable quantities. He/she can use the basic methods of processing and analysis of signals or data. He/She is aware of the level of his/her knowledge in relation to the conducted research in exact and technical sciences. He/She is aware of deepening and extending the knowledge to solve newly created technical problems.

Course objective

Getting to know the basic issues related to the high voltage technique. Understanding the test sources of high voltages. Understanding the measurement techniques of typical high voltage parameters. Understanding the physical phenomena occurring in insulating systems under high voltage.

Course-related learning outcomes

Knowledge:
1. Student has structured and theoretically founded knowledge in the field of technical sciences, including electrical engineering and high voltage techniques.
2. He/She has basic knowledge in the field of material properties and applications of insulation materials.

Skills:
1. Student has basic knowledge about the methods of high voltage generation and measurement and measurements of basic quantities characterizing high voltage systems.
2. He/She is able to choose the appropriate method and use measuring apparatus to do measures under high voltage.
3. He/She knows the dangers of working under high voltage and applies principles of health and safety at work.

Social competences:
1.Student is able to think and act in a creative way, taking into account the safety, ergonomics and responsibility for the work effects of the team and its participants.
2. He/She is aware of its social role as a graduate of a technical university. He/She is ready to communicate popular-scientific content to the society and to identify and resolve basic problems related to the field of study.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: Knowledge acquired during the lecture is verified by a 90-minute colloquium, carried out at the last lecture. Each test consists of 3-5 questions (open), evenly scored. Passing threshold: 50% points + 1. A list of a minimum of 10 questions that may appear at the colloquium, will be presented to students during the lecture, at least a week before the colloquium.
Laboratory exercises:
Skills acquired as part of the laboratory classes are verified based on the assessment of knowledge and skills acquired during the implementation of the exercise tasks and on the basis of grades for reports of laboratory exercises. In addition, at the beginning of each laboratory class, students can be checked (orally or in writing) for preparation for these classes. In cases of excused students" absence from classes and the inability to do these exercises in classes of another group, the classes may be passed on the basis of an oral or written knowledge test.

Programme content

Update: 31.01.2020.
The lecture presents knowledge about the sources of DC (rectifiers), AC (high voltage test transformer) and surge (Marx generator) voltage sources, methods of measuring electrical quantities characteristic of high voltage techniques, such as electrical strength (flat spark gap, sphere-sphere spark gap, cylindrical spark gap, edge spark gap), volume resistance and surface capacitance, partial discharges, dielectric loss factor tg (delta) (Schering bridge). In addition, the lecture provides knowledge on the subject of statistical analysis of measurement results and electric and magnetic field (proffesional and environmental exposure).
As part of the laboratory, the following topics are carried out: measurements of the electrical strength of flat and edge spark gaps, analysis of the corona phenomenon, the relationship between the electric strength and air pressure, the effect of spatial charge on air strength, distribution of potential on the chain insulators, high voltages measurement techniques, testing of transformer oil.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples on the board.
2. Laboratory exercises: presentations illustrated with examples given on the board and performing tasks given by the teacher - practical exercises.

Bibliography

Basic

1. Flisowski Z., Technika wysokich napięć, Wydawnictwo WNT, Warszawa, 2017.
2. Ćwiczenia laboratoryjne z materiałoznawstwa elektrotechnicznego i techniki wysokich napięć, pod redakcją H. Mościckiej-Grzesiak, skrypt, Wydawnictwo Politechniki Poznańskiej, Poznań, 2002.
3. Florkowska B., Wytrzymałość elektryczna gazowych układów izolacyjnych wysokiego napięcia, Uczelniane Wydawnictwo Naukowo-Dydaktyczne AGH, Kraków, 2003.
Additional
1. Gacek Z., Wysokonapięciowa technika izolacyjna, Wydawnictwo Politechniki Śląskiej, Gliwice, 2006.
2. Gacek Z., Kształtowanie wysokonapięciowych układów izolacyjnych stosowanych w elektroenergetyce, Wydawnictwo Politechniki Śląskiej, Gliwice, 2002.
3. Florkowska B. i inni, Mechanizmy, pomiary i analiza wyładowań niezupełnych w diagnostyce układów izolacyjnych wysokiego napięcia, Uczelniane Wydawnictwo Naukowo-Dydaktyczne AGH, Kraków, 2001.
4. PN-EN 60270:2003 Wysokonapięciowa technika probiercza - Pomiary wyładowań niezupełnych
5. Sikorski W., Morańda H., Lokalizacja źródeł wyładowań niezupełnych w transformatorach energetycznych metodą emisji akustycznej i konwencjonalną metodą elektryczną, Pomiary Automatyka Kontrola, 2017, T. 57, ss. 356-359
6. Nadolny Z., Grzybowski A., Kasprzak W., Ludwikowski K., Lopatkiewicz R., Moranda H., Przybylek P., Sikorski W., Siodla K., Analysis of electric and magnetic field intensity generated by overhead power distribution lines of high voltage in Poznan, Przegląd Elektrotechniczny, T. 86, Wyd. 11b, 2010/11, ss. 254-257

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
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)	55	2,00