High-voltage engineering - course description

General information

Course name	High-voltage engineering
Course ID	06.2-WE-ELEKTP-HVE-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Electrical Engineering
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2019/2020

Course information

Semester	4
ECTS credits to win	4
Course type	obligatory
Teaching language	english
Author of syllabus	• dr hab. inż. Adam Kempski, prof. UZ

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	30	2	-	-	Credit with grade
Laboratory	30	2	-	-	Credit with grade

Aim of the course

To familiarize students with the basic physical processes occurring during the operation of high-voltage systems; developing students understand the specificity of high-voltage systems as regards their measurements and design

Prerequisites

Circuit theory, Electromagnetic field theory , Fundamentals of electrical power engineering.

Scope

Introduction. Subject and range of discipline. Electric field distributions. Electric field non-uniformity coefficient. Ionization and deionization processes.
Electric breakdown strength of materials and composite insulation. Electrical breakdown in gases. Townsend's mechanism. Paschen's law. Streamer mechanism of spark breakdown. Breakdown under impulse voltage. Insulating properties of high-pressure gas. Processes of electrical breakdown in liquids. Effect of oil contamination on the electrical strength. Breakdown processes in solid dielectrics. Partial discharges. Dielectric aging. Breakdown in composite insulation. Forms of surface discharge. Overvoltages. Types of overvoltages. External and internal overvoltages. Wave phenomena in electrical power transmission power lines. Travelling waves in real conditions. Lightning protection and transit overvoltage protection. Lightning overvoltages. Lightning protection. Overvoltage protection. Coordination of overvoltage protection. Electrical insulation systems. Principles of insulation coordination. Outdoor and indoor high voltage insulators. Electrical insulation of rotating machines, transformers and cables. High voltage testing techniques. High voltage measurements. High voltage measurements safety.

Teaching methods

Lecture, laboratory exercises

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Knows and is able to apply the principles of design and lightning surge protection		• an evaluation test	• Lecture
Knows and understands the processes of occurrence and spread of overvoltages in electrical power systems		• an evaluation test	• Lecture
Knows and understands nature of phenomena in high voltage systems		• an evaluation test	• Lecture
Knows and can apply principles of design and operation of systems for high voltage transmission and distribution of electric energy		• a discussion • an evaluation test	• Lecture
Can carry out basic high voltage measurements accompanied by related safety measures		• an ongoing monitoring during classes	• Laboratory

Assignment conditions

Lecture – a condition of passing is to obtain positive grades from written or oral tests conducted at least once in a semester.
Laboratory – the passing condition is to obtain positive marks from all laboratory exercises to be planned during the semester

Calculation of the final grade: lecture 60% + laboratory 40%

Recommended reading

1. Flisowski Z.: High voltage technique, WNT W-wa, 2005 (in Polish)
2. Naidu M.S., Karamaju V. High voltage engineering, McGraw-Hill, 1995
3. Kufel J., Kufel E., Zaengl W.S.: High voltage engineering Fundamentals, Elsevier 2000

Further reading

1. Gacek Z.: High voltage insulation technique, Wydawnictwo Politechniki Śląskiej, 1996 (In Polish)

Notes

Modified by dr hab. inż. Radosław Kłosiński, prof. UZ (last modification: 01-11-2019 00:33)