COURSE DESCRIPTION CARD - SYLLABUS

Course name
High voltage engineering

Course

Field of study
Electrical Engineering
Year/Semester
2/4
Area of study (specialization)
-
Profile of study
practical
Level of study
First-cycle studies
Course offered in
Polish
Form of study
full-time
Requirements
compulsory

Number of hours

Lecture
15
Laboratory classes
30
Other (e.g. online)
0
Tutorials
0
Projects/seminars
0

Number of credit points

3

Lecturers

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Prerequisites

Student has knowledge in frame of electric engineering material science, and knows fundamental principles of theory of electrical circuits. He/she can build simple electrical system. He/she can work and cooperate in group.

Course objective

To know simple tasks connected to high voltage engineering. To know sources of test Voltage. To know methods of measurements of typical properties for high voltage engineering. To know fundamental definitions regarding to overvoltage protection.

Course-related learning outcomes

Knowledge

1. Student has structured and theoretically founded knowledge about the construction, principles of operation and operation of transformers, electrical machines and technical systems, knows the processes occurring in their life cycle.
2. He/She has basic knowledge necessary to understand social, ethical, economic, legal and other non-technical conditions of engineering activities, knows the basic principles of ergonomics, health and safety and hazards occurring in the industry related to the awarded qualification.
3. He/She knows and understands the physical phenomena occurring in high-voltage insulation systems, systems for generating high voltage and surge protection, has basic knowledge about the life cycle of this type of systems.

Skills

1.Student is able to plan and carry out simulations and measurements of basic quantities characteristic for electrical systems; can present the results in numerical and graphical form, make their interpretations and draw the right conclusions.
2. He/She is able to design and perform, in accordance with the specification and using the right methods, techniques, tools and materials, typical electrical systems designed for different applications.
3. He/She is able to use his knowledge in the selection of measuring apparatus for the measurement and acquisition of basic measurable quantities characteristic of electrical engineering, in typical and atypical conditions (not fully predictable).

Social competences

1. Student is aware of the necessity to initiate activities for the public interest, understands various aspects and effects of the electrical engineer's activity, including the impact on the environment, and the related responsibility for decisions.
2. He/She correctly identifies and resolves dilemmas related to the profession.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:

- assessment of knowledge and skills proved on tests,

Laboratories:

- tests and preemie of knowledge which is necessary to realize fundamental tasks in some fields of laboratory,
- continuous assessment on each laboratory ? preemie of knowledge increase,
- assessment of knowledge and skills connected to realization of laboratory tasks, assessment of report.

Programme content

Sources of DC test voltage, AC (high voltage transformer) and pulse (Marx generator). Method of measurements of electrical properties, describing high voltage engineering, such as electrical strength (plate spark gap, spherical spark gap, cylindrical spark gap, sharp spark gar), resistance (Schering bridge), surfacial resistance, capacity (Schering bridge), partial discharge, dielectric losses factor (Schering bridge). Overvoltage protection (overvoltage factor, source of overvoltage, spares, attenuation of

overvoltage waveform, overvoltage installations, touch voltage). Electrical and magnetic fields: professional and environmental exposure.

In frame of laboratory, following subjects are realized: measurements of electrical strength of plate spark gap, spherical spark gap, cylindrical spark gap, sharp spark gap; relationship between electrical strength of air and pressure; influence of space charge on electrical strength of air; surfacial breakdown; distribution on voltage on insulator; methods of measurements of high voltage; development of conductive bridge in oil; analysis of transformer oil.

Teaching methods

LECTURE - lecture with multimedia presentation (including drawings, photos, animations) supported with the content given on the board, taking into account various aspects of the issues presented, including: economic, ecological, legal and social, presenting a new topic preceded by a reminder of related content known to students from other items.

LABORATORY - detailed review of reports by the laboratory leader and discussions on comments, demonstrations, teamwork.

Bibliography

Basic

1. Flisowski Z., Technika wysokich napięć, Wydawnictwo WNT, Warszawa, 2015.
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. Florkowska B. i inni, Mechanizmy, pomiary i analiza wyładowań niezupełnych w diagnostyce układów izolacyjnych wysokiego napięcia, Uczelniane Wydawnictwo Naukowo-Dydaktyczne AGH, Kraków, 2001.
2. PN-EN 60270:2003 Wysokonapięciowa technika probiercza - Pomiary wyładowań niezupełnych
3. 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
4. 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	80	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation of reports on laboratory classes, preparation for exam) [1]	35	1,0

[1] delete or add other activities as appropriate