COURSE DESCRIPTION CARD - SYLLABUS

Course name
High voltage insulation systems

Course

Field of study
Electrical Engineering
Year/Semester
3/6
Area of study (specialization)
Insulation systems, devices and electric power installations
Profile of study
general academic
Level of study
First-cycle studies
Course offered in
Polish
Form of study
full-time
Requirements
elective

Number of hours

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

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
dr hab. inż. Piotr Przybyłek, prof. PP
email: piotr.przybylek@put.poznan.pl
tel. 61-665-2018
Faculty of Environmental Engineering and Energy
Piotrowo 3a Str., 60-965 Poznań

Responsible for the course/lecturer:
mgr inż. Cyprian Szymczak
email: cyprian.szymczak@put.poznan.pl
tel. 61-665-2272
Faculty of Environmental Engineering and Energy
Piotrowo 3a Str., 60-965 Poznań

Prerequisites

Student starting this course:
1. Has knowledge in frame of electrical engineering material science and knows fundamental principles related to electrical circuits theory, and has fundamental knowledge in the area of high voltage engineering.
2. Can build simple electrical system and make measurements of physical properties related to insulation systems. He/she can make measurements of high voltage using various methods.
3. Can work and cooperate in group. He/she knows influence of high voltage insulation systems on natural environment.

Course objective

The aim of the course is getting knowledge about fundamental problems related to high voltage insulation systems used in electric power devices such as insulators, transformers, capacitors, cables and GIS substations, and discussion of issues related to the electrical strength of materials and insulation systems.

Course-related learning outcomes

Knowledge

1. Has knowledge of the impact of individual material properties on the reliability of high-voltage insulation systems.
2. Knows and understands physical phenomena occurring in high voltage insulation systems and has basic knowledge about the electrical strength of materials and insulation systems.

Skills

1. Is able to design and test basic high voltage insulation systems.

Social competences

1. He/she understands role of their own work, work in team, and responsibility of team tasks carried out in the frame of high voltage engineering.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:

1) Assessment of knowledge and skills proved on written exam

Laboratories:

1) Assessment of knowledge and skills related to performed laboratory classes - assessment of laboratory report
2) Continuous checking of the preparation for the laboratory classes

Project:

1) Assessment of the project task

Programme content

In the frame of lectures the following topics are presented:
high voltage laboratory systems, high voltage insulation systems used in electric power devices such as insulators, transformers, capacitors, cables and GIS substations, selected issues related to the electrical strength of insulation materials and systems, properties of selected electrical insulation materials.

In the frame of laboratory classes the problems related to high voltage insulation systems, used in electric power systems, such as insulators, transformers, cables, capacitors, GIS substations. Laboratories are related to following problems: the influence of contaminants on electric strength of insulators; voltage breakdown of spare gap; the influence of barriers on electric strength; test of high

voltage cable; estimation of work voltage of insulators on the basis of voltage breakdown; capacitors test; analysis of electric field distribution on model of cable.

In frame of project, students design chosen high voltage insulation system (insulator, transformer, capacitor, cable).

Teaching methods

The theory presented during lectures is closely related to practice. During the lecture a discussion is initiated. Lectures with multimedia presentation (including: figures, photos, videos) complemented by the information on the board.

Laboratory classes are done in teams. Laboratory reports are reviewed by the instructor and discussed in the presence of the author.

Project classes are supplemented by multimedia presentations, a detailed review of the project documentation is carried out by the project leader. The use of tools enabling students to perform tasks at home (e.g. open source software) is foreseen.

Bibliography

Basic

1. Flisowski Z., Technika wysokich napięć, Wydawnictwo Naukowo-Techniczne, Warszawa 2017
2. Furgał J., Układy izolacyjne urządzeń stacji wysokiego napięcia, Wydawnictwo AGH, Kraków 1995
3. Gacek Z., Wysokonapięciowa technika izolacyjna, Wydawnictwo Politechniki Śląskiej, Gliwice 2006
4. Mościcka-Grzesiak H., Ćwiczenia laboratoryjne z materiałoznawstwa elektrotechnicznego i techniki wysokich napięć, Wydawnictwo Politechniki Poznańskiej, Poznań 2002
5. Gielniak J., Ćwiczenia laboratoryjne z inżynierii materiałowej w elektrotechnice, Wydawnictwo Politechniki Poznańskiej, Poznań 2009

Additional

1. Mościcka-Grzesiak H., Inżynieria wysokich napięć w elektroenergetyce, Wydawnictwo Politechniki Poznańskiej, tom I – 1996
2. Mościcka-Grzesiak H., Inżynieria wysokich napięć w elektroenergetyce, Wydawnictwo Politechniki Poznańskiej, tom II – 1999
3. Celiński Z., Materiałoznawstwo elektrotechniczne, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005
4. Lisowski M., Pomiary rezystywności i przenikalności elektrycznej dielektryków stałych, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004
5. Przybyłek P., Water saturation limit of insulating liquids and hygroscopicity of cellulose in aspect of moisture determination in oil-paper insulation, IEEE Transactions on Dielectrics and Electrical Insulation, Vol. 23, Issue 3, 2016, 1886-1893, DOI: 10.1109/TDEI.2016.005627

Breakdown of average student's workload

	Hours	ECTS
Total workload	115	4,0
Classes requiring direct contact with the teacher	70	3,0
Student's own work (literature studies, preparation for laboratory classes, preparation for exam, preparation of laboratory classes reports and project) [1]	45	1,0

[1] delete or add other activities as appropriate