COURSE DESCRIPTION CARD - SYLLABUS

Course name
Devices diagnostics [S2ZE1E>DU]

Course

Field of study
Green Energy

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

dr hab. inż. Jarosław Gielniak prof. PP
jaroslaw.gielniak@put.poznan.pl

Lecturers

Prerequisites

Extended knowledge in the field of measurement and assessment of measurement uncertainty, mathematics (discrete and applied mathematics, probability, differential calculus, numerical optimization methods). Knowledge of the analysis of electrical circuits. Skills to evaluate the usefulness and selection of computational methods or software to solve a given problem.

Course objective

Getting to know the types and scope of tests of electric power devices. Acquiring the ability to select appropriate diagnostic methods, both for new and operated devices. Getting to know the theoretical and practical basics of testing and monitoring the condition of electrical power devices. Mastering the skills to diagnose and formulate recommendations for the further use of devices.

Course-related learning outcomes

Knowledge:
1. Student knows the maintenance strategies of power devices
2. The student has an advanced knowledge of testing and monitoring power transformers, insulators, cables, capacitors, stations and gas insulated power transmission lines

Skills:
1. The student is able to choose the appropriate diagnostic methods of electrical power devices, taking into account the maintenance strategies, their importance in the system and technical condition
2. The student is able to perform measurements of quantities characterizing the technical condition of electric power devices
3. The student is able to diagnose the technical condition of the device, give recommendations for further use and prepare a professional test report

Social competences:
1. The student understands the contemporary problems of power supply safety and the importance of properly conducted diagnostics in terms of the reliability of the power system operation

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:
1. Assessment of the knowledge and skills by means of written exam. Assessment of the exam on the basis of a point system, 50% of the maximum number of points required.
Laboratory classes:
1. Assessment of knowledge and skills related to performed laboratory classes - assessment of laboratory report.
2. Checking of the preparation for the laboratory classes during introductory conversation for classes.
3. Short tests to check the preparation for laboratory classes.

Programme content

The issues covered include a discussion of the needs for diagnostic tests, operational strategies, types of diagnostic tests, techniques for conducting diagnostic tests, making a diagnosis, formulating operational recommendations and forecasts for further prospects for the operation of power equipment. Issues related to diagnostics will be discussed in the context of testing devices such as high voltage switchgears, cables, power transformers, bushings, motors, capacitors, current and voltage transformers, reaktors.

Course topics

Lectures:
- Maintenance strategies of electric power devices and types of diagnostic tests
- Methods of diagnostics of insulation systems: methods of dielectric spectroscopy (RVM, FDS, PDC), methods of partial discharges measurement (electric, acoustic, radio UHF)
- Methods for assessing the condition of device mechanics (vibroacoustics, SFRA winding deformation assessment method)
- Physicochemical methods for assessing the state of insulation (DGA method, infrared spectroscopy method, polymerization degree testing, acid number testing, standard liquid testing)
Laboratory classes:
- Detection of deformation of transformer windings using the frequency response method
- Measurement of water content in cellulose insulation using the FDS method
- Location of partial discharge sources using the trilateration technique
- Vibroacoustic tests of the transformer core
- Dissolved gas analysis
- Methods of measuring the moisture content of insulating liquids - KFT method, capacitive sensor
- Measurement of partial discharges using the HF / VHF / UHF methods
- Measurement of the apparent charge of partial discharges by the conventional electric method
- Rules for the preparation of professional research reports
- Measurement of the degree of polymerization of cellulose paper by microscopy

Teaching methods

Lectures:
lecture with multimedia presentation (including: drawings, photos) supplemented with examples given on the blackboard. Theory presented in close connection with practices
Laboratory classes:

laboratory exercises carried out in teams of several people, compiling measuring systems in practice, dividing tasks between cooperating persons, performing measurements and analyzing the results in terms of assessing the condition of the tested devices

Bibliography

Basic:
1. Florkowska B., Diagnostyka wysokonapięciowych układów izolacyjnych urządzeń elektroenergetycznych, Wydawnictwa AGH, Kraków 2016
2. Kaźmierski M., Olech W., Diagnostyka techniczna i monitoring transformatorów, Zakład Pomiarowo-Badawczy Energetyki ENERGOPOMIAR-ELEKTRYKA, Gliwice, 2013
3. Flisowski Z., Technika wysokich napięć, WNT, Warszawa, 2017
4. Gacek Z., Wysokonapięciowa technika izolacyjna we współczesnej elektroenergetyce, Wydawnictwo Politechniki Śląskiej, Gliwice 2016

Additional:
1. Gielniak J., Zawilgocenie izolacji papierowo-olejowej transformatorów wysokiego napięcia, Wydawnictwo Politechniki Poznańskiej, Poznań 2012
2. Florkowska B., Wytrzymałość elektryczna gazowych układów izolacyjnych wysokiego napięcia, Wydawnictwo AGH, Kraków, 2003
3. Gielniak J., Przybyłek P., Mościcka-Grzesiak H.,Wytrzymałość elektryczna nanomodyfikowanych dielektryków ciekłych, Przegląd Elektrotechniczny, ISSN 0033-2097, R. 91 NR 2/2015
4. Gielniak J., Dombek G., Wróblewski R., Fire Safety and Electrical Properties of Mineral Oil/Synthetic Ester Mixtures, 8th International Symposium on Electrical Insulating Materials, September 12-15, 2017, Toyohashi Chamber of Commerce &Industry, Toyohashi City, Japan, Conference Proceedings of ISEIM 2017, V1-10, p. 227-230

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,00
Classes requiring direct contact with the teacher	45	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	1,50