STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Diagnostics of power equipment		**1010315431010315646**
Field of study: **Power Engineering**	Profile of study (general academic, practical): **(brak)**	Year /Semester: **2 / 3**
Elective path/specialty: **-**	Subject offered in: **Polish**	Course (compulsory, elective): **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time): **part-time**	
No. of hours: Lecture: **8** Classes: **-** Laboratory: **8** Project/seminars: **-**		No. of credits: **2**
Status of the course in the study program (Basic, major, other): **(brak)**	(university-wide, from another field): **(brak)**	
Education areas and fields of science and art		ECTS distribution (number and %)

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student has basic knowledge in power engineering
2	**Skills**	Student is able to construct a simple power device
3	**Social competencies**	Understands the importance of teamwork

Assumptions and objectives of the course:

Knowledge of diagnostic methods related to energy devices such as transformers, insulators, cables, capacitors, GIS stations.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student has extensive knowledge in the field of energy equipment diagnostics, based on electrical measurement and modern measurement systems - [K_W05++]
2. Student has extensive knowledge of liquid and gaseous issues in power equipment - [K_W11+]

Skills:

1. The student is able to use known diagnostic methods - if necessary to modify them accordingly - to analyze the state of energy devices - [K_U06++]
2. Student can assess the usefulness of diagnostic methods in relation to energy devices - [K_U09+]
3. The student is prepared to work in an industrial environment and knows the rules of work safety - [K_U12+]

Social competencies:

1. The student is able to think and act in a creative and entrepreneurial way, understands the need to formulate and communicate to the public information and opinions concerning the technical state of the energy equipment - [K_K01+]

Assessment methods of study outcomes

Lectures:

- assessment of knowledge and skills in written and oral exams

Laboratory:

- tests, continuous evaluation for each course
- evaluation of the knowledge and skills associated with the implementation of the practice tasks, the assessment of exercise report.

Course description

1. Transformer diagnostic methods: dielectric spectroscopy method (RVM, DFR, PDC), method of measurement of partial discharges (electric, acoustic, UHF), winding deformation evaluation method, Karl-Fisher method;
2. Cable diagnostic methods: reflected wave method, cable insulation measurement method;
3. Diagnostic methods of capacitors: thermovision, method of measurement of electrical capacitance
4. Diagnostic methods of insulators: thermovision method, measurement of partial discharges;
5. GIS diagnostic methods: measurement of partial discharges (radio method - UHF)

Update 2017:

Vibroacoustic method for evaluating the mechanical state of the windings

Applied methods of education:

lectures - lecture with multimedia presentation (including: drawings, pictures) supplemented with examples given on the board. Theory presented in close connection with practice

laboratories - team work, detailed review of lab reports and discussion of comments

Basic bibliography:

1. Flisowski Z., Technika wysokich napięć, WNT, Warszawa, 1988.
2. Kosztaluk R. i inni, Technika badań wysokonapięciowych, tom I i II, WNT, Warszawa, 1985.
3. Florkowska B., Wytrzymałość elektryczna gazowych układów izolacyjnych wysokiego napięcia, Uczelniane Wydawnictwo Naukowo ? Dydaktyczne AGH, Kraków, 2003.
4. Florkowska B., Diagnostyka wysokonapięciowych układów izolacyjnych urządzeń elektroenergetycznych, Wydawnictwa AGH, Kraków 2009

Additional bibliography:

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, Uczelniane Wydawnictwo Naukowo - Dydaktyczne 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

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	15
2. Participate in laboratory classes	15
3. Participate in the exam	1
4. Preparing for the exam	5
5. The consultation	3
6. Preparing for the lab	5
7. Preparation of reports	3

Student’s workload

Source of workload	hours	ECTS
Total workload	47	2
Contact hours	34	1
Practical activities	18	1