COURSE DESCRIPTION CARD - SYLLABUS

Course name
Measurement systems in power engineering [N1Energ2>SPwE]

Course

Field of study
Power Engineering

Year/Semester
5/9

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture
20

Laboratory classes
10

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of mathematics, physics, electrical engineering. Ability to perform measurements of basic electrical quantities. Ability to properly interpret the results of measurements and calculations. Awarness of the need to expand their competences and is ready to cooperate as part of a team.

Course objective

Knowledge of the modern techniques of acquisition, processing and evaluation of measurement data in the power grids. Understanding the basic issues of assessment of power quality.

Course-related learning outcomes

Knowledge:
1. Knowledge and understanding of the principles of correct operation of energy machinery and equipment
2. Knowledge in the field of power equipment diagnostics, Knowledge and understanding of the measurement methods of basic quantities characterizing electrical devices and systems; knowledge of the calculation methods and IT tools necessary to analyze the results of experiments.
3. Knowledge of the basic principles of organizing and conducting research in the field of power energy

problems and presenting the results of his work.

Skills:
1. Ability to plan and carry out experiments, including measurements, as well as construct an algorithm and use properly selected programming environments.
2. Ability to use properly selected methods and devices enabling measurement of basic quantities characterizing energy elements and systems.
3. Ability to present the results obtained in numerical and graphic form, make inferences and interpretations.

Social competences:
Awareness of the importance of professional behavior, compliance with professional ethics and the requirement of it from others.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures
Evaluation of the knowledge with a written exam related to the content of lectures (test, computational and problem questions). Passing threshold of test equals 50%.
The grade from laboratory and project classes as well as attendance and activities during the lectures are taken into account.
Laboratory
Assessment of knowledge and skills necessary to carry out the laboratory exercise. Assessmeny of the activity and quality of perception during the laboratory exercise. Evaluation of the reports of the exercises performed. Final test in written (passing threshold 50%).

Programme content

Planning and implementation of measurement tasks, considering elements of error theory, uncertainty of results, and the characteristics of measurement transducers, including their static and dynamic properties and linearity. Measurement of electrical signals using analog and digital oscilloscopes, measurements of non-electrical quantities, organization of measurement systems, as well as diagnostics of electrical and power systems using thermography and assessment of electrical energy quality.

Course topics

Lectures
Planning and implementation of the measurement task. Elements of error theory and uncertainty of measurement results. Measuring transducer: processing characteristics, static and dynamic properties, linearity, power supply. Compatibility of the measuring transducer with the meter - signal transmission, mutual interaction. Measurement of electrical signals using an analog and digital oscilloscope. Analog and digital measurements of electrical quantities. Measurements of non-electrical quantities. Introduction to the structure and organization of measuring systems. Preparation of documentation from the obtained measurement results. Thermovision - basics, diagnostics of electrical and power systems. Assessment of power quality in power grids.
Laboratory
Basic quantities describing the state of power grids. Voltage, current and power measurement. Metrological and operational properties and testing of modern measurement equipment. Thermovision temperature measurements. Flickermeter - basics, construction and application. Examples of electricity quality analyzers. Assessment of electricity quality based on measurement results recorded in power networks. Measurement unaccuracy of quantities describing the state of power grids.

Teaching methods

Lectures
Lectures are performed using multimedia presentations illustrated with simulation examples and necessary mathematical calculations on the blackboard. Theoretical questions are presented in the exact reference to the practice.
Laboratory
Laboratory exercises are carried out in laboratory teams. During the classes, the measuring system is

connected, the selected measurements are carried out, the results of the measurements and the reports are prepared.

Bibliography

Basic:
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3. T. Sikorski, Monitoring i ocena jakości energii w sieciach elektroenergetycznych z udziałem generacji rozproszonej, Wyd. PWr, Wrocław, 2013.
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16. Normy dotyczące kompatybilności elektromagnetycznej: PN-EN 50160, PN-EN 61000-4-30, PN-EN 61000-4-15, PN-EN 61000-4-7.
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Additional:
18. A. Chwaleba, M. Poniński, A. Siedlecki, Metrologia elektryczna, WNT, Warszawa, 2014.
19. S. Tumański, Technika pomiarowa, WNT, Warszawa, 2013.
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Breakdown of average student's workload

	Hours	ECTS
Total workload	85	3,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	55	2,00