



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Metrology and measuring systems

### Course

Field of study

Power Engineering

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

2/3

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

30

Other (e.g. online)

0

Tutorials

0

Projects/seminars

15

### Number of credit points

5

### Lecturers

Responsible for the course/lecturer:

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Faculty of Control, Robotics and Electrical

Engineering

Piotrowo 3A street, 90-965 Poznań

Responsible for the course/lecturer:

### 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. Awareness of the need to expand their competences and is ready to cooperate as part of a team.

### Course objective

Knowledge of the measurement techniques, properties of modern measuring equipments, the principles of using analog and digital instruments and the fundamentals of measurement results evaluation.

### Course-related learning outcomes

Knowledge

1. Understanding the basic physical phenomena occurring in electrical, power energy and electronic components and systems and in their surroundings.



2. Knowledge in the field of theory of electrical and electronic circuits and in the field of signal theory and methods of their processing.
3. Knowledge and understanding the methods of measuring basic quantities characterizing devices and electrical systems of different kinds.

#### Skills

1. Ability to use properly selected methods and devices enabling measurement of basic quantities characterizing power elements and systems.
2. Ability to design simple power systems for various applications.
3. Ability to run and test a designed simple electrical system

#### Social competences

1. Understanding the need and knowledge the possibilities of continuous training, raising professional competences, and is ready to critically assess knowledge, recognizes its importance in solving cognitive and practical problems.
2. Awareness of the responsibility for own work and readiness to comply with the principles of team work and to bear the responsibility of the professional role in jointly implemented tasks.

#### 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. Assessment 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%).

##### Project

Assessment of acquired skills on the basis of the prepared project of a simple electronic measurement system and on the basis of the prepared implementation of the digital measuring signal chain of the selected quantity determining the power quality.

#### Programme content

##### Lectures



Measurement methodology: definition and basic terms. Planning and realization of a measurement task. Elements of errors theory and uncertainty of measurement results. Measuring transducer: processing characteristics, static and dynamic properties, linearity, supply. Cooperation between measuring transducers and devices - signal transmission, interaction. Measurements with oscilloscopes. Methods of measurements. Measuring bridges. Analog and digital measurements of electrical quantities. Selected examples of measurements of nonelectrical quantities. Introduction to structure and organization of measurement systems. Knowledge of safety principles during measurements. Planning and realization of measurements of the basic electrical quantities with widely available analog and digital equipment. Measurements of electrical signals with analog oscilloscopes. Preparation of the documentation based on the obtained results of measurements.

#### Laboratory

Measurement methodology: definitions, concepts, standards, units of measurement. Planning and implementation of the measurement task. Elements of error theory and uncertainty of measurement results. Measurement methods. Measuring transducers: AC voltage detectors, measuring amplifiers, A/D converters. Analog and digital measurements of electrical quantities. Oscilloscopic measurements. Examples of measurement of electrical quantities and the assesment of their results unaccuracy.

#### Project

Preparation of the project of simple measurement systems with the use of selected electronic components. Introduction to the normative requirements by the implementation of a digital measurement signal chain of the selected quantity determining the power quality.

### Teaching methods

#### Lecture

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.

#### Project

Independent implementation of design tasks in selected programming environments with the support of the teacher.

### Bibliography



Basic

1. A. Chwaleba, M Poniński, A. Siedlecki, Metrologia elektryczna, WNT, Warszawa, 2009.
2. A. Cysewska-Sobusiak, Podstawy Metrologii i inżynierii pomiarowej, Wyd. Politechniki Poznańskiej, 2010.
3. J. Rydzewski, Pomiary oscyloskopowe, WNT, Warszawa, 2007.

Additional

1. Międzynarodowy Słownik Podstawowych i Ogólnych Terminów Metrologii, Wydanie polskie, Główny Urząd Miar, Warszawa, 1996.
2. W. Winiecki, Organizacja komputerowych systemów pomiarowych, Ofic. Wyd. PW, Warszawa, 1997.
3. A. Zatorski, R. Sroka, Podstawy metrologii elektrycznej, Wyd. AGH, Kraków 2011.
4. S. Tumański, Technika pomiarowa, WNT 2007.

**Breakdown of average student's workload**

	Hours	ECTS
Total workload	140	5,0
Classes requiring direct contact with the teacher	75	3,0
Student's own work (literature studies, preparation for laboratory/project classes, preparation for tests, project preparation) <sup>1</sup>	65	2,0

<sup>1</sup> delete or add other activities as appropriate