



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Metrology

### Course

Field of study

Electrical Engineering

Area of study (specialization)

-

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

2/3

Profile of study

practical

Course offered in

Polish

Requirements

compulsory

### Number of hours

Lecture

15

Laboratory classes

30

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

### Number of credit points

4

### Lecturers

Responsible for the course/lecturer:

dr inż. Arkadiusz Hulewicz

email: arkadiusz.hulewicz@put.poznan.pl

tel. 61 665 2546

Faculty of Control, Robotics and Electrical Engineering

ul. Piotrowo 3A, 60-965 Poznań

Responsible for the course/lecturer:

Dr inż. Przemysław Otomański

email: przemyslaw.otomanski@put.poznan.pl

tel. 61 665 2599

Faculty of Control, Robotics and Electrical Engineering

ul. Piotrowo 3A, 60-965 Poznań

### Prerequisites

Basic knowledge of mathematics, physics, electrotechnics, electronics and metrology. Ability to realize the efficient self-education in the area related to the chosen field of studies. Awareness of the necessity of broadening of the competences in the field of electrical engineering and willingness to cooperate in a team.

### Course objective

Knowledge of measurement methodology, attributes of modern measuring devices and equipment, principles of using analog and digital measuring devices, and evaluation of measurement results

### Course-related learning outcomes

Knowledge



1. Ability to describe principles of methodology of electrical quantities measurements made with basic analog and digital devices.
2. Ability to explain a principle of the proper choice of elements of a simple set for measurements of electrical quantities

#### Skills

1. Ability to use the basic electrical measuring devices in accordance with operating manuals and to explain appropriate operation of the simple measuring systems.
2. Ability to made a simple measuring task and evaluate the inaccuracy of the obtained results

#### Social competences

1. Ability to think and act in the enterprising way in the area of measuring engineering.

#### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratory exercises: continuous estimating with the tests, awarding the skill increase, the evaluation of knowledge and skills connected with the measuring tasks and prepared reports

Getting additional points for the activity during classes, in particular: the efficiency of the use of acquired knowledge to solve a given problem; skill of the co-operation within the team practically realizing a given detailed task in the laboratory; remarks connected with the improvement of didactic materials; the aesthetic qualities of the reports

#### Programme content

Methods of education are orientated to students to motivate them to participate actively in education process by discussion and reports. Planning and accomplishment of measuring tasks. Electromechanical and electronic measuring devices. Analog and digital measurements of electrical quantities. Measurements of alternating voltage. Testing of a voltmeter equipped with the double-integration A/D converter. Application of analog oscilloscope in measurements. Examples of measurements of electrical quantities. Interpretation of measurement results and estimation of their inaccuracy

#### Teaching methods

Lectures: Multimedia presentations expanded by examples shown on a board.

Laboratory: Multimedia presentations expanded by examples shown on a board and realization of experiments

#### Bibliography

##### Basic

1. A. Cysewska-Sobusiak - Podstawy metrologii i inżynierii pomiarowej, Wyd. Politechniki Poznańskiej, Poznań 2010



2. A. Chwaleba, M. Poniński, A. Siedlecki - Metrologia elektryczna, WNT, Warszawa 2014
3. J. Rydzewski - Pomiary oscyloskopowe, WNT, Warszawa 2007
4. A. Cysewska-Sobusiak, Z. Krawiecki, A. Odon, P. Otomański, D. Turzeniecka, G. Wiczyński - Laboratorium z metrologii elektrycznej i elektronicznej, Wydawnictwo Politechniki Poznańskiej, Poznań 2000
5. Hulewicz A., Rozwiązania układowe oraz parametry detektorów wartości szczytowej, Elektronika, nr 7 2014, s. 149-153.
6. Hulewicz A., Krawiecki Z., Narzędzia statystyczne w procesie normalizacji wyników pomiarów, Poznan University of Technology Academic Journals, Electrical Engineering No 88, Computer Applications in Electrical Engineering 2016, Poznan 2016, s. 251-260.

Additional

1. S. Bolkowski - Elektrotechnika, Wydawnictwa Szkolne i Pedagogiczne, Warszawa 2009
2. S. Tumański - Technika pomiarowa, WNT, Warszawa 2007
3. T. Zieliński - Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań, WKŁ, Warszawa 2007
4. T. Skubis, Podstawy metrologicznej interpretacji wyników pomiarów, Wydawnictwo Politechniki Śląskiej, Gliwice, 2004
5. Międzynarodowy Słownik Podstawowych i Ogólnych Terminów Metrologii, Główny Urząd Miar, Warszawa, 1996
6. [www.bipm.org](http://www.bipm.org)
7. [www.gum.gov.pl](http://www.gum.gov.pl)

**Breakdown of average student's workload**

	Hours	ECTS
Total workload	110	4,0
Classes requiring direct contact with the teacher	60	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	50	2,0

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