



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Fundamentals of metrology

### Course

Field of study

Mathematics in technology

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

2/4

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

15

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

### Number of credit points

4

### Lecturers

Responsible for the course/lecturer:

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Faculty of Control, Robotics and Electrical

Engineering

ul. Piotrowo 3A, 60-965 Poznań

Responsible for the course/lecturer:

### Prerequisites

Basic knowledge in the scope of mathematics, physics and electrotechnics. Ability to the efficient self-education in the area concerned with the chosen of studies. Awareness of the necessity of broadening of the competences in the field of electrical engineering and willingness to work as a team.

### Course objective

Knowledge of the metrological and operational properties of basic measuring tools and evaluation of measuring results. Develop the skills of the appropriate selection of measurement methods and devices for the implementation of engineering measurement tasks.

### Course-related learning outcomes

Knowledge

Well-ordered knowledge of the classification of basic measurement methods and the mathematical



methods of determining measurement inaccuracy. Ability to describe the basic methods of signal processing used in electrical metrology.

#### Skills

Ability to make a proper choice of the measurement method and tools to realize a measurement of the basic electrical quantities. Ability to plan and make a simple measurement task with a measurement system.

#### Social competences

Awareness of the limitations of his knowledge and of the need to constantly improve it. Ability to think and act in the enterprising and responsible way.

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

Learning outcomes presented above are verified as follows:

Lectures: evaluation of the knowledge related to the content of lectures (test, computational and problem questions, 50% pass mark). Bonus activity and quality of perception during the lecture.

Laboratories: evaluation of knowledge and skills related to the implementation of the project and evaluation of the report made in class or at home. Evaluation of degree of completed tasks and rewarding of activity.

#### Programme content

Lectures: basic concepts of metrology; measuring tools - classification, metrological properties, basics of error calculation, develop of measurement results - direct measurement, indirect measurement, mathematical methods for determining the uncertainty of measurement, electromechanical and electronic meters construction, principle of operation, metrological properties, Wheatstone bridge, voltage and current transformers, power measurements in one-phase systems, measurements with oscilloscopes, signal generators, digital measurements of frequency and voltage, selected issues of advanced measurement systems.

Laboratory: introduction to the basic measuring apparatus in the laboratory: multimeter, generator, analog oscilloscope, digital oscilloscope, power supply, measurements: voltage, current, resistance, capacity, frequency, period, phase shift between signals, determination of inaccuracies in direct and indirect measurements, development measurement result.

#### Teaching methods

Lecture with multimedia presentation supplemented by examples on the board, initiation of discussions in relation to the subject, presentation of a new topic preceded by a reminder of the previous lecture (main issues).

Laboratories: groups of students work as teams. Discussion on different methods and aspects of problem solutions. Detailed reviewing of particular laboratories documentation.



## Bibliography

### Basic

1. Chwaleba A., Poniński M., Siedlecki A., Metrologia elektryczna, WNT, Warszawa, 2010
2. Cysewska-Sobusiak A., Podstawy metrologii i inżynierii pomiarowej, Wyd. Politechniki Poznańskiej, 2010
3. Dusza J., Gortat G., Leśniewski A., Podstawy miernictwa, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2007.
4. Rydzewski J., Pomiary oscyloskopowe, WNT, Warszawa, 2007
5. Tumański S., Technika pomiarowa, WNT 2007
6. Nawrocki W., Rozproszone systemy pomiarowe, WKiŁ, Warszawa, 2006

### Additional

1. Międzynarodowy Słownik Podstawowych i Ogólnych Terminów Metrologii, Wydanie polskie, Główny Urząd Miar, Warszawa, 1996
2. Zatorski A., Sroka R., Podstawy metrologii elektrycznej, Wyd. AGH, Kraków 2011

## Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project laboratory report preparation) <sup>1</sup>	50	2,0

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