



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Metrology in electromobility

### Course

Field of study

Electromobility

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

Laboratory classes

Other (e.g. online)

30

Tutorials

Projects/seminars

### Number of credit points

3

### Lecturers

Responsible for the course/lecturer:

dr inż. Zbigniew Krawiecki

email: zbigniew.krawiecki@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. 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

### Prerequisites

The student starting this course should have basic knowledge of mathematics, physics and the basics of electrical engineering and the ability to work in a laboratory group.

### Course objective

Learning about various measurement methods, the properties of modern measuring instruments, the principles of using analog and digital instruments and the principles of elaborating measurement results.



### Course-related learning outcomes

#### Knowledge

1. Has knowledge of basic measurements of electrical quantities using analog and digital instruments.
2. Has knowledge of technical and functional properties of measuring devices.
3. Has knowledge of working out the results of the experiment.

#### Skills

1. Knows how to use appropriate methods to measure selected electrical quantities.
2. Knows how to use measuring instruments in accordance with the user's manual.
3. Can perform an engineering task and assess the accuracy of the results.

#### Social competences

1. Understands that knowledge of the operation of electrical circuits is important in the work of an engineer.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The skills acquired during laboratory exercises are verified on the basis of reports prepared by students. Continuous assessment, in every class. Assessment of knowledge and skills related to the implementation of the measurement task. Rewarding the use of learned principles and methods.

### Programme content

The issues covered are related to:

- planning and implementation of the measurement task
- measurement of basic electrical quantities
- calculation of errors and uncertainty of measurement results
- preparation of documentation from measurements
- measurement of electrical signals using an oscilloscope
- analog and digital measurement of electrical quantities
- using measuring bridges
- using simple measurement systems
- getting to know the safety rules at the measuring station.

### Teaching methods

Performing laboratory exercises in teams (preparation of the station, building measuring systems, performing experiments) with the help and supervision of the teacher.



## Bibliography

### Basic

1. Chwaleba A., Poniński M., Siedlecki A.: Metrologia elektryczna, WNT, Warszawa 2014
2. Cysewska-Sobusiak A.: Podstawy metrologii i inżynierii pomiarowej, Wyd. Politechniki Poznańskiej, Poznań 2010
3. Zakrzewski J., Kampik M.: Sensory i przetworniki pomiarowe, Wyd. PŚ, Gliwice, 2013
4. Cysewska-Sobusiak A., Krawiecki Z., Odon A., Otomański P., Turzeniecka D., Wiczyński G.: Laboratorium z metrologii elektrycznej i elektronicznej, Wydawnictwo Politechniki Poznańskiej, Poznań 2000
5. Rydzewski J.: Pomiary oscyloskopowe, WNT, Warszawa 2007
6. Dusza J., Gortat G., Leśniewski A.: Podstawy miernictwa, Wyd. PW, Warszawa, 2007
7. Gawędzki W.: Pomiary elektryczne wielkości nieelektrycznych, Wyd. AGH, Kraków, 2010
8. Suchocki K.: Sensory i przetworniki pomiarowe. Przetworniki indukcyjne, przetworniki pojemnościowe, Wyd. PG, Gdańsk, 2015

### Additional

1. Miłek M.: Metrologia elektryczna wielkości nieelektrycznych, Wyd. UZ, Zielona góra, 2006
2. Wołk-Łaniewski L., Wittek J.: Niepewność pomiaru w zadaniach rachunkowych z metrologii elektrycznej. Wyd. UTP, Bydgoszcz, 2008
3. Nawrocki W.: Sensory i systemy pomiarowe, Wyd. PP, Poznań, 2006
4. Kitchin Ch., Counts L.: Wzmacniacze operacyjne i pomiarowe: przewodnik projektanta, BTC, 2009
5. Międzynarodowy Słownik Podstawowych i Ogólnych Terminów Metrologii, Główny Urząd Miar, Warszawa 1996
6. Hulewicz A., Rozwiązania układowe oraz parametry detektorów wartości szczytowej, Elektronika, nr 7 2014, s. 149-153
7. Otomański P., Krawiecki Z.: Wykorzystanie środowiska LabVIEW do oceny niedokładności pomiarów rezystancji, Pomiary Automatyka Kontrola, 2011, vol. 57, nr 12, s. 1561-1563
8. 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. 251-2608



### Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	35	1,5
Student's own work (literature studies, preparation for laboratory classes/ <del>tutorials, preparation for tests/exam, project reports preparation</del> ) <sup>1</sup>	40	1,5

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