Metrology - course description

General information

Course name	Metrology
Course ID	06.2-WE-ELEKTP-Metrol-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Electrical Engineering
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2021/2022

Course information

Semester	4
ECTS credits to win	4
Course type	obligatory
Teaching language	english
Author of syllabus	• prof. dr hab. inż. Ryszard Rybski

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	30	2	-	-	Exam
Laboratory	30	2	-	-	Credit with grade

Aim of the course

- To familiarize students with measurement methods and construction, principles of operation of analog and digital measuring instruments for selected electrical quantities

- Shaping among students skills in performing simple measurement tasks and developing and interpreting measurement results

- To familiarize with the classification, construction and characteristics of measurement systems

Prerequisites

Fundamentals of electrical engineering, Fundamentals of electronics, Fundamentals of metrology

Scope

Analog, analog-to-digital and digital-to-analog signal processing. Principle of operation and metrological properties of basic analog function operators. Sampling and quantizing. Sample and hold, analog-to-digital and digital-to-analog converters.

Measurements of voltages and currents. Electronic voltmeters and digital voltmeters. Zero measurement method: Compensation measurement of voltage and current. Comparative methods.

Methods and systems for measuring resistance and impedance. Technical methods. DC and AC bridges methods. Transformer bridges. Unbalanced bridges.

Measurements of frequency, period, time and angle of phase shift. Analog and digital methods of measurement and period and frequency. Digital frequency meters and phase meter.

DC and AC power and energy measurements in single- and three-phase systems.

Principle of power and energy measurement. Electrodynamic wattmeter. Voltage and current measurement transformer. Electronic power measuring instruments. Measurement of active and reactive power in three-phase systems. Electronic energy meters.

Registration of electrical signals. Analog and digital oscilloscope. Signal recorders for measuring signals.

Testing of electrotechnical materials, semiconductors and dielectrics. Measurement of the properties of magnetic materials.

Computer measuring systems. General characteristics of measuring systems. Types and configurations of computerized measuring systems. Basic functional blocks of computer measurement systems: measurement cards, intelligent sensors. Interfaces.

Teaching methods

Lecture: conventional lecture, problem lecture, discussion

Laboratory: working with source document, group work, laboratory exercises

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form

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Student is able to use measuring instruments and perform simple measurement tasks and interpret measured results		• a quiz • an ongoing monitoring during classes	• Laboratory
Student is able to choose the method and measuring instruments for simple measurement tasks		• a quiz • an ongoing monitoring during classes	• Laboratory
Student can explain the principle of operation of analog and digital measuring instruments intended for measuring basic electrical quantities		• an exam - oral, descriptive, test and other	• Lecture
Student can present and characterize the basic types and configurations of measurement systems		• an exam - oral, descriptive, test and other	• Lecture

Assignment conditions

Lecture – the credit is given for obtaining positive grades in written tests carried out at leastonce a semester.

Laboratory – to receive a final passing grade stude nt has to receive positive grades in all laboratory exercises provided for in the laboratory syllabus.

Calculation of the final grade: lecture 50% + laboratory 50%

Recommended reading

1. Tumanski S.: Principles of electrical measurement. Taylor & Francis, 2006
2. Bhargawa S.C: Electrical measuring instruments and measurements. CRC Press, 2012
3. Vetelino J., Reghu A.: Introduction to sensors. CRC Press, 2010
4. Fraden J.: Handbook of modern sensors. Springer, 2016.

Further reading

1. Skubis T.: Fundamentals of measurement results metrological interpretation. Published by Silesian University of Technology, Gliwice, 2004 (in Polish)

Notes

Modified by dr hab. inż. Paweł Szcześniak, prof. UZ (last modification: 08-07-2021 21:49)