Measurement transducers - course description

General information

Course name	Measurement transducers
Course ID	06.2-WE-ELEKTP-MS-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 2019/2020

Course information

Semester	5
ECTS credits to win	5
Course type	optional
Teaching language	english
Author of syllabus	• dr hab. inż. Wiesław Miczulski, prof. UZ

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 the parameters of transducers and methods of description of their static and dynamic properties.

- to familiarize students with the construction, principle of operation and characteristics of functional blocks of measuring signal processing circuit and measuring transducers of basic non-electric quantities.

- to shape the skills of planning and carrying out experiments in the field of experimental determination of the characteristics of measuring signal processing circuit elements.

Prerequisites

Fundamentals of Electrical Engineering, Fundamentals of Electronics, Metrology

Scope

General characteristics of transducers and measuring signals. Basic definitions of classification of signals and transducers. Structures of measuring transducers.

Static and dynamic properties of measuring transducers. Definitions of basic static parameters. Methods for describing the dynamic characteristics of time and frequency converter transducers. Models of perfect dynamic transformation. Models and dynamic properties of real transducers. Analogue measurement converters of selected electrical quantities. Power, Voltage and AC Converters. Transducer structures.

Analog function blocks: input stages, absolute value converters, logarithmic and delogarithmic circuits, multipliers, RMS circuits.

Analog-to-digital and digital-to-analog processing. General characteristics of A / D and D / A processing: sampling, quantization, coding. Classification and basic functions and development tendencies of A / D and D / A converters. Construction and characteristics of selected types of D / A converters. Converters: with resistor network, with switching capacity, sigma - delta; the multiply D / A converter. Static and dynamic parameters of D / A converters. Construction and properties of selected A / D converters. Converters: integral, frequency-conversion, SAR, sigma-delta. Static and dynamic parameters of AC converters.

Signal conditioning circuits of sensors outputs. Parametric characteristics (resistive and reactance) and generative measurement sensors. Signal conditioning systems working with parametric and generation sensors. Intelligent measuring sensors.

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
The student knows the parameters and methods used to describe and evaluate the properties of static and dynamic transducers		• an exam - oral, descriptive, test and other	• Lecture

Outcome description	Outcome symbols	Methods of verification	The class form
Can plan and conduct experiments that allow to determine, by the experimental way, processing characteristics of the elements of the measurement path		• a quiz • an ongoing monitoring during classes	• Laboratory
Can explain the operation principle of measuring transducers of basic electrical and non-electrical quantities, basic types of analog-to-digital and digital-to-analog converters and can characterize and evaluate their properties		• an exam - oral, descriptive, test and other	• Lecture
Can design selected elements of the measurement signal processing track		• a quiz • an ongoing monitoring during classes	• Laboratory

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. Pallas-Areny R., Webster J.G.: Sensors and signal conditioning. John Willey& Sons, Inc., 2001
5. Fraden J.: Handbook of modern sensors. Springer, 2010

Further reading

1. Horowitz P., Hill W.: The art of electronics. Cambridge University Press, 2010
2. Miczulski W., Krajewski M., Sienkowski S., A New Autocalibration Procedure in Intelligent Temperature Transducer, IEEE Transactions on Instrumentation and Measurement .- 2019, Vol. 68, iss. 3, s. 895--902.

Notes

Modified by dr hab. inż. Wiesław Miczulski, prof. UZ (last modification: 29-10-2019 18:58)