

# Measurement transducers - opis przedmiotu

| Informacje ogólne   |                                                                   |
|---------------------|-------------------------------------------------------------------|
| Nazwa przedmiotu    | Measurement transducers                                           |
| Kod przedmiotu      | 06.0-WE-AutP-MeasTran-Er                                          |
| Wydział             | <a href="#">Wydział Informatyki, Elektrotechniki i Automatyki</a> |
| Kierunek            | WIEiA - oferta ERASMUS / Automatyka i robotyka                    |
| Profil              | -                                                                 |
| Rodzaj studiów      | Program Erasmus pierwszego stopnia                                |
| Semestr rozpoczęcia | semestr zimowy 2018/2019                                          |

| Informacje o przedmiocie        |                                                                                          |
|---------------------------------|------------------------------------------------------------------------------------------|
| Semestr                         | 5                                                                                        |
| Liczba punktów ECTS do zdobycia | 3                                                                                        |
| Typ przedmiotu                  | obowiązkowy                                                                              |
| Język nauczania                 | angielski                                                                                |
| Sylabus opracował               | <ul style="list-style-type: none"><li>dr hab. inż. Wiesław Miczulski, prof. UZ</li></ul> |

| Formy zajęć  |                                         |                                        |                                            |                                           |                     |
|--------------|-----------------------------------------|----------------------------------------|--------------------------------------------|-------------------------------------------|---------------------|
| Forma zajęć  | Liczba godzin w semestrze (stacjonarne) | Liczba godzin w tygodniu (stacjonarne) | Liczba godzin w semestrze (niestacjonarne) | Liczba godzin w tygodniu (niestacjonarne) | Forma zaliczenia    |
| Wykład       | 30                                      | 2                                      | -                                          | -                                         | Egzamin             |
| Laboratorium | 30                                      | 2                                      | -                                          | -                                         | Zaliczenie na ocenę |

## Cel przedmiotu

- 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.

## Wymagania wstępne

Fundamentals of Electrical Engineering, Fundamentals of Electronics, Metrology

## Zakres tematyczny

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.

## Metody kształcenia

Lecture: conventional lecture, problem lecture, discussion

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

## Efekty uczenia się i metody weryfikacji osiągnięcia efektów uczenia się

| Opis efektu | Symbole efektów | Metody weryfikacji | Forma zajęć |
|-------------|-----------------|--------------------|-------------|
|-------------|-----------------|--------------------|-------------|

| Opis efektu                                                                                                                                                                                                                          | Symbole efektów | Metody weryfikacji                                                                                                                                | Forma zajęć                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| The student knows the parameters and methods used to describe and evaluate the properties of static and dynamic transducers                                                                                                          |                 | <ul style="list-style-type: none"> <li>egzamin - ustny, opisowy, testowy i inne</li> </ul>                                                        | <ul style="list-style-type: none"> <li>Wykład</li> </ul>       |
| 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 |                 | <ul style="list-style-type: none"> <li>egzamin - ustny, opisowy, testowy i inne</li> </ul>                                                        | <ul style="list-style-type: none"> <li>Wykład</li> </ul>       |
| Can design selected elements of the measurement signal processing track                                                                                                                                                              |                 | <ul style="list-style-type: none"> <li>bieżąca kontrola na zajęciach</li> <li>sprawdzian</li> <li>wykonanie sprawozdań laboratoryjnych</li> </ul> | <ul style="list-style-type: none"> <li>Laboratorium</li> </ul> |
| Can plan and conduct experiments that allow to determine, by the experimental way, processing characteristics of the elements of the measurement path                                                                                |                 | <ul style="list-style-type: none"> <li>bieżąca kontrola na zajęciach</li> <li>sprawdzian</li> <li>wykonanie sprawozdań laboratoryjnych</li> </ul> | <ul style="list-style-type: none"> <li>Laboratorium</li> </ul> |

## Warunki zaliczenia

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

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

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

## Literatura podstawowa

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 Wiley & Sons, Inc., 2001
5. Fraden J.: Handbook of modern sensors. Springer, 2010

## Literatura uzupełniająca

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.

## Uwagi

Zmodyfikowane przez dr hab. inż. Wojciech Paszke, prof. UZ (ostatnia modyfikacja: 01-05-2020 10:51)

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