**SYLLABUS**

**Name: Fundamentals of Metrology**
**Name in Polish: Podstawy metrologii**
**Name in English: Fundamentals of Metrology**

**Information on course:**

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|---|---|
| **Course offered by department:** | Faculty of Organisation and Management |
| **Course for department:** | Silesian University of Technology |
| **Study level and form:** | Bechelor's degree, Full-time |
| **Term:** | winter semester 2020/2021 |
| **Coordinator of course edition:** | Magdalena Palacz, Ph.D., D.Sc. |

**Default type of course examination report:**

Credit

**Language:**

English

**Course homepage:**

[link]

**ECTS**

4

**Short description:**

Basic terminology from the metrology area of expertise: metrology, unit, error, accuracy, precision, calibration, the definition of different errors, uncertainty, Instrumentation used for measurements, modern sensors and their hardware requirements.

**Description:**

Lectures:
1. & 2. Definition of metrology. Classification in metrology. Units definition. Inspection procedures. Difference between accuracy and precision. Calibration of measurement equipment. Description of errors in measurements. Source of various types of errors. Systematic vs. random error.
3. & 4. Measurement - definition. Definition of measurement types. Description of a variety of errors. Introduction to uncertainty in measurements. Significant figures and their influence on measurement accuracy. Reporting uncertainties. Explanation of how to operate with a calliper and a micrometer.
5. & 6. Measuring instrumentation - absolute, secondary, analogue, and digital instruments. Mechanica, electrical and electronic instruments. Self-operating instruments vs. power-operated instruments. Examples of instrumentation used for length, area, volume, angle, orientation in space, level and direction measurement tools.
7. & 8. Measuring instruments for mass or volume, speed, acceleration, mass, linear momentum, force, pressure, angular velocity, torque, and energy carried by mechanical quantities.
9. & 10. Measuring instruments for electricity, electronics and electrical engineering, thermodynamics, basic information about the continuum mechanics measurements, human senses, meteorology, astronomy, and military. Recapitulation of the material.

Laboratory:
1. & 2. Measurements are done by the use of a calliper and a micrometer.
3. & 4. Measurements are done by the use of Charpy's hammer
5. & 6. Measurements are done by the use of Vicker's hardness testing machine

A number of hours of classes with direct participation of academic teachers or other persons teaching courses and students:
Contact hours:
Lecture: 15h
Laboratory: 30h

Lecture credit: 2h
Laboratory credit: 3 h

Student's own work:
Preparation for lecture credit: 15h
Preparation for laboratory credit: 35h

Total workload: 120
Number of ECTS credits: 4 including ECTS credits covered by the study programme to be earned as part of the courses taught with the direct participation of academic teachers or other persons teaching courses and students: 2

**Bibliography:**


1. Applied Metrology for Manufacturing Engineering by Ammar Grous.
2. Metody wykonywania pomiarów i szacowanie niepewności pomiaru.
3. Engineering metrology and measurements by Krishnamurthy, L. Raghavendra, N. V.
4. Handbook of Measurement in Science and Engineering Volume 1 by Myer Kutz.

5. Handbook of Measurement in Science and Engineering Volume 2 by Myer Kutz.

**Learning outcomes:**

The student knows:
K1A_W01 – topics in mathematical analysis, in particular:
- differential and integral calculus of functions of one variable and its applications,
- ordinary differential equations in order to clearly identify measurement uncertainties
K1A_W05 – a basic knowledge of the principles of measurement and of the development of physical measurement results, the types of measurement uncertainties, and how to determine and express them.
The student is able to:
K1A_U05 – carry out basic physical measurements and process and present their results, in particular:
- is able to construct a simple measuring system using standard measuring equipment according to a given scheme and specification,
- is able to determine the results and uncertainties of direct and indirect measurements,
- is able to evaluate the reliability of measurement results and their interpretation in the context of his/her physical knowledge.
K1A_U06 – plan and carry out experiments, including measurements and computer simulations, interpret the results obtained and draw conclusions.
The student is ready to:
K1A_K01 – understand the need for continuous learning, above all to improve his/hers professional and personal competencies.

**Assessment methods and assessment criteria:**

Knowledge of the content of the lecture is evaluated on the basis of the final test.

The content of the laboratory is evaluated on the basis of the report prepared according to the teacher's instructions provided during classes.
The total note for this subject is a standard mean of notes from lectures and laboratories. Both parts must be positive (>3.0).

The exam may be taken in case of a positive note at the end of the semester. An excellent final grade exempts one from the examination.

**Practical placement:**

Not applicable