



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Fundamentals of Metrology [S1FT2>PM]

Course

Field of study

Technical Physics

Year/Semester

1/1

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

0

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of physics and mathematics (high school curriculum level). Ability to solve simple physical problems based on acquired knowledge and to obtain information from indicated sources. Understanding the need for expanding one's competencies.

Course objective

1. To prepare students to work with measuring instruments. 2. To provide theoretical preparation for analyzing and processing measurement results.

Course-related learning outcomes

Knowledge:

As a result of the conducted classes, the student has basic knowledge in metrology, knows and understands methods of measuring physical quantities, and analysis of measurement results.

Skills:

Student:

1. Can independently conduct a preliminary analysis of laboratory measurement results and draw

conclusions based on literature.
2. Has the ability to self-learn.

Social competences:

The student understands the need for continuous learning.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The learning outcomes listed above are verified as follows:

The outcomes are assessed during a written examination (quiz). Students must demonstrate theoretical knowledge and practical skills such as reading from a vernier scale, calculating uncertainties of simple and complex measurements, rounding measurement results. Passing the course requires achieving more than 50% of the maximum points.

Programme content

1. Construction and principle of operation of selected measuring instruments
2. Methods of measuring selected electrical and non-electric quantities
3. The idea of analog-digital processing, computer as a measurement tool
4. Analysis and processing of measurement results

Course topics

1. Construction, principle of operation, accuracy of the following measuring instruments: caliper, goniometer, micrometer screw, micrometer sensor, ammeter, voltmeter, ohmmeter, wattmeter, digital multimeter, oscilloscope (analog and digital).
2. Measurement methods: voltage, resistance, power, magnetic field, temperature, light.
3. The idea of analog-to-digital conversion, computer as a measurement tool.
4. Classification of uncertainty and measurement errors (definitions, examples).
5. Basic concepts of measurement statistics: normal distribution (expected value, standard deviation, probability distribution), histogram, median, mode, arithmetic mean, variance, sample standard deviation, standard deviation of the mean, Student's distribution, weighted mean.
6. Calculation of the uncertainty value of complex quantities: logarithmic differential method, total differential method.
7. Rules for rounding up and recording the measurement result and its uncertainty.
8. Regression method, the use of the least squares method to calculate the parameters of the line, correlation coefficient.
9. Basic markings on electrical diagrams.
10. Graphical preparation of measurement results: correct planning of the graph, rectangles of measurement uncertainty.

Teaching methods

Multimedia presentation supplemented with examples presented on the board.

Bibliography

Basic:

1. A. Chwaleba, M. Poniński, A. Siedlecki, Metrologia elektryczna, WNT, Warszawa 2010
2. J. Piotrowski, Podstawy miernictwa, WNT, Warszawa 2002
3. J. R. Taylor, Wstęp do analizy błędu pomiarowego, PWN, Warszawa 1999

Additional:

1. Pomiar, pod red. J. Piotrowskiego, WNT, Warszawa 2009
2. H. Szydłowski, Pracownia fizyczna, PWN, Warszawa 2003

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00