Metrology - course description

General information

Course name	Metrology
Course ID	13.2-WF-FizP-M-S21
Faculty	Faculty of Physics and Astronomy
Field of study	Physics
Education profile	academic
Level of studies	First-cycle studies leading to Bachelor's degree
Beginning semester	winter term 2022/2023

Course information

Semester	1
ECTS credits to win	2
Course type	obligatory
Teaching language	english
Author of syllabus	• dr hab. Piotr Lubiński, 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
Class	15	1	-	-	Credit with grade
Lecture	15	1	-	-	Credit with grade

Aim of the course

Acquaint students with the basics of the experiment planning, measurement procedures and data analysis. Introducing fundamental concepts of metrology (measurement, uncertainty, etc.). Development of skills in application of the standard techniques used for data analysis (probability distribution, mean and standard deviation, regression, chi2 test.

Prerequisites

Knowledge of mathematics and physics at the secondary school level.

Scope

- SI system. Base, derived and additioal units.
- Number notation, significant figures, prefixes.
- Classification of the measurement methods. Precise and accurate data.
- Parent and sample population. Parameter and estimator.
- Measurement uncertainty, statistical and systematic errors, data selection.
- Parameters of the data distribution: mean, standard deviation, mode and median.
- Propagation of errors.
- Weighted mean.
- Presentation of the measurement results, tables and figures.
- Probability distributions: binomial, Poisson, normal, Student, chi-square.
- Regression and correlation.
- Function fitting. Least-square method, chi-square test.
- Guidelines for preparing the laboratory reports.

Teaching methods

lecture, classes, discussion, solving problems.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Student is aware of an importance of professional behaviour, following the ethic rules and tolerance of various points of view.	• K1A_K03	• a discussion	• Class
Student knows fundamentals of the measurement methodology used in physics allowing him/her to understand basic physical phenomena and their cause and effect relations.	• K1A_W01	• an evaluation test	• Lecture • Class

Outcome description	Outcome symbols	Methods of verification	The class form
Student recognizes a need of improving professional and personal competences, uses various sources of information for this purpose.	• K1A_K04	• a discussion	• Lecture • Class
Student applies the rules of the measurement methodology in physics; is able to plan and perform simple physical measurements, analyze obtained data, interpret them and present the results.	• K1A_U03	• a project • an evaluation test	• Lecture • Class
Student understands and is able to explain a description of the physical phenomena and processes; is prepared to recover the theorems and laws and calculations related to them; is able to create a theoretical model of a phenomenon relating it with the measurement results.	• K1A_W03	• a discussion • a project	• Lecture • Class

Assignment conditions

The final grade is a weighted mean of several elements:
- degree of being prepared for exercises (discussion, activity during the class): 25%,
- preparation of reports and homework solutions: 25%,
- final test: 50%.

Recommended reading

1. J.R. Taylor, An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements 2nd Edition, University Science Books, 1996.
2. P.R. Bevington, D.K. Robinson, Data Reduction and Error Analysis for the Physical Sciences, Third Edition, McGraw-Hill, 2003.

Further reading

1. S. Brandt, Data Analysis: Statistical and Computational Methods for Scientists and Engineers, 3rd Edition, Springer, 1998.

Notes

Modified by dr Marcin Kośmider (last modification: 04-04-2022 20:43)