Physics Laboratory II - course description

General information

Course name	Physics Laboratory II
Course ID	13.2-WF-FizD-PL-II-S14
Faculty	Faculty of Physics and Astronomy
Field of study	Physics
Education profile	academic
Level of studies	Second-cycle studies leading to MS degree
Beginning semester	winter term 2020/2021

Course information

Semester	2
ECTS credits to win	6
Course type	obligatory
Teaching language	english
Author of syllabus	• dr Bartosz Brzostowski

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
Laboratory	60	4	-	-	Credit with grade

Aim of the course

The goal of the advanced lab is to become familiar with experimental physics research. It is a test run as an experimental physicist with all responsibilities. This includes learning how to conduct meaningful experiments, mastering important experimental instrumentation and methods, analyzing data, drawing meaningful conclusions from them and presenting your results in a succinct manner. For this, you will conduct several experiments and error-analysis exercises.

Prerequisites

- Physics laboratory I (General Physics Lab).
- calculus.

Scope

RSE CONTENTS:

Experiments at an advanced level:

- Hall effect.
- Study of converse piezoelectric effect (stress in response to applied electric field) by the static method.

- Studies of ferroelectrics.
- Electron paramagnetic resonance (EPR) and Nuclear magnetic resonance (NMR) spectroscopy.
- The study of piezoelectric and elastic properties of polycrystalline ferroelectrics.
- Spontaneous and forced birefringence in TGS crystal.
- Ultrasonic defectoscope.

- Absorption of ultrasonic waves in air.

Teaching methods

Laboratory exercises - exercises in accordance with the instructions and recommendations of the instructor (may increase the number of measurements to be done and recommend to perform additional analyzes on the basis of measurements).

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Furthermore student should know the safety rules in science experiments. Moreover student has the ability to plan complex physics experiments including different methods of measurement.	• K2_W07	• an ongoing monitoring during classes • carrying out laboratory reports	• Laboratory

Outcome description	Outcome symbols	Methods of verification	The class form
As a result of successfully completing this course, students will be familiar with modern methods of research in the field of solid state physics, optics and physics of atoms and molecules and should understand research limitations	• K2_W03 • K2_W04	• a test • an ongoing monitoring during classes • carrying out laboratory reports	• Laboratory
Student is able to handle complex measurement systems using electronic and information technology tools and has the ability to perform accurate measurements and data analysis and make presentation and interpretation of measurement results.	• K2_U02 • K2_U04 • K2_U12	• an ongoing monitoring during classes • carrying out laboratory reports	• Laboratory

Assignment conditions

To pass the laboratory the student should make a reasonable number of exercises in order to get a total of 7.5 points, with the following scores for the exercise:
1,2,3,6 – 1.0 points,
4,7,8,9 – 1.25 points,
5,11,13,14 – 1.5 points,
10,12 – 2.0 points.
The experiments will be conducted in groups of two students. Each student should submit his/her own report.
The lab grade consists of two parts: the lab pre-quiz is worth 25% and the lab report is worth 75% of the grade for each lab.
Pre-quiz: Students are expected to prepare for lab by reading the appropriate literature in advance of their lab. The pre-quiz will be taken at the beginning of each lab session and will consist of several questions on material covered in the lab manual.
Lab report: The lab report is a summary of what the student has observed and understood during the lab. Although you will work in twos in the lab, lab reports are to be done individually.
The format is as follows:
Introduction: Briefly give a general overview of the experiment, your expectations (a hypothesis) and the theory behind it. Summarize the main point of doing the lab. Your introduction should be about a 2 pages long.
Results: Present the data in the form of a table or a graph. Usually you will give details of what you observed in the lab. Show any calculations carried out etc. Remember to include units.
Discussion/Conclusion: Discuss in your own words and from your point of view your results.
Example: Looking at your results, tables or graph, can you see any general trend? What is the behaviour of the graph/line? What was the aim of the experiment? Have we achieved anything? If not, how large is the error? Does your result make sense? Can you compare your result to those from the books? What does the book say?
Lab reports are due one week after completion of the last measurement in the experiment.

During the last 3 weeks of the semester the students will have the option to do an extra lab to replace the worst grade and/or to run a make-up lab. At this time, any student who missed a lab, regardless if the absence was excused or unexcused, can make up one lab.

Recommended reading

1] Each task has its own list of references. The instructor helps the student to choose the most appropriate position, or suggest other items.

Further reading

[1] R. P. Feynman, R. B. Leighton, M. Sands, Feynmana wykłady z fizyki, t. 1-3, Wydawnictwo Naukowe PWN, Warszawa 2001.
[2] David Halliday, Robert Resnick, Jearl Walker. Podstawy fizyki, t. 1-5. Wydawnictwo Naukowe PWN, Warszawa 2005/2006.
[3] D. Halliday, R. Resnik, Fizyka, PWN, Warszawa 1994.
[4] I. Sawieliew, Wykłady z fizyki, PWN, Warszawa 2002.
[5] J. Orear, Fizyka, tom 1-2, WNT, Warszawa 2008.
[6] Cz. Bobrowski, Fizyka - krótki kurs, WNT, Warszawa 2004.
[7] P.G. Hewitt, Fizyka wokół nas, PWN, Warszawa 2008.
Fizyka atomowa i spektroskopia:
[1] Hermann Haken, Hans Christoph Wolf, Atomy i kwanty. Wprowadzenie do współczesnej spektroskopii atomowej, Wydawnictwo Naukowe PWN, Warszawa 1997.
[2] Wolfgang Demtröder, Spektroskopia laserowa, Wydawnictwo Naukowe PWN, Warszawa 1993.
Fizyka ciała stałego:
[1] Neil W. Ashcroft, N. David Termin, Fizyka ciała stałego, Państwowe Wydawnictwo Naukowe, Warszawa

1986.
[2] C. Kittel. Wstęp do fizyki ciała stałego, Państwowe Wydawnictwo Naukowe, Warszawa 1974.
[3] K. W. Szalimowa, Fizyka półprzewodników, Państwowe Wydawnictwo Naukowe, Warszawa 1974.
Optoelektronika i fizyka laserów:
[1] Bernard Ziętek, Lasery, Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika, Toruń 2008.
[2] Bernard Ziętek, Optoelektronika. Wydawnictwo Uniwersytetu Mikołaja Kopernika, Toruń 2004.
[3] Koichi Shimoda, Wstęp do fizyki laserów, Wydawnictwo Naukowe PWN, Warszawa 1993.
Fizyka jądrowa:
[1] Ewa Skrzypczak, Zygmunt Szefliński, Wstęp do fizyki jądra atomowego i cząstek elementarnych, Wydawnictwo Naukowe PWN, Warszawa 1995.
[2] Adam Strzałkowski, Wstęp do fizyki jądra atomowego, Państwowe Wydawnictwo Naukowe, Warszawa 1979.
[3] Janusz Araminowicz, Krystyna Małuszyńska, Marian Przytuła, Laboratorium fizyki jądrowej, Państwowe Wydawnictwo Naukowe, Warszawa 1978.
In English:
For each exercise, the instructor will indicate the literature. However, you may find useful:
General Physics
9[1] Richard P. Feynman, Robert B. Leighton and Matthew Sands, The Feynman Lectures on Physics, Addison Wesley; 2 edition (August 8, 2005).
[2] David Halliday, Robert Resnick, Jearl Walker, Fundamentals of Physics, Wiley; 9 edition (March 16, 2010).
[3] Paul G. Hewitt, Conceptual Physics, Addison Wesley; 9th edition (July 2, 2001).
[4] Jay Orear, Physics, MacMillan Publishing Company (May 3, 1979).
Atomic Physics and Spectroscopy:
[1] Hermann Haken, Hans Christoph Wolf, W. D. Brewer, The Physics of Atoms and Quanta: Introduction to Experiments and Theory, pringer; 7th rev. and enlarged ed. 2005 edition (October 19, 2005).
[2] Wolfgang Demtröder, Laser Spectroscopy: Vol. 1: Basic Principles, Springer; 4th edition (July 29, 2008).
[3] Wolfgang Demtröder, Laser Spectroscopy: Vol. 2: Experimental Techniques, Springer; 4th edition (September 17, 2008).
Solid State Physics:
[1] Neil W. Ashcroft and N. David Mermin, Solid State Physics, Brooks Cole; 1 edition (January 2, 1976).
[2] Charles Kittel, Introduction to Solid State Physics, Wiley; 8 edition (November 11, 2004).
[3] Marius Grundmann, The Physics of Semiconductors: An Introduction Including Nanophysics and Applications, Springer; 2nd ed. 2010 edition (December 24, 2010).
Optoelectronics and laser physics:
[1] Koichi Shimoda, Introduction to Laser Physics, Springer; 2nd edition (September 3, 1986).
[2] Orazio Svelto, Principles of Lasers, Springer; 5th ed. 2010 edition (December 28, 2009).
Nuclear physics:
[1] Carlos A. Bertulani, Nuclear Physics in a Nutshell, Princeton University Press; 1 edition (April 3, 2007).
[2] Kenneth S. Krane, Introductory Nuclear Physics, Wiley; 3 edition (October 22, 1987).

Notes

Modified by dr hab. Piotr Lubiński, prof. UZ (last modification: 09-06-2020 22:27)