SYLLABUS

Name: ***Measurements in chemistry (WTCCXCSM-MCh)***
Name in Polish:
Name in English: ***Measurements in chemistry***

Information on course:

Course offered by department: Faculty of Advanced Technologies and Chemistry
Course for department: Faculty of Advanced Technologies and Chemistry
Term: Summer semester 2025/2026 Year
Cordinator of course edition: dr inż. Michał Grabka

Default type of course examination report:

Graded pass

Language:

English

Course homepage:

http://www.wtc.wat.edu.pl

Short description:

The main goal of the lectures is to teach the basics of the theory of experiments and theoretical models of measurement instruments as well as to transfer knowledge about modern methods of experimental methods specific to chemistry.

Description:

LECTURES
1. Elements of measurement theory
1.1. Measurement and metrology – basic concepts/2 hours
1.2. Static and dynamic properties of measuring transducers/2 hours
2. Methods of measuring electrical quantities
2.1. Electrical quantities/2 hours
2.2. DC and AC circuits, semiconductor elements /2 hours
2.3. Methods of measuring electrical quantities/2 hours
3. Methods of measuring non-electrical quantities used in chemical laboratories
3.1. Phenomena and effects used in sensors to measure non-electric quantities. Pressure measurement, flow measurement, temperature measurement/2 hours
3.2. Chemical sensors: electrochemical, thermochemical (catalytic), electrical, ionization, gravimetric/2 hours

EXERCISES
As part of the accounting exercises, tasks related to the following problems are solved:
- calculation of measurement uncertainty and error propagation/2 hours
- static and dynamic characteristics of measuring transducers/2 hours
- elements of the theory of linear circuits/2 hours
- processing signals from measurement sensors/2 hours

LABORATORIES
Students perform laboratory exercises devoted to:
- methods of measuring electrical quantities/4 hours
- testing the characteristics of measurement sensors/4 hours

Bibliography:

1. J. R. Taylor, An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements-2nd ed., University Science Books, Warszawa 1996.
2. C. Alexander. Fundamentals of electronic circuits – 4th ed., The McGraw-Hill Companies, 2009.
3. P. Horowitz, W. Hill, The Art of Electronics 3rd ed., Cambridge University Press, 2015.
4. J. Fraden, Handbook of modern sensors: Physics, Designs, and Applications, Springer 2015.

Learning outcomes:

W1. The student has well-established and extended knowledge in the selected specialty / K_W02
W2. The student knows classical and instrumental analytical methods, their analytical possibilities, and theoretical foundations. Knowledge of methods for checking the reliability of quantitative chemical analysis results and statistical methods for assessing analysis results. Knows the development trends of analytical equipment / K_W12
U1. The student is able to determine the structure of materials and their physicochemical properties based on X-ray, adsorption, thermophysical, optical, and other tests / K_U07
U2. The student is able to critically evaluate the results of experiments, observations, and theoretical calculations, as well as discuss measurement errors / K_U08
K1. The student is ready to perform professional roles responsibly, taking into account changing social needs, including developing the achievements of the profession, maintaining the ethos of the profession, observing and developing the principles of professional ethics, and working to comply with these principles / K_K03

Assessment methods and assessment criteria:

Lectures on the subject are passed on the basis of a written examination. The questions asked during the exam concern the knowledge provided during lectures and acquired independently by the student while studying the topics of the lectures. The condition for obtaining a positive grade is to demonstrate the knowledge specified in the learning outcomes at an at least sufficient level. The condition for passing the course is passing the exercises and laboratories.
The classes are assessed on the basis of a final test. The final test includes accounting tasks related to the subject of the exercises.

The laboratory is assessed on the basis of grades from colloquiums, allowing the completion of individual laboratory exercises and grades from reports. The topics of the colloquiums allowing for the implementation of individual laboratory exercises include the content in the laboratory instructions and the knowledge acquired by students during their preparation for the laboratories.
The achievement of W1 and W2 outcomes is checked when passing lectures and when answering questions during exercises and laboratories.

Achieving the U1, U2, and K1 effects are checked during exercises and laboratories.

Mode of study

full-time studies

Form of study

second-cycle studies

Course

optional

Introductory subjects

Mathematics (basics of mathematical analysis and differential calculus, elements of probability theory).

Physics (basic theory of electricity and magnetism, phenomena of transport of liquids and gases).

Programs

field of study: chemistry

Form of course / number of hours / final requirement

lecture: 14 hours – pass with grade
exercises: 8 hours - pass without grade
laboratories: 8 hours - pass without grade

Author

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ECTS balance

Activity/Load per hour
1. Participation in lectures/14
2. Independent study of lecture topics/10
3. Participation in exercises/8
4. Independent preparation for exercises/6
5. Participation in laboratories/8
6. Independent preparation for laboratories/6
7. Preparation for the exam/6

Hours/ECTS
Total student workload: 60/2
Classes with teachers: 30/2
Activities related to scientific activity: 30/2

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Default type of course examination report:

Graded pass

Bibliography:

missing bibliography in English