COURSE DESCRIPTION CARD - SYLLABUS

Course name

Analiza instrumentalna (Instrumental Analysis)

Course

Field of study	Year/Semester
Technologia chemiczna (Chemical Technology)	III/5
Area of study (specialization)	Profile of study
-	general academic
Level of study	Course offered in
First-cycle studies	Polish
Form of study	Requirements
part-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
20	30	0
Tutorials	Projects/seminars	
0	0	

Number of credit points

6

Lecturers

Responsible for the course/lecturer:

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Prerequisites

The student has knowledge of chemistry, physics and mathematics, necessary to understand the physicochemical phenomena used in instrumental techniques.

The student should use English.

The student has the ability to understand and analyze phenomena and situations.

The student is aware of the limitations of their own knowledge and understands the need for further education.

Course objective

The aim of the course is to provide students with knowledge of selected modern instrumental methods.

Course-related learning outcomes

Knowledge

1. Student should know and understand the basics of instrumental analytical techniques, knows their general principles of operation. [K_W11]

Skills

1. The student has the ability to select the appropriate instrumental technique necessary to solve the analytical problem. [K_U14, K_U21]

2. The student has the ability to use specialized vocabulary in Polish and English. [K_U03, K_U06]

Social competences

1. The student understands the need for self-education and raising their professional competences. [K_K01]

2. The student is aware of compliance with the principles of engineering ethics in a broad sense. [K_K02, K_K05]

3. Student is able to interact and work in a group, taking on different roles in it. [K_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures end with a written exam checking the level of understanding of acquired knowledge and the ability to draw conclusions.

Laboratories: Each experiment is preceded by verbal or written verification of the acquisition of the theoretical foundations necessary for understanding a given instrumental method.

Programme content

These are sequentially selected instrumental techniques:

1. spectral (UV-VIS spectrophotometry, flame photometry, spectrography, atomic absorption spectrometry),

2 chromatographic (gas and liquid chromatography, combination of both techniques with mass spectrometry),

3. electrochemical (types of electrodes, polarography and its modifications).

4. Electrochemical sensors in the study of water and air pollution. Electrochemical metal deposition processes,

For each of these groups of techniques, the theoretical foundations of physicochemical phenomena leading to the formation of the analytical signal and the method of its measurement, apparatus and methods of its calibration, measurement errors and their elimination are discussed. In addition, examples of applications in the analysis of real samples are presented.

The laboratory course includes spectroscopic, electrochemical and chromatographic techniques. During the laboratory course students perform 8 experiments:

1. Ion-selective electrodes - determination of fluoride in mouthwash, toothpaste and tap water.

2. Potentiometric titration - determination of phosphoric acid in the Coca -Cola.

3. Voltammetric determination of ascorbic acid .

4. Gas chromatography - qualitative analysis of the composition of the solvent.

5. Atomic absorption spectrometry - determination of manganese in the waste sample and/or in vitamin supplement.

6. Atomic absorption spectrometry – optimization of parameters of electrothermal atomization for selected elements.

7.Flame photometry - the determination of sodium and potassium in the waste water and tap water samples.

8. Spectrophotometry II - Determination of iron (II)ions as a complex with o-phenanthroline in waste sample.

Before the laboratory course, students are acquainted with the general principles of health and safety at work in the chemical laboratory. During the training , safety instructions for a workplace are given.

After laboratory course, the student has the opportunity to improve or supplement the missing experiments.

Teaching methods

Lecture: multimedia presentation and discussion of examples

Laboratory course: performing experiments using instrumental techniques - practical classes

Bibliography

Basic

1. A. Cygański, Metody spektroskopowe w chemii analitycznej, WNT, Warszawa 1995

2. Z. Witkiewicz, Podstawy chromatografii, WNT, Warszawa 1995

3. A. Cygański, Podstawy metod elektroanalitycznych, WNT, 1999

4. J. Minczewski, Z. Marczenko, Chemia Analityczna. Analiza Instrumentalna, T.3, PWN, Warszawa 1985

5. P. Sudera, J. Silbering, Spektrometria mas, Wyd. Uniwersytetu Jagiellońskiego Kraków 2006

Additional

1. J. Dojlido, J. Zerbe, Instrumentalne metody badania wody i ścieków, Arkady, Warszawa 1997

2. W. Szczepaniak, Metody instrumentalne w analizie chemicznej, PWN, Warszawa 2002

3. D.A. Skoog, D.M. West, F.J.Holler, S.R. Crouch, Podstawy chemii analitycznej, T. 1 i 2, PWN, Warszawa 2006

4. Z. Witkiewicz, J. Hetper, Chromatografia gazowa, WNT, Warszawa 2001

5. J. Namieśnik, Z. Jamórgiewicz, M. Pilarczyk, L. Torres, Przygotowanie próbek środowiskowych do analizy, WNT Warszawa 2000

6. H. Scholl, T. Błaszczyk, P. Krzyczmonik - Elektrochemia Zarys Teorii i Praktyki, 2007

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,0
Classes requiring direct contact with the teacher	75	3,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam, raports preparation [1]	75	3,0

[1] delete or add other activities as appropriate