COURSE DESCRIPTION CARD - SYLLABUS

Course name

Instrumental Analysis

Course

Field of study

Chemical Technology

Year/Semester

II/3

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

English

Form of study

full-time

Requirements

compulsory

Number of hours

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

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

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Wydział Technologii Chemicznej

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Responsible for the course/lecturer:

Prerequisites

Basic knowledge of inorganic and analytical chemistry, apparatus used in the chemical laboratory, mathematical tools used in the chemical calculations.

Usage a of basic chemical apparatus and volumetric glassware.

Course objective

To familiarize students with instrumental techniques (apparatus, physicochemical phenomena, quantitative and qualitative analysis) and presentation of the possibility of using the instrumental techniques (analytical atomic spectrometry -F AAS, ET AAS, ICP/MIP/DCP OES, UV-VIS

spectrophotometry, chromatography, electroanalytical tchniques, mass spectrometry) and presentation of the possibility of using the instrumental techniques in industry, agriculture, environmental protection, health and scientific institutions.

Course-related learning outcomes

Knowledge

1. Student has the necessary knowledge in the field of instrumental techiques for the understanding of phenomena and processes occurring during analysis - [[K_W03,K_W11]]

2. Student has a systematic, theoretically founded general knowledge in the field of instrumental analysis - [[K_W08]]

Skills

1. Student can obtain the necessary information from the literature to conduct the determination of an analyte in the test sample - [[K_U01]]

2. Student is able to perform basic chemical analysis, interprets the results of analyzes and draw appropriate conclusions - [[K_U01, K_U18, K_U21]]

3. Student is able to work both individually and in team during the laboratory work - [[K_U02]]

Social competences

1. Student can obtain the necessary information from the literature to conduct the determination of an analyte in the test sample using instrumental technique - [- [K_K01]]

2. Student is able to perform basic chemical analysis, interprets the results of analyzes and draw appropriate conclusions - [[K_K02, K_K05]]

3. Student is able to work both individually and in team during the laboratory work - [[K_K03]]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Oral and written control of the student's knowledge before the laboratory classes. Written reports of the performed exercises. Oral or written exam.

Programme content

Theoretical basis of physicochemical phenomena leading to the analytical signal measurement, signal measurement methods, analytical characteristics of the method. Instrumentl techniques: atomic absorption (F AAS and GF AAS) and emission spectrometry (ICP/MIP/DCP), UV-VIS spectrophotometry, electrochemical methods , chromatography , mass spectrometry, continuous and flow injection analysis.

The cycle of the laboratory includes spectroscopic, electrochemical and chromatographic techniques:

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

2 Potentiometric titration - determination of phosphoric acid in the soft drinks;

3. Gas Chromatography - qualitative analysis of the composition of the solvent.

4. Atomic absorption spectrometry - quantitative determination of manganese in the waste water sample,

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

6.Spectrophotometry - Determination of iron (II) ions in the real sample

7. Voltammetric determination of ascorbic acid based on the anodic oxidation.

Teaching methods

Knowledge acquired during the lectures is verified during the written exam, containing 10-15 questions with different scores depending on the degree of difficulty. Passing threshold: 55% of points.

A series of laboratory exercises of instrumental analysis is preceded by checking the theoretical foundations of the methods used. Students prepare written reports on completed exercises.

1. Lecture: multimedia presentation supported with examples presented on the board.

2. Laboratory classes: analyte determinations using analytical apparatus in accordance with the instructor's instructions.

Bibliography

Basic

1. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Podstawy Chemii Analitycznej T. 1 i 2, PWN, Warszawa, (1) 2006, (2)2007

2. J. Minczewski, Z. Marczenko, Chemia Analityczna. Analiza Instrumentalna T. 1-3, PWN, Warszawa, 1,2 (2007), 1(1985)

3. A. Cygański, Chemiczne metody analizy ilościowej, WNT Warszawa, 2019

4. A Cygański, Metody spektroskopowe w chemii analitycznej, WNT, Warszawa, 2020

5. A Cygański, Metody elektroanalityczne, WNT, Warszawa, 1999

6. I. Baranowska (red.) Analiza śladowa – Zastosowania, Wydawnictwo MALAMUT, Warszawa, 2013

7. J. Namieśnik, P. Konieczka, B. Zygmunt, Ocena i kontrola jakości wyników analitycznych, WNT, 2014.

8. A. Cygański, B. Ptaszyński, J. Krystek, Obliczenia w chemii analitycznej, WNT Warszawa, 2004

9. M. Wesołowski, K. Szefer, D. Zimna, Zbiór zadań z analizy chemicznej,WNT Warszawa, 2002

Additional

1. W. Ufnalski, Równowagi jonowe, WNT Warszawa 2004

2. A. Hulanicki, Reakcje kwasów i zasad w chemii analitycznej, WN PWN Warszawa 1992

3. Z. Galus, Ćwiczenia rachunkowe z chemii analitycznej, WN PWN Warszawa 1993

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

Breakdown of average student's workload

	Hours	ECTS
Total workload	120	4,0
Classes requiring direct contact with the teacher	70	2,3
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam) [1]	50	1,7

[1] delete or add other activities as appropriate