COURSE DESCRIPTION CARD - SYLLABUS

Course name
Instrumental analysis [S1TCh2E>AI]

Course

Field of study
Chemical Technology

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

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

Issue related to instrumental analysis.

Course topics

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. Atomic absorption spectrometry
2 Atomis emission spectrometry. Flame photometry
3.Spectrophotometry
4. Gas Chromatography
5. Voltammetric determinations
6. Ion-selective electrodes
7. Potentiometric titration

Teaching methods

Knowledge acquired during the lectures is verified during the written exam, carried out in a stationary or remote mode via e-Kursy platform, containing 10 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.
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9. M. Wesołowski, K. Szefer, D. Zimna, Zbiór zadań z analizy chemicznej,WNT Warszawa, 2002

Additional:
1. Ślachciński, M., Modern chemical and photochemical vapor generators for use in optical emission and mass spectrometry, Journal of Analytical Atomic Spectrometry, 2019, 34(2), 257-273
2. W. Ufnalski, Równowagi jonowe, WNT Warszawa 2004
3. A. Hulanicki, Reakcje kwasów i zasad w chemii analitycznej, WN PWN Warszawa 1992
4. Z. Galus, Ćwiczenia rachunkowe z chemii analitycznej, WN PWN Warszawa 1993
5. J. Dojlido, J. Zerbe, Instrumentalne metody badania wody i ścieków, Arkady, Warszawa 1997

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	64	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	61	2,50