



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Analytical Chemistry

Course

Field of study

Chemical Technology

Area of study (specialization)

-

Level of study

First-cycle studies

Form of study

part-time

Year/Semester

2/3

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

Number of hours

Lecture

20

Laboratory classes

30

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

6

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

Basic knowledge of inorganic chemistry, apparatus used in the chemical laboratory, mathematical tools used in the chemical calculations. Usage of the basic chemical apparatus and volumetric glassware.

Understanding of the need to supplement her/his education and increasing personal and professional competences.

Course objective

To familiarize Students with the practical use of conventional (volumetric) techniques and methods used in analytical chemistry. To teach the proper way of conducting (methodology, preparation of standard solutions, titration, weighing, precipitation and filtration, washing, drying) the determinations carried out in the laboratory (acid-base titration, oxidation-reduction titrations, complexometric titration, precipitation, gravimetric techniques) as well as gaining proficiency in analytical calculations. Thus it will boost the Student's confidence in their own skills at performing the analytical procedures.



Course-related learning outcomes

Knowledge

1. Student has the necessary knowledge in the field of chemistry for the understanding of phenomena and processes occurring during the reaction used in analytical chemistry [K_W03, K_W11]
2. Student has the systematic, theoretically founded general knowledge in the field of analytical chemistry [K_W08]

Skills

1. Student can gather 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 analyses 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. Students understand the need for self-studying and improvement of their professional competences [K_K01]
2. Student is aware of the principles of engineering ethics [K_K02, K_K05]
3. Students can cooperate and work in a group, taking different roles [K_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired as a part of the lecture is verified during the exam at the end of the semester (carried out in a stationary or remote mode (e-Kursy platform), depending on the situation). The exam covers main branches of analytical chemistry (acid-base reactions, redoximetry, complexometry, precipitation analysis and gravimetric analysis). Passing threshold: 55% of points.

Skills acquired as a part of the laboratory exercises are verified on the basis of four final tests (carried out in a stationary or remote mode (e-Kursy platform), depending on the situation). Each colloquium consists of 5-8 tasks/questions, differently scored depending on their level of difficulty. Passing threshold: 55% of points.

After each completion of the laboratory exercise, Student is required to make a written report.

Programme content

Practical aspects of analytical chemistry: ionic activity and ionic strength in solutions; strong and weak electrolytes; equilibrium in the acid-base reactions, oxidation-reduction reactions, complexes formation



reactions, precipitate formation reactions; volumetric-titration techniques (titration curves, indicators, analytical calculations) :

1. The assessment of risks occurring during the laboratory work

2. Volumetric analysis:

- acid-base titration: determination of total acidity (HCl) in the presence of phenolphthalein, determination of total alkalinity (NaOH) in the presence of methyl orange, simultaneous determination of sodium carbonate and sodium bicarbonate using Warder titration, determination of ammonia using the formaldehyde method,

- oxidation-reduction titration: permanganometric determination of calcium, determination of phenol using a bromometric method, determination of dissolved oxygen by Winkler titration,

- complexometric titration: determination of water hardness ($\text{Ca}^{2+} + \text{Mg}^{2+}$), determination of Ca^{2+} and indirect determination of Mg^{2+} , determination of iron,

- precipitate titration - determination of chloride with the use of Mohr method, determination of chloride with the use of Volhard method.

Teaching methods

1. Lecture: multimedia presentation, discussion.

2. Laboratory exercises: performing practical exercises (determinations) in accordance with the schedule of the subject and written reports including the appropriate chemical reactions together with mathematical calculations.

Bibliography

Basic

1. J. Minczewski, Z. Marczenko, Chemia analityczna, t.1 i 2, PWN Warszawa 2007/2020

2. A. Cygański, Chemiczne metody analizy ilościowej, WNT Warszawa 2005/2013

3. D. A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Podstawy chemii analitycznej, t.1, WNT Warszawa 2006/2007

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

Additional

1. A. Hulanicki, Reakcje kwasów i zasad w chemii analitycznej, PWN Warszawa 1992/2012

2. Z. Galus, Ćwiczenia rachunkowe z chemii analitycznej, PWN Warszawa 2013/2020

3. R. Kellner, J.M. Mermet, M. Otto, H.M. Widmer, Analytical Chemistry, Wiley-VCH, Weinheim, 1998



Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,0
Classes requiring direct contact with the teacher	85	3,4
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam, reports preparation) ¹	65	2,6

¹ delete or add other activities as appropriate