KAPITAŁ LUDZKI
NARODOWA STRATEGIA SPÓJNOŚCI
Projekt współfinansowany przez Unię Europejską w ramach Europejskiego Funduszu Społecznego
UNIA EUROPEJSKA
EUROPEJSKI FUNDUSZ SPOŁECZNY

| Course title | ECTS code |
|---|---|
| Analytical chemistry | 13.3.0752 |

**Name of unit administrating study**

Faculty of Chemistry

**Studies**

| faculty | field of study | | |
|---|---|---|---|
| Faculty of Chemistry | Chemical Business | type | all |
| | | form | all |
| | | specialty | all |
| | | specialization | all |

**Teaching staff**

prof. dr hab. inż. Tadeusz Ossowski; dr Dorota Zarzeczańska; dr Anna Wcisło; dr hab. Grzegorz Romanowski; dr Jaromir Kira; dr Paweł Niedziałkowski; dr Iwona Dąbkowska

**Forms of classes, the realization and number of hours**

**Forms of classes**

Auditorium classes, Laboratory classes, Lecture

**The realization of activities**

classroom instruction

**Number of hours**

Auditorium classes: 30 hours, Lecture: 30 hours, Laboratory classes: 45 hours

**ECTS credits**

7
classes - 105 h
tutorial classes – 15 h
student's own work – 55 h

Total: 175 h - 7 ECTS

**The academic cycle**

2023/2024 winter semester

**Type of course**

obligatory

**Language of instruction**

polish

**Teaching methods**

- conducting experiments
- multimedia-based lecture
- problem solving

**Form and method of assessment and basic criteria for eveluation or examination requirements**

**Final evaluation**

- Graded credit
- Examination

**Assessment methods**

- written exam with open questions
- (mid-term / end-term) test
- assignment work – completing a specific practical assignment
- graded course credit based on individual grades obtained during the semester
- written exam (test)
- written exam, quiz type
  written exam with open questions (tasks)
  short tests/partial exams
  performance of assignments – execution of a specific practical work
  determination of the final grade based on partial grades received during the semester
- oral exam

**The basic criteria for evaluation**

| | |
|---|---|
| | • obtaining 51% of points from the written exam consisting of accounting tasks (50%), open questions (20%) and closed questions (30%) covering the scope of material carried out at the lecture, computational classes and laboratory exercises,<br>• obtaining 51% of points from two coputational colloquiums, covering material realized during computational exercises: (I) alkacimetry & redoximetry and (II) complexometry, weight and precipitation analysis; for each test, no more than one correction term is predicted<br>• laboratory - obtaining 51% of points from eight partial tests received during the semester, correct determination of all the ions in four out of five qualitative analyzes and execution with a maximum 3% error in six of the seven quantitative analyses; the results of each task can be checked twice; the application of health and safety rules in the analytical laboratory. |

## Method of verifying required learning outcomes

## Required courses and introductory requirements

**A. Formal requirements**

completed general chemistry course

**B. Prerequisites**

using basic laboratory glass and applying the rules of work in a chemical laboratory,
writing chemical reactions taking into account the stoichiometry of reactions and determining the products, e.g. sediment, gas, etc., describing chemical equilibrium in the solution using chemical reactions, balancing the oxidation and reduction reactions;
calculations based on chemical reactions, calculating molar concentrations, percentages, calculating the pH of electrolytes

## Aims of education

Aims of education
• introduction of the principles of division of cations and anions into analytical groups,
• acquainting with the basic methods used in the quantitative and qualitative analysis of inorganic compounds,
• using chemical calculations to quantitative determination of substances,
• acquiring the ability to independent execution of basic qualitative and quantitative analyzes.

## Course contents

Course contents
A. The lecture:
Chemical reactions in analytical chemistry. Equilibria in solutions. Determination and detectability of metal ions, anions and inorganic compounds. Collection and preparation of samples for analysis. Basic concepts of classical qualitative analysis. Analytic division of cations by Fresenius. Group reagents and conditions for their use. Characteristic reactions of cations and analytical effects. Division of anions into analytical groups according to Bunsen, characteristic reactions of selected anions. Basic concepts of classical quantitative analysis. Titration analysis - general part, division of titration methods (alkacimetry, redoximetry, complexometry, precipitation titration analyzes), EqP (equivalence point) and EP (end point) concepts, types of titrimetric methods (direct, indirect and inverse). Weight analysis - phenomena related to precipitation and dissolution of sediments. Evaluation of the analysis results.
B. The auditorium/computational exercises:
Calculation of: ion activity in solution, pH of substance and mixture solutions, redox and SEM potentials, oxidation and reduction constant, solubility of solutes with regard to ionic strength, protolysis and complexation, ion concentrations in complex solutions, results and titration curves (alkacymmetric, redoximetric, complexometric and precipitation type), errors and losses in quantitative analysis, prediction of the direction of oxidation and reduction.
C. Laboratory exercises:
Principles of work in the analytical laboratory, qualitative analysis of cations I, IIA and III of the Fresenius analytical groups and mixtures of anions, quantitative analysis of substances in solution (alkacymetry, redoximetry, complexometry, precipitation titration, weight analysis).

## Bibliography of literature

Bibliography of literature
Literature required to pass the course
J. Minczewski i Z. Marczenko, Chemia analityczna1 i 2
Z. Galus, Ćwiczenia rachunkowe z chemii analitycznej
T. Lipiec, Z.S. Szmal, Chemia analityczna z elementami analizy instrumentalnej
H. Bentkowska, Chemia analityczna jakościowa
A. Cygański, Chemiczne metody analizy ilościowej
A. Persony , Chemia analityczna. Podstawy klasycznej analizy ilościowej,
Extracurricular readings
D. Harvey, Modern Analytical Chemistry
W. Gorzelany, A. Śliwa, J. Wojciechowska, Półmikroanaliza jakościowa

| The learning outcomes (for the field of study and specialization) | |
|---|---|
| | **Knowledge**<br>Knowledge<br>The student:<br>1. Provides the composition of group reagents.<br>2. Explains the working principles of group reagents and analyte-specific reagents.<br>3. Defines the basic problems of the theory describing the course of ionic reactions in solution.<br>4. Lists and explains the modus-operandi of indicators used in the quantitative titration.<br>5. Uses the proper names of glass and laboratory equipment used in qualitative and quantitative analysis.<br>6. Illustrates the course of the titration with the appropriate curve.<br>7. Illustrates and describes by means of chemical equations reactions taking place during qualitative and quantitative determinations.<br>8. Selects the calculation method to determine the amount of substance in the solution.<br>9. Characterizes the basic principles of health and safety procedures at the analytical laboratory. |
| | **Skills**<br>Skills<br>1. Recognizes analytical effects of characteristic reactions performed during qualitative analysis.<br>2. Based on the reactions carried out, identifies and qualifies ions to the appropriate groups according to the Fresenius and Bunsen taxonomy.<br>3. Identifies and applies the laboratory glass suitable for qualitative and quantitative analysis.<br>4. Balances the equations of chemical reactions and uses them to calculate the quantity determined substance.<br>5. Performs alkacymmetric, redoximetric, precipitation and complexometric titrations and weight determination in accordance to the analytical regiments.<br>6. Recognizes the end point of the titration.<br>7. Carries out calculations that lead to the determination of the concentration of ions in the solution, taking into account the presence of several equilibrium in the solution.<br>8. Predicts the course of reactions in solution based on the quantity and properties dissolved substance.<br>9. Adheres to health and safety rules. |
| | **Social competence**<br>Social competence<br><br>1.Demonstrates the ability to draw conclusions based on the work done.<br>2. Works independently.<br>3. Takes responsibility for his workplace and adheres to the principles of work in the analytical laboratory.<br>4. Skillfully handles chemicals. |

**Contact**

tadeusz.ossowski@ug.edu.pl