# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Analytical Chemistry

## Course

Field of study
Chemical Technology

Year/Semester
I/2

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 | 45 | 0 |
| **Tutorials** | **Projects/seminars** | |
| 0 | 0 | |

## Number of credit points

5

## Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:
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## 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 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. Student understands 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. Student 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. The exam covers main branches of analytical chemistry (acid-base reactions, redoximetry, complexometry, precipitation 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. 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) and gravimetric analysis techniques:
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 (Ca2+ + Mg2+), determination of Ca2+ and indirect determination of Mg2+, 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. Analytical Chemistry; G.D. Christian, P.K. (Sandy) Dasgupta, K. A. Schug; John Wiley & Sons, Inc.

2. Modern Analytical Chemistry; D. Harvey; The McGraw-Hill Companies.

3. Quantitative Chemical Analysis; D.C. Harris; W.H. Freeman and Company, NY.

Additional

1. D.A.Skoog, D.M. West, F.J. Holler, S.R. Crouch, Fundamentals of Analytical Chemistry vol. 1, Brooks/Cole, USA, 2004

2. 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 | 125 | 5,0 |
| Classes requiring direct contact with the teacher | 75 | 3,0 |
| Student's own work (literature studies, preparation for laboratory, preparation for tests/exam) [1] | 50 | 2,0 |

[1] delete or add other activities as appropriate