Course Specifications
Valid as from the academic year 2020-2021

Electrochemical Analysis and Mass Spectrometry (C003985)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size (nominal values; actual values may depend on programme)

<table>
<thead>
<tr>
<th>Credits</th>
<th>Study time</th>
<th>Contact hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td>120 h</td>
<td>35.0 h</td>
</tr>
</tbody>
</table>

Course offerings and teaching methods in academic year 2020-2021

<table>
<thead>
<tr>
<th>A (semester 1)</th>
<th>Dutch</th>
<th>Gent</th>
<th>seminar: coached</th>
<th>10.0 h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>exercises</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>lecture</td>
<td>25.0 h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>online demonstration</td>
<td>0.0 h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>online seminar</td>
<td>0.0 h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>online lecture</td>
<td>0.0 h</td>
</tr>
</tbody>
</table>

Lecturers in academic year 2020-2021

Adriaens, Mieke
Vanhaecke, Frank

WE06 lecturer-in-charge
WE06 co-lecturer

Offered in the following programmes in 2020-2021

<table>
<thead>
<tr>
<th>Bachelor of Science in Chemistry</th>
<th>4</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linking Course Master of Science in Chemistry (main subject Analytical and Environmental Chemistry)</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>Preparatory Course Master of Science in Chemistry (main subject Analytical and Environmental Chemistry)</td>
<td>4</td>
<td>A</td>
</tr>
</tbody>
</table>

Teaching languages

Dutch

Keywords

Chemical analysis, electrochemical methods, mass spectrometry, ICP-mass spectrometry, radiochemistry

Position of the course

The course unit analytical chemistry: instrumental methods II is part of the educational curriculum analytical chemistry. It consists of three parts: (1) electrochemical analysis methods, (2) mass spectrometry and (3) radiochemistry.

(1) The partim electrochemical analysis methods focusses on two aspects: the theoretical background of electrochemical methods of analysis and the principles, possibilities and limitations, applications and mutual relations of the various classes of electrochemical methods of analysis.

(2) The section on mass spectrometry aims at providing insight into the operating principles of the most widely used types of mass spectrometers and detectors. As one example of a mass spectrometric technique, ICP-mass spectrometry is treated into more detail, with attention for, among other, sample introduction and interferences. Attention is devoted to the isotopic composition of the elements and the analytical capabilities provided by studying induced (via use of a stable isotopic tracer) and natural variation in isotope ratios.

(3) The section on radiochemistry aims at providing the students with a basic understanding of radioactive decay and devotes attention to some analytical applications based on this phenomenon.

The course is a continuation of the course analytical chemistry: introduction, where basic principles of analytical chemistry have been dealt with.

Contents

Partim electrochemical methods
- Polarization
- Transport

(Approved)
- Steady-state voltammetry
- Transient voltammetry
- Potentials in case of zero current
- Mixed potentials and corrosion
- Voltammetry - direct current methods and pulse methods
- Amperometry
- Methods that are based on the complete conversion of the electroactive component
- Potentiometry
- Conductometry

Partim mass spectrometry
- Mass spectrometry (MS)
- ICP-mass spectrometry (ICP-MS)
- Isotopic analysis

Partim radiochemistry
- Introduction to radiochemistry
- Stability of nuclides and radioactivity
- Types of radioactive decay: alpha, beta and gamma decay, spontaneous fission
- Chart of the nuclides
- Half-life
- Detection methods: gas-filled detectors, scintillation detectors, semiconductor detectors
- Safety aspects
- Applications: $^{14}$C dating, radiochemical vs. non-radiochemical methods for detection of short- and long-lived radionuclides, tracer experiment

Initial competences
Having followed the courses "Chemistry: Structure of Matter", "Chemistry II: Reactions", and "Analytical Chemistry: Introduction" or having their competences obtained via equivalent courses.

Final competences
1. The student has obtained an overview of electrochemical analysis techniques, their fields of application, capabilities and limitations.
2. The students are able to describe the fundamental principles of the various electrochemical analysis methods.
3. The student has obtained an understanding of the operating principle of the most widely used types of mass spectrometers and detectors and in ICP-mass spectrometry as a powerful method for trace element determination.
4. The student is aware of the possibilities of isotopic analysis.
5. The student has a basic understanding of radioactive decay.

Conditions for credit contract
Access to this course unit via a credit contract is determined after successful competences assessment.

Conditions for exam contract
This course unit cannot be taken via an exam contract.

Teaching methods
Lecture, seminar: coached exercises, online demonstration, online lecture, online seminar

Extra information on the teaching methods
Due to COVID19 alternate teaching methods may be implemented should these prove necessary.

Learning materials and price
Dutch lecture notes

References

Course content-related study coaching
Answering questions via email, after lectures or during personal meetings after making an appointment by e-mail.

Evaluation methods

(Approved)
end-of-term evaluation
Examination methods in case of periodic evaluation during the first examination period
   Written examination with open questions, written examination with multiple choice questions,
   open book examination
Examination methods in case of periodic evaluation during the second examination period
   Written examination with open questions, written examination with multiple choice questions,
   open book examination
Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation
   not applicable
Extra information on the examination methods
   Periodic evaluation: evaluation of the insight into basic concepts and problem solving.
Calculation of the examination mark
   When the student scores less than 10/20 for at least one of three components of the course, he/she can no longer pass the entire course unit. If the total score is a mark of ten or more out of twenty, then this is reduced to the highest failing mark (9/20).