Course Specifications
Valid as from the academic year 2015-2016

X-ray and Laser Spectroscopy (C002559)

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>6.0</td>
<td>150 h</td>
<td>50.0 h</td>
</tr>
</tbody>
</table>

Course offerings and teaching methods in academic year 2017-2018

A (semester 2)

- lecture  30.0 h
- practicum  5.0 h
- seminar  15.0 h

Lecturers in academic year 2017-2018

Vincze, Laszlo WE08 lecturer-in-charge

Offered in the following programmes in 2017-2018

<table>
<thead>
<tr>
<th>Programme</th>
<th>crdts</th>
<th>offering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master of Science in Chemistry</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Exchange Programme in Chemistry (master's level)</td>
<td>6</td>
<td>A</td>
</tr>
</tbody>
</table>

Teaching languages

English

Keywords

Quantitative X-ray fluorescence (XRF), X-ray absorption spectroscopy (XANES/EXAFS), X-ray microanalysis, synchrotron radiation; lasers, laser induced breakdown spectroscopy (LIBS), Raman spectroscopy, laser induced fluorescence spectroscopy (LIFS)

Position of the course

Contents

X-ray spectroscopy:
- Interactions of X-rays with matter
- Properties of conventional X-ray and synchrotron radiation (SR) sources
- Quantitative methods in (SR)XRF analysis
- X-ray Absorption Near Edge Structure (XANES) spectroscopy: theory, instrumentation and applications
- Extended X-ray Absorption Fine Structure (EXAFS) spectroscopy: theory, instrumentation and applications
- Scanning X-ray microanalysis using synchrotron radiation
- X-ray fluorescence microtomography: theory, instrumentation and applications.
- Confocal X-ray fluorescence imaging

Laser spectroscopy:
- Working principle of lasers
- Types of lasers
- Properties of laser light
- Laser safety
- Interactions between laser light and matter
- Laser Induced Breakdown Spectroscopy (LIBS): theory, instrumentation, and applications
- Laser Ablation: theory, instrumentation, and applications
- Laser Induced Fluorescence Spectroscopy (LIFS): theory, instrumentation, and applications
- Raman Spectroscopy: theory, instrumentation, and applications

Initial competences

Having followed successfully the course “Spectroscopische analysemethoden / Spectroscopic Methods of Analysis” or having achieved these competences in an

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alternative way.

**Final competences**

1. Detailed knowledge on the interaction types of X-rays with matter, relevant for XRF/XANES/EXAFS spectroscopy.
2. Knowledge on the properties of conventional and synchrotron radiation sources.
3. The students are able to describe various approaches in quantitative XRF-analysis.
4. Knowledge on the principles of (synchrotron radiation) micro-XRF, XRF microtomography and XANES/EXAFS spectroscopy.
5. Detailed knowledge on the different types of lasers and are able to explain their working principle.
6. Detailed knowledge on the properties of laser light and on possible laser hazards.
7. The students are able to explain the working principles of LIBS, laser ablation, LIFS and Raman Spectroscopy; they can describe the respective instrumentations and are aware of possible applications of these techniques.

**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, practicum, seminar

**Learning materials and price**

- English syllabus, estimated cost 16 €

**References**


**Course content-related study coaching**

**Evaluation methods**

end-of-term evaluation and continuous assessment

**Examination methods in case of periodic evaluation during the first examination period**

Written examination

**Examination methods in case of periodic evaluation during the second examination period**

Written examination

**Examination methods in case of permanent evaluation**

Participation, report

**Possibilities of retake in case of permanent evaluation**

not applicable

**Calculation of the examination mark**

Written exam counts for 80%, practical exercise for 20%.

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