Bostedt Christoph, Boyarkine Oleg, Emsley Lyndon				
Chemical Engineering	BA5	Obl.	teaching Credits Session Semester	Linglish
Chemistry	BA5	Obl.		4 Winter Fall
HES - CGC	н	Obl.		
			Exam	Written
			Workload	120h
			Weeks	14
			Hours	4 weekly
			Lecture	3 weekly
			Exercises	1 weekly
			Number of positions	

# Summary

CH-314

The aim of this course is to treat three of the major techniques for structural characterization of molecules: mass spectrometry, NMR, and X-ray techniques.

#### Content

Weeks 1-5: Mass Spectrometry (Prof. Rizzo)

- Introduction to mass spectrometry
- Masses of elements and molecules
- Isotopes and isotope distributions
- Figures of merit: mass accuracy and resolution
- Mass spectrometry instrumentation: Ion sources, mass analyzers, and detectors

Structural analysis

- Tandem MS
- Ion mobility MS
- Combining MS with IR spectroscopy for molecular identification

#### Weeks 6-10: NMR (Prof. Emsley)

- Principles of nuclear magnetism
- Quantum description of magnetic resonance leading to the vector model
- Interactions defining the spectrum: chemical shifts, scalar, dipolar and quadrupolar couplings
- Time-domain spectroscopy by pulsed excitation: interaction with radiofrequency fields, coherence, precession, signal induction and the Fourier Tranform
- Relaxation and the return to equilibrium
- Polarization transfer
- Multi-dimensional correlation spectroscopy

#### Weeks (11-14): X-ray (Prof. Bostedt)

- Introduction to x-rays and x-ray sources
- X-ray properties of the elements
- Diffraction and refraction
- Scattering and imaging
- X-ray spectroscopy

### Keywords

#### 2023-2024 COURSE BOOKLET

Learning Outcomes

By the end of the course, the student must be able to:

# **Transversal skills**

- Access and evaluate appropriate sources of information.
- Set objectives and design an action plan to reach those objectives.

# Assessment methods

Written Examination

# Resources

Moodle Link

• https://go.epfl.ch/CH-314