CH-456

Molecular spectroscopy in chemistry

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Cursus	Sem.	Type
Chimiste	MA1, MA3	Opt.

Language of teaching	English
Credits	2
Session	Winter
Semester	Fall
Exam	Oral
Workload	60h
Weeks	14
Hours	**2 weekly**
Lecture	2 weekly
Number of positions	

Summary

Summary The course first, overviews the necessary background topics in geometrical and wave optics, quantum mechanics. This follows by studying the fundamentals of lasers, particular types of lasers and their applications for spectroscopy, chemical conversion, biomedical research and applications.

Content

- Brief introduction to the light wave properties, geometrical optics, diffration and interferomety phenomena and quantum mechanics.
- Fundamentals of lasers, different types of modern lasers and their practical use.
- Laser wavelength conversion, nonlinear optics.
- Laser spectroscopy, laser chemistry, laser applications in biological research and in medicine.

Keywords

chemistry, spectroscopy, wavelength, nonlinear, optics, biomolecules, analytical, polarization

Learning Prerequisites

Required courses

Basic in physics, in statistical and quantum mechanics.

Recommended courses

Basic in physics, in statistical and quantum mechanics.

Important concepts to start the course

Boltzmann distribution, molecular degrees of freedom, electromagnetic radiatio

Learning Outcomes

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

- Analyze basic parts of lasers
- Characterize laser radiation

- Operate commercial lasers
- Propose the optimal type of laser for their need
- Select appropriately type of spectroscopic method
- Design an experimental approach for identification of biomolecules
- Interpret the results of spectroscopic measurements
- Elaborate optimal spectroscopic anapytical approach

Transversal skills

- Demonstrate a capacity for creativity.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.

Teaching methods

PP presentations,
solving simple problems
demonstration of experiments

Expected student activities

actively ask questions

Assessment methods

oral exam

Supervision

Office hours	No
Assistants	No
Forum	No

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

G. R. Fowles, *Introduction to Modern Optics* (Holt, Reinhart, Winston, New York, 1978); ISBN 0-03-089404-2
J. H. Moore, C. C. Davis and M. A. Coplan, *Building Scientific Apparatus* (Addison-Wesley, Redwood City, 1989); ISBN 0-201-13189-7
A. E. Siegmann, *Lasers* (University Science Books, Mill Valley, 1986); ISBN 0-935702-11-5
A. Yariv, *Introduction to Optical Electronics*, (Holt, Reinhart, Winston, New York, 1976); ISBN 0-03-089892-7
D. L. Anrews, *Lasers in Chemistry* (Springer, 1997); ISBN 3-540-61982-8

Ressources en bibliothèque

- Lasers in chemistry / Andrews
- Introduction to modern optics / Fowles
- Building scientific apparatus / Moore
- Lasers / Siegemann
- Introduction to optical electronics / Yariv

Notes/Handbook
Lecture notes

Moodle Link
- https://go.epfl.ch/CH-456