CH-446

Lasers and applications in chemistry

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Cursus	Sem.	Type
Chemistry	BA6	Opt.
HES - CGC	E	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Oral
Workload	90h
Weeks	14
Hours	**2 weekly**
Courses	2 weekly
Number of positions	

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

laser, chemistry, spectroscopy, wavelength, nonlinear, optics, peptide, polarization

Learning Prerequisites

Required courses

Basic in physics, in statistical and quantum mechanics.

Recommended courses

Very basic in chemistry, optics, spectroscopy

Important concepts to start the course

Boltzmann distribution, molecular degrees of freedom, electromagnetic radiation

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
- Compare different types of lasers
- Construct a suitable tunable laser
- Propose the optimal type of laser for their need
- Formulate basic criteria for the desired laser
- Classify lasers by their hazard

Transversal skills

- Assess progress against the plan, and adapt the plan as appropriate.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Use a work methodology appropriate to the task.

Teaching methods

PP presentations, in-room demonstrations, solving numerical problems

Expected student activities

ask questions,
solve problems

Assessment methods

Count lecture activity and work on home problems,
Understanding the physical principles of the studied phenomena.
Link practical construction details to fundamental principles.
Knowledge of basic characteristic of lasers,
Ability to use the derived expressions
Aility to derive a few basic expressions

Resources

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

Notes/Handbook

Course description and PP presentations will be given to each student