Last update: 13-05-2015

230570 - LASERS - Laser Systems and Applications

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 721 - FEN - Department of Physics and Nuclear Engineering

Academic year: 2015

Degree: ERASMUS MUNDUS MASTER'S DEGREE IN PHOTONICS ENGINEERING, NANOPHOTONICS AND BIOPHOTONICS (Syllabus 2010). (Teaching unit Optional)
MASTER'S DEGREE IN PHOTONICS (Syllabus 2013). (Teaching unit Optional)

ECTS credits: 3 Teaching languages: English

Teaching staff

Coordinator: Cristina Masoller, UPC (coord.).

Others: Fidel Vega, UPC.

Opening hours

Timetable: cristina.masoller@upc.edu
fvega@oo.upc.edu

Degree competences to which the subject contributes

Transversal:

1. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
2. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.
3. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.
4. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.
5. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

Teaching methodology

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Learning objectives of the subject

The aim of this course is to provide the students a broad overview of the various laser systems currently being used in both scientific and industrial fields. Specific attention will be paid to cutting-edge applications such as diode lasers for telecoms and excimer and femtosecond lasers for micromachining and biomedical applications. This course also includes complementary activities such as hands-on computing sessions and visits to nearby industries which use lasers systems for material processing and laser-equipment for biomedical applications.

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The course is given in the second semester.

BIBLIOGRAPHY:
The course will include only parts of these references, at an appropriate level
- Fundamentals of Photonics, B. E.A. Saleh and M.C. Teich (Wiley, 2nd ed., 2007).
- Photonic devices, J.-M. Liu (Cambridge University Press, 2005).
- Semiconductor Lasers: Stability, Instability and Chaos, J. Ohtsubo (Springer, 2006).
- Laser Processing of Materials, P. Schaaf ed. (Springer, 2010).
- Femtosecond laser pulses: principles and experiments, C. Rulliere (Springer 1998).

Study load

Total learning time: 75h	Theory classes:	22h 30m	30.00%
	Practical classes:	0h	0.00%
	Laboratory classes:	0h	0.00%
	Guided study:	2h 15m	3.00%
	Self study:	50h 15m	67.00%

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Content

1.- Low-power laser systems for communications and information processing.

Degree competences to which the content contributes:

Description:
1.1.-Semiconductor laser physics.
1.2.-Types of semiconductor lasers and models.
1.3.-Applications in communications and information processing.

2.- Laser systems for high power applications.

Degree competences to which the content contributes:

Description:
2.1.-Laser-based material processing. Requirements to take into account for different processes: cutting, welding, drilling, marking, surface treatment, rapid prototyping (3D printing or additive manufacturing).
2.2.-Laser systems with minimum thermal load (excimer lasers and femtosecond lasers). Non-thermal ablation and micromachining.
2.3.-Examples of applications, photonic components production based on laser manufacturing (waveguides, beam-splitters).
2.4.-Laser safety.

3.- Laser systems for biomedical applications

Degree competences to which the content contributes:

Description:
3.1.-Laser surgery
3.2.-Laser patterning in biomaterials
3.3.-Optogenetics
3.4.-Lab-on-a-chip devices

Qualification system

- Oral or written presentation. The student will be able to chose to either give an oral presentation on a topic that he/she will chose among a list of topics proposed by the professors, or, to present a written report on the subject, in the same format as a journal article ¿with abstract, introduction, results, conclusions and bibliography (50%).
- Exam (30%).
- Attending classes, lab visits and hands-on sessions (20%)

Bibliography