

## 230565 - ULTRA - Ultrafast and Ultraintense Laser Light

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:	Jens Biegert, ICFO
Others:	Jose Trull, UPC Carles Serrat, UPC

### Opening hours

Timetable:	jens.biegert@icfo.eu (coordinator) jose.francisco.trull@upc.edu carles.serrat-jurado@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. 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

-

### Learning objectives of the subject

The course will give an overview on the challenges to produce ultra-short and ultra-intense laser light as well as highlight the different physical effects and possibilities pertaining to their usage. We will highlight state of the art methods and novel possibilities at the frontier of science

#### BIBLIOGRAPHY:

- Diels & Rudolph, "Ultrashort Laser Pulse Phenomena", Academic Press

## 230565 - ULTRA - Ultrafast and Ultraintense Laser Light

- Eberly & Milonni, "Lasers", John Wiley & Sons
- Trebino, "Frequency-Resolved Optical Gating", Kluwer Academic Publishers

### 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%

## 230565 - ULTRA - Ultrafast and Ultraintense Laser Light

### Content

#### 1. Ultrashort laser and X-ray pulses (J. Biegert)

Degree competences to which the content contributes:

Description:

- 1.1. Basic concepts for ultrabroadband pulses
- 1.2. Issues in amplification / OPCPA
- 1.3. Few-cycle pulse propagation
- 1.4. Few-cycle pulses / the absolute phase / frequency combs
- 1.5. High-harmonic generation, X-ray and Attosecond pulse generation

#### 2. Pulse characterization (J. Trull)

Degree competences to which the content contributes:

Description:

- 2.1. General issues
- 2.2. Short pulse characterization
- 2.3. Reconstructions methods
- 2.4. Spatio-temporal characterization
- 2.5. Pulse shaping techniques

#### 3. Coherent control and intense matter interaction (C. Serrat)

Degree competences to which the content contributes:

Description:

- 3.1. Basic concepts
- 3.2. Coherent control schemes
- 3.3. Optimal control theory
- 3.4. Attosecond coherent control

### Qualification system

- Homework + exam (35% + 35%)
- Attending and participation in class (30%)

Homework will be given for the three main sections of the course plus a final exam. Active participation in the class is an important aspect and will influence the final grades significantly.

### Bibliography