

230569 - PHOTOV - Optoelectronics and Photovoltaic Technology

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2014
Degree: MASTER IN PHOTONICS (Syllabus 2013). (Teaching unit Optional)
ERASMUS MUNDUS MASTER IN PHOTONICS ENGINEERING, NANOPHOTONICS AND BIOPHOTONICS (Syllabus 2010). (Teaching unit Optional)
MASTER IN ELECTRONIC ENGINEERING (Syllabus 2009). (Teaching unit Optional)
MASTER IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 3 Teaching languages: English

Teaching staff

Coordinator: Ramon Alcubilla, UPC (coord).
Others: Joaquim Puigdollers, UPC.
Cristobal Voz, UPC.

Opening hours

Timetable: ramon.alcubilla@upc.edu (coordinator).
Joaquim.puigdollers@upc.edu
cristobal.voz@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.

Teaching methodology

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Learning objectives of the subject

A BRIEF DESCRIPTION

The basic concepts and tools for the understanding and analysis of optical semiconductor devices are presented. Representative devices for light generation and detection are treated. Examples of circuital aspects in light emission and

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detection are discussed; Special emphasis is devoted to photovoltaic solar cells, covering conventional crystalline structures, thin film cells and advanced concepts.

TABLE OF CONTENTS:

- 1- Currents in a semiconductor. Generation and recombination. Radiative and non radiative recombinations. Continuity equation. Diffusion equation.
- 2- Photodiodes: Diode electrostatics. PIN and Avalanche Photodiode (PIN & APD).
- 3- Signal to noise ratio. Unified approach to PIN, APD and Photomultipliers (PMT).
- 4- Heterojunctions. Band diagrams. Current λ voltage characteristics.
- 5- LED's basic structure. Emitted power calculation.
- 6- Laser diodes: Population inversion. Fermi's pseudo λ levels.
- 7- Properties of sunlight. Solar cell operation and PN junctions
- 8- Crystalline solar cells.
- 9- Thin film solar cells.
- 10 λ Solar cell characterization
- 11- New concepts in photovoltaic conversion.

BIBLIOGRAPHY

Safa O. Kasap: Optoelectronics & Photonics. Principles & Practices. Prentice Hall 2012
 Jenny Nelson The Physics of solar cells. Imperial College Press 2004

Study load

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|--------------------------|---------------------|---------|--------|
| Total learning time: 75h | Hours large group: | 22h 30m | 30.00% |
| | Hours medium group: | 0h | 0.00% |
| | Hours small group: | 0h | 0.00% |
| | Guided activities: | 2h 15m | 3.00% |
| | Self study: | 50h 15m | 67.00% |

Qualification system

- Exam: written 60 %
- Exercises and homeworks 20%.
- Assistance 20 %

Bibliography