



230567 - INTEGR - Integrated Photonics

Coordinating unit: 230 - ETSIB Barcelona School of Telecommunications Engineering
Teaching unit: 1004 - UB - Universitat de Barcelona
Academic year: 2015 - 2016
Degree: Master's Degree in Photonics
 Erasmus Mundus Master's Degree in Photonics Engineering, Nanophotonics and Biophotonics
ECTS credits: 3 **Teaching languages:** English

Academic staff

Coordinator: [Sergi Hernandez](#) (UB) shernandez@el.ub.edu
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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. 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.
3. 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.
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

Lectures

Objectives and short description of the course

The objective of this course is to give in depth knowledge of devices that are basic components of integrated-photonic integrated-systems, including optical couplers, micro-ring resonators or nonlinear photonic devices. The fabrication processes, technology steps and designing tools will be described in detail. Emphasis in state of the art materials (Si or III-V compounds) will be made in the descriptions of photonics devices.

Study load

Total learning time: 75h	Hours large group:	22.5h	30%
	Hours medium group:	0h	0%
	Hours small group:	0h	0%
	Guided activity:	2.25h	3%
	Self study:	50.25h	67%

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Course index

1. Introduction

2. Passive integrated photonic components

- 2.1 Waveguides (rib, strip-loaded, slot...).
- 2.2 Optical couplers.
- 2.3 Add/drop micro-rings.
- 2.4 Tapers, MMIs, MZI.
- 2.5 Prism coupling and Periodic Coupling. Gratings for biosensing.

3. Active integrated photonic components

- 3.1 Light sources: lasers and LEDs.
- 3.2 Optical amplifiers: waveguides and SOA.
- 3.3 Detectors for visible and infrared ranges.
- 3.4 Modulators: Electro-optic and acousto-optics devices.

4. Integrated micro and nanophotonics technology

- 4.1 Technological platforms for photonic integrated circuits (PIC).
- 4.2 Basic technology steps (deposition, lithography, etching). Polymer technologies.
- 4.3 Optoelectronic hybrid integration.
- 4.4 Microlens and MOEMS for Optical Communications.
- 4.5 Simulation tools for designing photonic integrated systems.

Qualification system

Written exam (60%)

Simulation work based on OptiFDTD (20%)

Oral presentation regarding simulation work (20%)

Bibliography

- Fundamentals of Photonics. Salech – Teich. Wiley Series in Pure and Applied Optics.
- Integrated Photonics: Fundamentals, Ginés Lifante, John Wiley & Sons Ltd. (England) 2003.
- Elements of Photonics, Keigo Iizuka, John Wiley & Sons, Inc. (New York) 2002.
- Fundamentals of Optoelectronics, Clifford R. Pollock, McGraw-Hill, (New York) 1994.
- Integrated optics. Ed. T.Tamir. Springer-Verlag. Topics in Applied Physics.
- Microoptics: Elements, systems and applications. Hans Peter Herzig.
- MOEMS. Micro-Opto-Electro-Mechanical Systems. Ed. Motamedi. SPIE Press.