Last update: 15-10-2019

205085 - Applications of Photonics Technologies

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering

Teaching unit: 748 - FIS - Department of Physics

Academic year: 2019

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Teaching unit Optional)
MASTER'S DEGREE IN AUTOMATIC SYSTEMS AND INDUSTRIAL ELECTRONICS (Syllabus 2012). (Teaching unit Optional)

ECTS credits: 3 Teaching languages: English

Teaching staff

Coordinator: CRISTINA MASOLLER

Others: Primer quadrimestre:
CRISTINA MASOLLER - 1
SANTIAGO ROYO ROYO - 1

Teaching methodology

The course develops through lectures imparted with the aid of power-point presentations. Practical examples open to discussion will be incorporated in the lectures. The students will also visit the research laboratories of Prof. Masoller (at Gaia building) and Prof. Royo (at CD6 Center) to gain hands-on experience on the operation of laser diodes and photonic sensors.

Learning objectives of the subject

Light-based technologies are nowadays extensively developed and employed in many intelligent manufacturing environments, such as aerospace, automotive, energy, micro-manufacturing, semiconductors, surface finish, optics, etc. Femtosecond lasers and photonic imaging sensors are just two examples of photonic devices that are being widely used in the innovative manufacturing processes of medical devices, optoelectronic sensors, health and solar cells. By providing intelligence and interconnection, such photonic devices enable the design of new efficient and adaptive production concepts for the factory of the future.

This course will provide the students with a broad overview of Photonic Technologies for Industry 4.0, introducing the basics on detectors and emitters of radiation and focusing on applications in laser processing, inspection and monitoring systems for QA (Quality Assurance), self-driven cars and robotics, medical devices, predictive diagnostics and optical sensors for the IoT. Extended practical cases on three agreed use cases with hand-on work in the lab will be implemented, being possible the development of use cases proposed by the students as small projects.

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Study load

Total learning time: 75h	Hours large group:	18h	24.00%
	Hours medium group:	0h	0.00%
	Hours small group:	9h	12.00%
	Guided activities:	0h	0.00%
	Self study:	48h	64.00%

Content

Module 1: Photonic devices and properties of light for applications

Learning time: 37h 30m

Theory classes: 9h
Laboratory classes: 4h 30m
Self study : 24h

Description:
1.1. Properties of light from the point of view of applications.
1.2. Introduction to light sources (different types of lasers, LEDs), photonic detectors and sensors, and light handling and light shaping components for industrial applications

Related activities:
- Lectures and discussion of examples.
- Laboratory visit and systems manipulation.

Module 2: Applications of Photonics to Industry 4.0

Learning time: 37h 30m

Theory classes: 9h
Laboratory classes: 4h 30m
Self study : 24h

Description:
2.1. Applications of Photonics to Industry 4.0: laser processing, light-measuring systems (position, critical dimensions, speed, color, shape, texture, temperature, etc.), medical devices
2.2. Case studies: laser manufacturing, sensors for IoT (vibrometry, flowmetry), self-driving cars, in-vivo health monitoring

Related activities:
- Lectures and discussion of examples
- Module 2 involves three extended theory+lab sessions on agreed use cases, including theory and practical development. Alternatively, analysis of practical cases proposed by the students may be developed as short projects.

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Qualification system

The students will have to present a report for each module of the course. One of the reports can be a short oral presentation (depending on the number of students) that will be followed by questions. The final grade will be the average of the grades obtained in the reports. The final grade will also take into account the student ' s participation in class and in the visits to the laboratories.

Bibliography

Basic:

J. M. Liu. Photonic devices . Cambridge University Press, 2009.

J.Donnelly, N.Massa . Light: Introduction to Optics and Photonics . Photonics Media , 2017.

K.Iniewski . Smart sensors for industrial applications. CRC Press , 2017.

Lasers in industry. Photonics Media Press, 2016.

Complementary:

B.E.A . Saleh and M.C. Teich . Fundamentals of Photonics . 2nd ed. Wiley, 2007.