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230809 - OPTO3D - Optoelectronic Devices and 3D Vision

Coordinating unit:	230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit:	739 - TSC - Department of Signal Theory and Communications 710 - EEL - Department of Electronic Engineering
Academic year:	2016
Degree:	BACHELOR'S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Optional) BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Teaching unit Optional) BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Teaching unit Optional) BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Optional)
ECTS credits:	6
Teaching languages:	Catalan, Spanish

Teaching staff

Coordinator:	Voz Sanchez, Cristobal
Others:	Bermejo Broto, Alexandra

Opening hours

Timetable: To agree with the student by appointment by e-mail

Prior skills

Common subjects of the Bachelor's degree in Telecommunications Technologies and Services Engineering

Teaching methodology

- Lectures
- Exercises
- Short answer test (Control)
- Extended answer test (Final Exam)

Learning objectives of the subject

Understanding how the main optoelectronic and image devices work and the underlying physical principles.

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Study load

Total learning time: 150h	Hours large group:	52h	34.67%
	Self study:	98h	65.33%

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Content

1.- Nature of light

Learning time: 8h
Theory classes: 8h

Description:
Wave-particle duality
Refractive index, dispersion
Reflexion and refraction of light: Fresnel equations
Antireflection coatings, dielectric mirrors
Light absorption
Superposition, interferences and difraction

2.- Semiconductor fundamentals

Learning time: 14h
Theory classes: 14h

Description:
Energy bands
Intrinsic and extrinsic semiconductors
Thermal equilibrium, generation and recombination
Charge carrier transport, drift and difussion
Continuity equations
The PN junction diode
Homojunctions and heterojunctions

3.- Optoelectronic devices

Learning time: 14h
Theory classes: 14h

Description:
Light-Dependent-Resistance (LDR)
The solar cell: principles, photovoltaic energy generation, fabrication technology
The photodiode: responsivity and quantum efficiency
The light-emitting diode: LED efficiency, device structure
The laser diode: stimulated emission, efficiency and monochromaticity

4.- Image devices

Learning time: 12h
Theory classes: 12h

Description:
Electronic ink: ebook operation
Photocopiers and scanners: working principles
Image sensors: CCD and CMOS, active and passive matrix displays
Display technologies: LCD, TFT and OLED

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4.- PRESENTATION OF STUDENT REPORTS (4 hours)	Learning time: 4h Theory classes: 4h
Description: 4.1.- Presentation of student reports	

Planning of activities

EXERCISES	Hours: 60h Self study: 60h
Description: Exercises published in ATENEA must be answered and returned by the student.	

PAPER ON THE WORK	Hours: 28h Laboratory classes: 28h
Description: Students must work on a topic previously agreed with the lecturer. They must submit also a written report.	

Qualification system

Course evaluation:
The syllabus is divided into four parts: nature of light, semiconductor fundamentals, optoelectronic devices and image devices. Each part is evaluated separately with a control (15 points) and exercices (5 points). In addition, the student will present a work about the concepts studied during the course (20%).
Controls=4x15%=60%
Exercises=4x5%=20%
Work=20%
Students who pass this assessment will pass the course and do not need to attend the final exam.

Final exam:
The final exam is intended for students not passing the course controls and assignments or to improve their qualification. The final exam will replace the qualification of controls and exercises.
Final exam=80%
Work=20%

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Bibliography

Basic:

Kasap, S.O. Optoelectronics and photonics: principles and practices. 2nd ed. rev. Upper Saddle River, NJ: Prentice Hall, 2013. ISBN 9780273774174.

Prat, L.; Calderer, J. Dispositius electrònics i fotònics: fonaments [on line]. 2a. ed. Barcelona: Edicions UPC, 2006 [Consultation: 10/03/2015]. Available on: <http://hdl.handle.net/2099.3/36595>. ISBN 8483018551.

Chen, J.; Cranton, W.; Fihn, M. Handbook of visual display technology [on line]. 2nd. ed. Cham: Springer International Publishing, 2016 [Consultation: 05/05/2017]. Available on: <http://dx.doi.org/10.1007/978-3-319-14346-0>. ISBN 9783319143460.