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 TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (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 SYSTEMS ENGINEERING (Syllabus 2010). (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.
### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 52h (34.67%)</th>
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<tbody>
<tr>
<td>Self study:</td>
<td>98h (65.33%)</td>
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### Content

#### 1.- Nature of light
**Description:**
- Wave-particle duality
- Refractive index, dispersion
- Reflection and refraction of light: Fresnel equations
- Antireflection coatings, dielectric mirrors
- Light absorption
- Superposition, interferences and diffraction

**Learning time:** 8h  
Theory classes: 8h

#### 2.- Semiconductor fundamentals
**Description:**
- Energy bands
- Intrinsic and extrinsic semiconductors
- Thermal equilibrium, generation and recombination
- Charge carrier transport, drift and diffusion
- Continuity equations
- The PN junction diode
- Homojunctions and heterojunctions

**Learning time:** 14h  
Theory classes: 14h

#### 3.- Optoelectronic devices
**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

**Learning time:** 14h  
Theory classes: 14h

#### 4.- Image devices
**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

**Learning time:** 12h  
Theory classes: 12h
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 exercises (5 points). In addition, the student will present a work about the concepts studied during the course (20%).

Controls: 4 x 15% = 60%  
Exercises: 4 x 5% = 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:

