230809 - OPTO3D - Optoelectronic Devices and 3D Vision

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 230 - ETSETB - Barcelona School of Telecommunications 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.
# Study load

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

Total learning time: 150h

Hours large group: 52h

Self study: 98h

34.67%

65.33%
# 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 diffraction

## 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 diffusion  
- 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
Planning of activities

EXERCISES

| Hours: 60h |
| Theory classes: 4h |

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=$4 \times 15\% = 60\%$

Exercises=$4 \times 5\% = 20\%$

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\%
Bibliography

Basic:

