



Course guides

230809 - OPTO3D - Optoelectronic Devices and 3D Vision

Last modified: 27/10/2016

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.
710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2016 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Voz Sanchez, Cristobal

Others: Bermejo Broto, Alexandra

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

Type	Hours	Percentage
Self study	98,0	65.33
Hours large group	52,0	34.67

Total learning time: 150 h

CONTENTS

1.- Nature of light

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

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

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

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

4.- PRESENTATION OF STUDENT REPORTS (4 hours)

Description:

4.1.- Presentation of student reports



ACTIVITIES

EXERCISES

Description:

Exercises published in ATENEA must be answered and returned by the student.

Full-or-part-time: 60 h

Self study: 60h

PAPER ON THE WORK

Description:

Students must work on a topic previously agreed with the lecturer. They must submit also a written report.

Full-or-part-time: 28 h

Laboratory classes: 28h

GRADING 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:

- 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 fotogrònics: 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.