

## Course guide

# 230466 - PEF1 - Projects of Engineering Physics 1

Last modified: 25/05/2023

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

**Degree:** BACHELOR'S DEGREE IN ENGINEERING PHYSICS (Syllabus 2011). (Compulsory subject).

**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

### LECTURER

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**Coordinating lecturer:** Consultar aquí / See here:  
<https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura>

**Others:** Consultar aquí / See here:  
<https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma>

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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#### Specific:

1. Knowledge of experimental techniques and procedures in the field of physics, engineering and nanotechnology. Ability to design experiments using the scientific method and criteria of efficiency, rationality and cost.
2. Knowledge of experimental data analysis techniques. Knowledge of statistical methods for experimental data treatment. Ability to process, analyze and graphically present experimental data.

#### Generical:

6. ABILITY TO IDENTIFY, FORMULATE, AND SOLVE PHYSICAL ENGINEERING PROBLEMS. Planning and solving physical engineering problems with initiative, making decisions and with creativity. Developing methods of analysis and problem solving in a systematic and creative way.

7. ABILITY TO CONCEIVE, DESIGN, IMPLEMENT, AND OPERATE COMPLEX PHYSICAL ENGINEERING SYSTEMS.

Ability to conceive, design, implement, and operate complex systems in the fields of micro and nano technology, electronics, advanced materials, photonics, biotechnology, and space and nuclear sciences.

3. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

#### Transversal:

1. ENTREPRENEURSHIP AND INNOVATION - Level 2. Taking initiatives that give rise to opportunities and to new products and solutions, doing so with a vision of process implementation and market understanding, and involving others in projects that have to be carried out.
4. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
5. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

## TEACHING METHODOLOGY

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Lectures.  
Individual work.  
Team assignments (at home).  
Laboratory sessions.

## LEARNING OBJECTIVES OF THE SUBJECT

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Understand the problems associated with measurements and security in a lab environment.  
Learn to analyze, measure and design basic analog circuits.  
Be able to plan and develop a low complexity electronics project.  
Understand light phenomena in geometric and wave optics.  
Understand and analyze phenomena related to polarization, interference and diffraction.  
Be able to build and analyze simple optics systems.

## STUDY LOAD

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Type	Hours	Percentage
Hours large group	26,0	17.33
Hours small group	39,0	26.00
Self study	85,0	56.67

**Total learning time:** 150 h

## CONTENTS

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### 1. Introduction to laboratory

**Description:**

Lab organization. Schedule. General lab rules. Final project description.

**Full-or-part-time:** 1h 30m

Theory classes: 1h

Self study : 0h 30m

### 2. Security, errors and data processing

**Description:**

Electrical security. Connections and grounding. Errors. Basic data processing.

**Full-or-part-time:** 9h

Theory classes: 5h

Self study : 4h

### 3. Optical theory

**Description:**

1. Light: Introduction, light sources and electromagnetic waves.
2. Geometric optics: Basic concepts, devices and aberrations.
3. Wave optics: Interference, diffraction and polarization.

**Full-or-part-time:** 18h 30m

Theory classes: 10h

Self study : 8h 30m

### 4. Basic start-up notions

**Full-or-part-time:** 8h 30m

Theory classes: 6h

Self study : 2h 30m

### 5. Electronics lab sessions

**Description:**

- A1: Static measurements.
- A2: Dynamic measurements.
- A3: Amplifiers.
- A4: Sensors.
- D1: Introduction to MCUs
- D2: Serial port.
- D3: Analog signals.
- D4: Interrupts.
- D5: Stepper motor control.

**Full-or-part-time:** 48h 30m

Laboratory classes: 18h

Self study : 30h 30m

### 6. Optic lab sessions

**Description:**

- 1: Refraction index measurement.
- 2 & 3: Light polarization.
- 4: Optical systems and image formation.
- 5: Interference and optical diffraction.
- 6: Interference and microwave diffraction.

**Full-or-part-time:** 32h 30m

Laboratory classes: 12h

Self study : 20h 30m



## 7. Development of an electronics project

### Description:

Development of an electronic project following a sequence of phases:

- Project proposal and schedule.
- Project development.
- Project assessment and presentation.

The project can be selected from a pool of options or can be a new proposal. In any event the professors will check that its complexity is adequate.

**Full-or-part-time:** 31h 30m

Guided activities: 14h

Self study : 17h 30m

## GRADING SYSTEM

The final assessment will be a weighted mean between Optics (35%) and Electronics (65%).

Electronics assessment:

Laboratory (60%)

Calculations prior to class (10%)

Lab work (20%)

Final report (30%)

Project (40%)

Complexity (10%)

Project plan (10%)

Final report (20%)

Optics lab assessment:

Calculations prior to class (20%)

Lab work (20%)

Final report (60%)

## BIBLIOGRAPHY

### Basic:

- Hecht, E. Optics. 5th ed. Harlow: Pearson, 2017. ISBN 9781292096933.

- Wolf, S.; Smith, R.F.M. Student reference manual for electronic instrumentation laboratories. 2nd ed. Upper Saddle River: Pearson Education, 2004. ISBN 0130421820.

### Complementary:

- Margolis, M.; Jepson, B.; Weldin, Nicholas Robert. Arduino cookbook: recipes to begin, expand, and enhance your projects [on line]. 3rd ed. Sebastopol: O'Reilly Media, Inc., 2020 [Consultation: 02/07/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=6177122>. ISBN 9781491903506.