GENERAL OBJECTIVES OF THE SUBJECT

1. Provide a minimum knowledge to understand why light is useful for technological applications, particularly for engineering. It will be considered how the light is generated, in particular by means of lasers, how it is controlled and detected, and what properties have to make it more and more useful today.

2.- To illustrate the practical potentials of light through the detailed knowledge of the research and knowledge transfer activities that are carried out on the Terrassa Campus, in particular the CD6 (Center for the Development of Sensors, Instruments and Systems, https://www.cd6.upc.edu/) and the DONLL Group (Non Linear Dynamics, Nonlinear Optics and Lasers Research Group, https://donll.upc.edu/), through explanations, visits to laboratories, manipulations, etc.

3. Analyze the criteria of design and use of the electro-optical sensors, in order to introduce them into control systems and automated production environments. Also know the current operation and applications, especially in materials processing and industrial metrology, of the different types of lasers with industrial interest, their specifications, their control systems and their integration in automatic systems. Also know, to a certain extent, other current investigations, in nonlinear optics, characterization of materials and biomedicine.
## Study load

<table>
<thead>
<tr>
<th></th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong> 75h</td>
<td>27h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>48h</td>
</tr>
<tr>
<td></td>
<td>36.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
## Content

### 1. Optical Radiation. What is light, and basic properties

**Learning time:** 10h  
Theory classes: 1h 30m  
Guided activities: 1h 30m  
Self study: 7h

**Description:**  

**Related activities:**  
All

**Specific objectives:**  
Learn about the most useful properties of light, which will allow us to understand the applications and experiments of laboratories that we will visit.

### 2. Photonic sensors, metrology. Related research activities, on the Campus de Terrassa.

**Learning time:** 25h  
Theory classes: 0h  
Guided activities: 9h  
Self study: 16h

**Description:**  
Description, visit and handling of photonic sensors, for measurements, optimization, detection of presence, detection of defects, etc.

**Related activities:**  
All

**Specific objectives:**  
To know the different types of photonic sensors and different applications that are developed on the Campus, and manipulate some of them. Acquire the ability to find out and select the most suitable type of sensor, depending on the application.
### 3. Laser systems for the materials processing.

**Learning time:** 16h  
- Theory classes: 1h  
- Guided activities: 5h  
- Self study: 10h  

**Description:**  
Study of laser systems that are used for the processing of materials, from welding in cars and industrial companies to marking and 3D laser printing. Numerical control practice.

**Related activities:**  
All

**Specific objectives:**  
Understand the type of laser systems that exist and their potentialities, as well as the handling of one of them and the practice of numerical control.

### 4. Applications of Photonics in other fields.  
**Research activities on the Terrassa Campus.**

**Learning time:** 24h  
- Theory classes: 0h  
- Guided activities: 9h  
- Self study: 15h  

**Description:**  
Applications of Photonics to nonlinear optics (generation of new frequencies, etc.), structural analysis and study of processes in materials, medicine, communications, nonlinear dynamics, generation, measurement and applications of pulses of ultra short duration, etc. Visit of experiments in the research laboratories of the Campus.

**Related activities:**  
All

**Specific objectives:**  
Learn about other applications of lasers and photonic technologies, in different fields, knowing what is done on the campus and participating in its manipulation, to the extent possible.
### Planning of activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
<th>Description</th>
<th>Support materials</th>
<th>Specific objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1 Lecture classes (through examples)</strong></td>
<td>6h 30m</td>
<td>Lectures given by the professor, giving examples</td>
<td>Bibliography, internet, technical information</td>
<td>To know the minimum bases on the concepts, phenomena, devices and systems that will be observed in the laboratories.</td>
</tr>
<tr>
<td><strong>A2 Practice classes and supervised work</strong></td>
<td>35h 30m</td>
<td>Consideration of examples that will be visited, and direction / advice for the realization, on the part of the students, of a small summary or work in relation to the laboratories visits or the design of a photonic system for a certain type of application, proposed by the student.</td>
<td>Bibliography, internet, technical information, laboratory material.</td>
<td>Foster creative and entrepreneurial skills to design new technical applications.</td>
</tr>
<tr>
<td><strong>A3. Laboratory visits</strong></td>
<td>33h</td>
<td>Visit of Campus laboratories, demonstration of experiments, and participation whenever possible.</td>
<td>Laboratory equipment.</td>
<td>To know materials, devices and real photonic systems, in particular lasers, and learn how to handle them.</td>
</tr>
</tbody>
</table>

**Support materials:**
- Bibliography
- Internet
- Technical information
- Laboratory material

**Specific objectives:**
- To know the minimum bases on the concepts, phenomena, devices and systems that will be observed in the laboratories.
- Foster creative and entrepreneurial skills to design new technical applications.
- The evaluation will be based on active attendance at the sessions.
205069 - Photonics Sensors and Laser Technology

Qualification system

Attendance to classes and explanations about campus laboratories (30%) and active assistance to visits to laboratories and research groups (20% +20% +20%). Conducting a small report or work (10%).

Regulations for carrying out activities

(No exam will be held)

Bibliography

Basic:


Complementary:


Others resources:

Visit to Campus research laboratories.