

60039 - Security and industrial processes with laser

Syllabus Information

Academic year: 2023/24

Subject: 60039 - Security and industrial processes with laser

Faculty / School: 100 - Facultad de Ciencias

Degree: 538 - Master's in Physics and Physical Technologies
589 - Master's in Physics and Physical Technologies

ECTS: 5.0

Year: 1

Semester: First semester

Subject type: Optional

Module:

1. General information

This subject deals with a subject of great interest as lasers allow different industrial, scientific and everyday applications. The subject aims to provide basic training in the use, characterization and applications of laser systems.

It is recommended that students have a basic background in optics. Part of its contents are related to the subjects "Applications of Optics in the Industrial Environment" (first four-month period) and "Materials Science" (first four-month period).

These approaches and objectives are aligned with SDG 4 (Quality Education) of the Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (<https://www.un.org/sustainabledevelopment/es/>).

2. Learning results

Nowadays, lasers are used in a large number of scientific, medical and industrial experimental facilities. Therefore, for a student doing a master's degree in Physics, it is important to have a broad knowledge of lasers and sufficient experimental skills in their handling, as well as a basic knowledge of the interaction of laser radiation on materials and its applications in materials science and in the industrial environment.

The student, in order to pass this subject, must demonstrate the following learning results:

- Search and analyse scientific and/or commercial information on lasers, discriminate superfluous information and relate relevant information to possible applications of such lasers.
- Decide on and plan appropriate safety measures for an experimental facility containing any lasers.
- Select the type of laser system required to carry out different treatment processes on different types of materials: heating, melting, vaporization.
- Understand, analyse and present in a report the relevant results in a materials processing experiment (such as glass or crystal fabrication, welding, cutting, ablation machining, surface modification, etc.).

3. Syllabus

Master Sessions:

1. Laser description. Technical specifications.
2. Optical characteristics and laser beam transformation.
3. Main types of lasers (description, characteristics, applications).
4. Interaction of radiation with matter.
5. Laser systems in industrial processes.
6. Safety in laser environments.
7. Industrial processes.

The practices are grouped into the following two sessions:

- Propagation and transformation of a laser beam in compliance with safety standards.
- Laser-assisted melting and ablation processes applied to materials processing.

4. Academic activities

The program offers the students help to achieve the expected results and comprises the following activities:

- Participative lectures, case studies and problem-based learning. These activities will be developed in 4 ECTS (100 hours) with an attendance of 40% (40 hours).
- Laboratory practices and demonstrations. They will be developed in 1 ECTS (25 hours) with an attendance of 10% (10 hours).

5. Assessment system

The student must demonstrate achievement of the intended learning results through the following assessment activities:

1. Answers to technical questions about the laser and its applications (70% of the final grade).
2. Performance of laboratory practices and presentation of a report on each one of them (30% of the final grade).

Passing the subject by means of a single global test.

The subject is planned primarily for face-to-face sessions. However, there will be a global assessment test of the subject, as indicated in the regulations of the University of Zaragoza. This test will be of a theoretical-practical nature.