

## 26919 - Electromagnetic Waves

### Syllabus Information

**Academic year:** 2023/24

**Subject:** 26919 - Electromagnetic Waves

**Faculty / School:** 100 - Facultad de Ciencias

**Degree:** 447 - Degree in Physics

**ECTS:** 6.0

**Year:** 2

**Semester:** Second semester

**Subject type:** Compulsory

**Module:**

#### 1. General information

Starting from Maxwell's equations and the propagation equation we will describe the basic phenomenology of electromagnetic radiation propagation in different media and with boundary conditions and some of the related applications. The main objective is to provide the student with a knowledge of the nature of Electromagnetic Waves and the phenomena associated with their propagation, allowing them to understand, describe and quantify these phenomena.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (<https://www.un.org/sustainabledevelopment/es/>), in such a way that they will contribute to a certain extent to the achievement of Objectives 4.3 and 4.4 of Goal 4.

It is recommended to have previously taken the subject Electromagnetism.

#### 2. Learning results

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

- To know the nature of electromagnetic waves: spectrum, transversality, intensity, etc
- To identify which quantities describe an electromagnetic wave: amplitude, frequency, propagation speed, polarization
- To understand the phenomena present in the propagation of these waves: reflection, refraction, diffraction.
- To describe the result of the superposition of electromagnetic waves: interference, wave groups, polarization.
- To know how to characterize propagation in dielectric and conductive media: scattering, absorption.
- To understand the phenomena present when there is a change of medium in propagation: Brewster's angle, total reflection.
- To know the characteristics of guided propagation: propagation modes, cut-off frequency, attenuation, dispersion.
- To have information on the characteristics of antennas and other sources of electromagnetic waves.

#### 3. Syllabus

**The program of the subject will be structured in the following topics:**

0. Introduction,
1. Electromagnetic waves, fundamentals
2. Radiation beams.
3. Polarization.
4. Interference. Diffraction.
5. Radiation-matter interaction.
6. Change of medium.
7. Guided waves.
8. Generation of electromagnetic radiation.

#### 4. Academic activities

**The distribution, in terms of credits and classroom hours, of the different programmed activities is as follows:**

- Theoretical classes: 3.5 credits, which will represent 35 hours of student attendance and will be carried out in the format of master class.
- Types of problems: 1.5 credits, which will represent 15 hours of student attendance and will be carried out in participatory class format.
- Laboratory practices: 1 credit, which will involve 10 face-to-face hours of the student and will be carried out in four sessions in the laboratory: one of explanation (duration of 1 hour) and three of laboratory practices (3 hours of duration each).

## **5. Assessment system**

There will be two different systems to assess students: The percentages of the different evaluation tools in each system are as follows:

### **Continuous assessment system**

- 10% continuous evaluation activities proposed by the teacher
- 20% short reports of the activities carried out in the laboratory practices
- 70% Grade obtained in a theoretical-practical exam divided in two parts (theory and problems) carried out during the period established for this purpose

### **Continuous assessment system**

- 20% short reports of the activities carried out in the laboratory practices
- 80% Grade obtained in a theoretical-practical exam divided in two parts (theory and problems) carried out during the period the period established for this purpose

Both systems will have the following requirements:

- The laboratory practices are of compulsory attendance and in order to pass them it will be an essential condition to hand in their reports and to obtain a grade of at least 5 out of 10
- The grade of the exam will be the average of those obtained in the two parts of which it consists, being necessary to pass the subject that both are greater or equal to 4 out of 10, and that the average is greater or equal to 5
- The student's final grade will correspond to the highest of the grades obtained with the two possible systems.