Universidad Zaragoza

Academic Year/course: 2023/24

30310 - Electromagnetism and Waves

Syllabus Information

Academic year: 2023/24
Subject: 30310 - Electromagnetism and Waves
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 438 - Bachelor's Degree in Telecommunications Technology and Services Engineering
581 - Bachelor's Degree in Telecommunications Technology and Services Engineering
ECTS: 6.0
Year: 2
Semester: First semester
Subject type: Basic Education
Module:

1. General information

This subject provides the student with the understanding and mastery of the basic concepts of the general laws of acoustic and electromagnetic waves, and their application to solve problems related to the engineering of telecommunication technologies and services. As a basic subject, it contributes to the competence in the fundamentals of scientific-technological knowledge.

In order to successfully take this subject, it is highly recommended to have acquired the competencies corresponding to the subjects of physics and mathematics in the first year.

These approaches and objectives are aligned with the Sustainable Development Goals (SDGs) of the 2030 Agenda of United Nations (https://www.un.org/sustainabledevelopment/es/) and the activities planned in this subject will contribute to some extent to the achievement of targets 7.3, 7b, 8.2, 9.1, 9.5 and 9c of the corresponding goals.

2. Learning results

- To know the fundamental concepts and laws of fields, waves and electromagnetism and to know how to apply them correctly to basic engineering problems.
- To know the characteristic parameters of plane and spherical waves, as well as the phenomena associated with the superposition and interference of waves.
- To know and know how to apply the expressions of the energy associated with the magnetic and electric field.
- To properly formulate and interpret the physical meaning of Maxwell's equations in integral and differential form in vacuum and in material media.
- To deduce and know how to apply plane wave solutions for potentials and electromagnetic fields in simple infinite and semi-infinite media.
- Solve in a complete and reasoned way, using a rigorous, clear and precise language, exercises and problems of electromagnetism and waves, reaching correct numerical results expressed in the appropriate units.
- Correctly use basic methods of measurement, processing, presentation and interpretation of experimental data, relating these with the appropriate physical magnitudes and laws and identifying the degree of approximation used.
- Write a simple technical report or paper integrating experimental results and theoretical foundations and be able to present it orally.

3. Syllabus

Theory:

1. Introduction to the electromagnetic model.
2. Electrostatics in vacuum and in material media.
3. Stationary electric current. Current density.
4. Magnetostatics in vacuum and in material media.
5. Electromagnetic field
6. Fundamentals of waves.
7. Electromagnetic waves in infinite media.
8. Reflection and refraction of plane electromagnetic waves.
9. Sound waves in the air.

Practices:

1. Measurement of the permittivity of dielectrics.
2. Numerical solution of the Laplace Equation.

3. Experimental verification of the Faraday-Lenz Law. Shielding by conductors.

4. Computer simulation of plane wave propagation in different media.

5. Propagation of ultrasound in air.

4. Academic activities

Face-to-face activities:

Timetables and dates defined by EINA

- Participatory lectures 40 hours, in classroom.
- Problem solving and case studies: 10 hours, in classroom.
- Laboratory practices: 10 hours in 5 two-hour sessions, in small groups, in the laboratory.
- Assessment tests. 3 hours, in classroom.

Other activities:

- Tutored group work (information search, case resolution, report writing, meetings): 27 hours Personal work (study, problem solving and writing practice reports): 60 hours

5. Assessment system

The student will have a **global test** in each session. The grade will be calculated as follows:

1. W**ritten exam (60%)** with two parts, both with the same weight: a theoretical one in which the knowledge acquired is evaluated through a series of short questions and a practical one in which theproblem solving capacity is evaluated

2. Laboratory practicals (25%) The evaluation will be carried out through the presentation of a written report in a specified format, with a deadline for each practice.

3. Tutored group work (15%): The assessment will be carried out by means of a written report with a due date that will include theoretical developments and the resolution of specific problems.

In order to pass the subject, a minimum score of 3.5 out of 10 is required in each of the two parts of the written exam, as well as an average of at least 4 out of 10 in both parts.

The evaluation system for the practice and tutored work will be governed exclusively by the continuous assessment modality in the first call. Those students who have not been able to complete the practices and/or work during the term will have the possibility of passing them and/or work exam in the second exam session.