Electromagnetic Fields

Academic Year: (2023 / 2024) **Review date: 28/04/2023 12:59:12**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: INCLAN SANCHEZ, LUIS FERNANDO DE

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

- Physics
- Calculus I
- Calculus II
- Linear Algebra

OBJECTIVES

Introduction to the theory of waves: plane waves and guided waves. Fundamentals of wave propagation and radiation fundamentals.

Ability to understand the mechanisms of propagation and transmission of electromagnetic waves and their corresponding transmitter devices
and receptors.

Study and characterization of the primary acoustic signals. Study of the transmission of both flat and spherical acoustic waves, considering free field and confined spaces.

DESCRIPTION OF CONTENTS: PROGRAMME

- Acoustic signals and systems in the time and frequency domains.
- Plane waves in the free field. Acoustic intensity. Coherence and incoherence phenomena.
- Spherical wave in the free field. Directivity. Simple source. Source composition.
- Stationary waves. Acoustic material characterization.
- Electrostatics and Magnetostatics. Maxwell's Equations.
- Plane- wave propagation.
- Guided waves propagation.
- Radiation and Antennas.

LEARNING ACTIVITIES AND METHODOLOGY

Four types of training activities are proposed: Lectures , problem classes, labs and interactive online content.

ECTS credits in all cases include the share of staff or team work by the student .

THEORY LESSONS (3 ECTS)
Theory classes will be lectures on board with using transparencies or other media to illustrate certain concepts . These classes are supplemented by explanations actual examples of applied electromagnetism and professional sound systems .

Through these sessions students will acquire the basic content of the course. The student , based on the explanations of teachers, should deepen the concepts explained , solving and developing cases that will arise in lectures .

Problems (1.25 ECTS)
For the class of problems (face-to-face teaching in small groups) , students will have in advance of the relevant statements.
In this type of class students will be organized into small groups so actively involved in solving problems .

Problem solving by students will serve to assimilate the concepts presented in class theory in a more applied context and self-assess their knowledge.

The kinds of problems include pooling of individual solutions and joint correction, which should serve to consolidate knowledge and develop the ability to analyze and communicate the relevant information for troubleshooting.

PRACTICES (1 ECTS)
The practice sessions will be conducted online. Basically consist of demonstrations of basic concepts in the laboratory and computers, in which the student participates actively .

Practices are held by computer , preferably using Matlab, and have the following contents:

Practice 1: SIMPLE HARMONIC MOTION.
- Addition of signal levels

Practice 2: SPHERICAL WAVES.

- Constructive and destructive fields emitted by ideal point source (concept of radiation pattern of an array of isotropic sources) contributions .

Practice 3 : PLANE WAVES

Part I: Diagram standing wave at normal incidence .

Part II : Polarization of plane waves .

Practice 4: GUIDED WAVES

Part I: Brillouin diagram and impedance mode.

Part II : Analysis of TEmn modes for a traveling wave (lossless case) .

ONLINE CONTENT (0.75 ECTS):
-complementary material
-interactive activities

ASSESSMENT SYSTEM

% end-of-term-examination/test:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

The continuous assessment will consist of tests (2-tests) performed during the development of the semester (30%) and assessment of practices done and online activities associated with the interactive content part (20%).

The final exam (50%) will consist of two parts.
Theory (short questions, 40% final exam grade)
Problems (2 or 3 problems on various topics, 60% final exam grade)

BASIC BIBLIOGRAPHY

- David K. Cheng Fundamentals of Engineering Electromagnetics, Pearson, 1993

- F.T. Ulaby, U. Ravaioli Fundamentals of applied electromagnetics , Pearson, 2015

- José Luis Vázquez Roy Course Notes, Aula Global II, 2015

- L. A. Kinsler Fundamentos de acústica, Limusa, 1988

- Manuel Recuero López Ingeniería Acústica, Paraninfo, 1999

ADDITIONAL BIBLIOGRAPHY

- C. Balanis Advanced Engineering Electromagnetics, Wiley, 2012

- D. M. Pozar Microwave engineering , John Wiley & Sons, 2011

- Nathan Ida Engineering Electromagnetics, Springer, third edition, 2015