Antenna Technology

Academic Year: (2023 / 2024) **Review date: 24-04-2023**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: SEGOVIA VARGAS, DANIEL

Type: Electives ECTS Credits : 6.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Electromagnetic Fields

OBJECTIVES

Through this course, the student will learn basic knowledge about the fundamentals of the mechanism of radiation and propagation of electromagnetic waves both in free space as well as in a guided medium. Besides the most common procedures used in practice to apply the electromagnetic model will be introduced. In order to achieve this goal, the student will obtain a knowledge base and a set of skills.
In terms of knowledge, after this course the student will learn:

To understand the basis of the propagation of electromagnetic waves and to know the parameters that describe this propagation.
To know the global electromagnetic model including Maxwell equations and boundary conditions.
To understand the main role that the medium where electromagnetic waves propagate plays when analyzing this propagation. The student will learn how to characterize electromagnetically the different media.
To know plane waves as a good approximation for many realistic situations, their characteristics, and how they propagate when there are discontinuities. Special attention will be paid to polarization.
To know the fundamentals of propagation of electromagnetic waves by not physical support.
To learn the fundamentals that determine the controlled radiation of the electromagnetic waves. This includes concepts related to antennas and the parameters that characterize them.
To understand the role of the different elements that in a radiolink to allow the radiolink evaluation.

In terms of the skills, we can classify them into specific skill and generic skills.

The specific skills include:

To understand the meaning of the different parameters which characterize the propagation of electromagnetic waves in homogeneous medium or by a physical support.
To interpret the polarization of a plane wave.
To classify the media as a function of their electromagnetic characteristics.
To analyze what happens when a travelling electromagnetic wave propagating in an homogeneous medium finds a different medium. To correctly interpret the associated phenomena of reflection and transmission, including the particular case of good conductors.
To analyze the characteristics of wave propagation in a waveguide, being able of calculation the waveguide cutoff frequency, attenuation, etc. Similarly, the student will be able of designing waveguides fulfilling required work specifications. This concerns both rectangular waveguides and transmission lines.
To understand the meaning of the parameters used to characterize an antenna. To be able of selecting according to these parameters (directivity, polarization, radiation pattern) the best antenna for a particular type of radio communication.
To evaluate radiolinks knowing the elements that intervienen en los mismos: transmitting and receiving antenna, distance

DESCRIPTION OF CONTENTS: PROGRAMME

1. Theoretical concept review about fundamental characteristics of antennas.
2. Vector potential A and F. Wire antennas.
3. Arrays: analysis and synthesis.

4. Aperture antennas. Reflector antennas.
5. Introduction to wave propagation.

LEARNING ACTIVITIES AND METHODOLOGY

The following activities will be combined as described in the detailed program of the course:

1- Theory lectures in the blackboard and with slides. Resolution of small exercises
2- Problems
3- Labs (four labs in computer room and experimental laboratories)
4- Office hours
5- Proposed exercises with solutions will be published in each chapter for self-studying.

ASSESSMENT SYSTEM

Global exam at the end of the semester (60% of the final grade (6 points)).
Theory exam (without books or notes): test and/or short questions: 40%
3 to 4 problems with a manuscript summary of equations (10 pages maximum): 60%.

The last 40% will be obtained by the continuous evaluation (4 points). This includes in the middle of the course an exam.
Realization of 4 lectures in the laboratory. Each assignment includes an evaluation test.

A minimum of 4 points in the final exam is required to consider the points achieved by the continuous evaluation.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- Cardama Antenas, UPC, 1986
- Krauss Antennas, McGraw Hill, 2001
- Schelkunoff Antennas Theriy and Practice, Wiley, 1954

ADDITIONAL BIBLIOGRAPHY

- Balanis Antennas, Wiley, 2011