Wireless propagation and transmission

Academic Year: (2023 / 2024) **Review date: 07-06-2021**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: RAJO IGLESIAS, EVA

Type: Compulsory ECTS Credits : 6.0

Year : 4 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Electromagnetic Fields
High Frequency Technologies

OBJECTIVES

PROGRAM OUTCOMES AND GOALS
Through this course, the student will learn the basic concepts on antenna engineering. In order to achieve this goal, the student will obtain a knowledge based on a set of skills.
In terms of knowledge, the student will learn:

Knowledge of nowadays telecommunication antennas such as mobile telecommunication antennas, broadcast antennas, etc.

The basis of the radiation and radiowave propagation concepts. Knowledge of the following concepts: directivity, gain, radiation pattern and polarization concepts.

The radiation integral and the Fourier Transform applied to antennas.

Analysis of antenna arrays: linear and planar arrays in regular lattices.

Analysis of aperture antennas and horn antennas. Reflector antennas.

Introduction to radiowave propagation: attention will be paid to propagation conditions in radiolinks.

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

Basic concepts of radiation and radiation parameters.

Analysis and design of linear antennas: dipoles, loops and monopoles.

Analysis of antenna arrays.

Analysis and design of aperture antennas:

Horn antennas.

Reflector antennas.

In terms of the generic skills, during the course the student will achieve:

¿ Overview of telecommunication systems by analysing and understanding the essential role of the antennas as the last stage of the transmitting or receiving RF-front-end. The student will achieve the ability to apply knowledge of mathematics and physics to design different kinds of antennas. (PO a)

¿ In addition he/she will be able to identify the antennas needed to develop a specific front-end by conducting (software packages such as CST or ADS) and discussing the corresponding results. (PO b, c, e and k)

¿ Ability to work in group and effectively communicate the results of the realized experiments by explaining in speech the results of the experiments. (PO g, k)

¿ Assumption by the student of the necessity continuous learning and knowledge of the contemporary issues. (PO a, c, j, k)

REQUIREMENT:
Knowledge similar to that given in the following subjects of this course are assumed: Electromagnetic fields (3rd course, 1st four-month period) and High frequency techniques (3rd course, 2nd four-month period).
BASIC BIBLIOGRAPHY:

¿ D. Segovia and L.E. García, notes of the course

¿ C. A. Balanis: Antenna Theory Analysis and Design. 2nd or 3rd Edition Wiley

¿ Cardama, Jofre, Romeu, Rius, Blanch: Antenas. Ediciones UPC

¿ Kraus, J.D.: Antennas. McGraw-Hill, 1988.

¿ W. Stutzman: Antenna Theory and Design. Wiley

ADDITIONAL BIBLIOGRAPHY:

¿ Collin, R.E.: Antennas and Radiowave Propagation. McGraw-Hill, 1985.

¿ R.S. Elliot: Antenna Theory and Design: re

DESCRIPTION OF CONTENTS: PROGRAMME

1) Fundamentals of radiation: antenna parameters.
2) Wire antennas: dipoles and monopoles.
3) Antenna arrays: analysis and synthesis.
4) Aperture antennas. Reflector antennas.

LEARNING ACTIVITIES AND METHODOLOGY

The teaching methodology will consist of three parts:

Lectures on the main theoretical topics: the main theoretical topics of the course will be presented in these classes. Both the blackboard and computer presentations will be used. The students can have a text book and a set of slides covering all the topics in the course. This set of slides will be available from the beginning of the course. (PO a y c).

Lectures on practical exercises. The students group will be divided in smaller groups with less than forty students. The students can have a problems book with many problems covering the topics of the course.(PO c y e)

Practical work in the laboratory. Two kinds of practical work will be developed. Common sessions for all the students that will be divided in groups of 20 students. In the common session a final quiz will have to be filled by the students. (PO b y k)

ASSESSMENT SYSTEM

The evaluation allows knowing the degree of satisfaction of the knowledge goal, thus all work of the students will be evaluated by using continuous evaluation of their activities by two midterm exams (one about wire antennas and the other about arrays with a total of 30%), four labs with software CST (10%) and a final exam (60%)

The evaluation criterion is based on both a final exam (60% of the final mark) and a continuous evaluation (40% of the final mark).

The final exam will consist of a short questions part that has to be done without books and a problems part that will be done with notes. (PO a, c and e)

The continuous evaluation procedure will consist of 2 exams with an overall weight of 30% and the labs work that will be developed by the students that has a weight of 10%. (PO a, b, c, e and k).

In any case, to pass the course the student need to get at least 4 points over 10 in the Final Exam.

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

BASIC BIBLIOGRAPHY

- Balanis, C. Antenna theory : analysis and design , 3rd Edition, John Wiley & Sons, 2005
- Collin, R.E. Antennas and radiowave propagation , McGraw-Hill, 1985
- Kraus, J. D. Antennas : for all applications , McGraw-Hill, 2002
- Stutzman, W.L. Antenna theory and design , John Wiley & Sons, 1998

ADDITIONAL BIBLIOGRAPHY

- Chen, Z.N. Antennas for portable devices , John Wiley & Sons, 2007
- James, J.R. & Hall, P. Handbook of microstrip antennas , Peter Peregrinus, 1989
- Kildal, P.S. Foundations of antennas : a unified approach , Studentlitteratur, 2000
- Schelkunoff, S.A. Antennas : theory and practice , Chapman & Hall, 1952
- Volakis, J.L. Antenna engineering handbook , McGraw-Hill, 2007