Radio frequency and antenna subsystems

Academic Year: (2019 / 2020) **Review date: 05-01-2020**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: SEGOVIA VARGAS, DANIEL

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Students should have passed courses on Microwave circutis and antennas and electromagnetic fields and analysis and design of circuits.

OBJECTIVES

The student will aquire the following skills

- Capacity to design receivers and transmitters of RF, microwave and millimeters waves.
- Capacity to apply advanced knowledge of high frequency electronics
- Capacity to develop microwave subsystems for radiocommunications, radionavigation and radar
- Capacity to develop antennas for previous subsystems
- Capacity to implement cable and radio satellite communication systems.

DESCRIPTION OF CONTENTS: PROGRAMME

1) Radiofrequency subsystems
   1.1 Fundamentals of active and passive devices in microwave frequencies
      1.1.1 Diodes
      1.1.2. BJT and HBT transistors
      1.1.3. JFET, MESFET and HEMT transistors
   1.2 Linear and power microwave amplifiers
      1.2.1. High gain microwave amplifiers
      1.2.2. Low noise microwave amplifiers
      1.2.3. Introduction to power microwave amplifiers
   1.3 Microwave oscillators
   1.4 Detectors and mixers
      1.4.1. Non-linear performance of microwave diodes
      1.4.2. Passive mixers
      1.4.3. Active mixers
      1.4.4 Detectors and phase-shifters
   1.5 Introduction to microwave measurements
2) Antennas
   2.1. Fundamentals on radiation parameters
   2.2. Radiation integrals
   2.3. Elementary antennas: dipoles, loops and patches
   2.4. Array antennas: analysis
   2.5. Aperture antennas: horns and reflectors
   2.6. Introduction to antenna measurements

LEARNING ACTIVITIES AND METHODOLOGY

Three different activities are proposed: theory classes, problem classes and lab classes. The assignement of ECTS include the corresponding part of the student work.

- THEORY CLASSES. These classes use electronic or classical facilities. These classes include both theory classes and exercises to clarify the explanation. The students should take part in the class in a way as positive as possible.

- PROBLEMS. The students will have a collection of problems in advance so that they can prepare the

solution of the problems in advance.

- Lab work. They basically consist on self-contained laboratory work.

ASSESSMENT SYSTEM

The assesment system will validate whether the student has achieved the knowledge and the skills presented in previous sections.

There will be one final exam and a continuos evaluation during the course. The final assesment will comprise 55% of the final mark (and the students must have a mark higher than 45/100 in order to make an average with the continuous)

The continuous evaluation will comprise 45% of the overall mark that will be divided in three parts: 15% microwave exam, 15% antennas exam and 15% for the lab work.

% end-of-term-examination:	55
% of continuous assessment (assigments, laboratory, practicals…):	45

BASIC BIBLIOGRAPHY

- Balanis Antenna Theory, Analysis and Design, Wiley, 2005
- Balanis Modern Antenna Handbook, Wiley, 2008
- Collin Foundations for microwave engineering, Mc Graw Hill, 1992
- Stutzman Antenna Theory and Design, Wiley , 1998
- Vendelin, Pavio, Rohde Microwave Circuit Design Using Linear and Nonlinear techniques, Wiley, 2005

ADDITIONAL BIBLIOGRAPHY

- Kildal Foundations of Antenna Engineering, Ed. Kildal, 2015
- Kraus Antennas and Wave Propagation, Mc Graw-Hill, 2016
- Sorrentino Microwave and RF Engineering, Wiley, 2010