

Academic Year: (2019 / 2020)

Review date: 06-05-2020

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: VAZQUEZ ROY, JOSE LUIS

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

The student must have similar knowledge to the one given in Electromagnetic Fields and Analysis and Design of Circuits.

OBJECTIVES

Through this course, the student will learn the basic concepts on microwave systems and circuits. 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:

- Analysis and design of microwave passive and introduction to active devices.
- Study of basic tools for analysis and design of microwave devices: Smith chart and S parameters.
- Analysis and design of passive microwave circuits: matching networks, dividers, directional couplers, resonators and filters, non reciprocal devices such as circulators.
- Introduction to active microwave circuits: amplifiers.

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

Specific skills:

- Review of the basic concepts on guided propagation explained in electromagnetic fields: basic concepts on waveguides and transmission lines.
- Knowledge of circuit tools to analyse microwave circuits:
 - o Knowledge of transmission line theory from the circuit theory point of view: Smith chart.
 - o Tools for microwave network analysis: scattering (S) parameters.
- Skills to design of passive microwave circuits:
 - o Two port, three port and four port networks: dividers, combiners and couplers.
 - o Analysis of resonators.
 - o Analysis and design of microwave filters.
 - o Introduction to non-reciprocal passive circuits.
- Introduction to microwave measurements: impedance measurement and fundamentals of network analyzers.

- Skills to analyse and design microwave amplifiers.

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 transmitting or receiving RF-front-end. The student will achieve the ability to apply knowledge of mathematics and physics to design the circuits that transmit and receive the communication signal. (PO a)
- In addition he/she will be able to identify the circuits needed to develop a specific front-end by conducting (software packages such as AWR or ADS) and measuring the corresponding experiments (with the network analyzer). (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)

DESCRIPTION OF CONTENTS: PROGRAMME

0. Introduction to Microwave Circuits
 1. Review of waveguide and transmission line theory: practical transmission lines.
 2. Circuit theory of transmission lines: Smith chart, impedance matching.
 3. Microwave network analysis: S parameters and graph theory.
 4. Two, three and four ports passive microwave circuits: directional couplers and dividers.
- Introduction to non-reciprocal networks: circulators.
5. Microwave resonators.

6. Microwave filters.
7. Introduction to microwave measurements: impedance measurement and network and spectrum analyzers.
8. Introduction to microwave amplifiers.

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. The students will be divided in groups of 20 students to realize the four proposed practical works. They will work in groups of 2-3 students. In all the session a final quiz will have to be filled by the students. (PO b y k)
- Tutorship: There will be up to four time slots for tutorship during the week. These slots can be used by students once they have applied for it by e-mail. In addition there will be other collective tutorship. Students are encouraged to make use of both teaching mechanisms.

ASSESSMENT SYSTEM

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 an exam with 3 problems that have to be solved without books, although the formulae needed to solve the exam will be provided. (PO a, c and e)

The continuous evaluation procedure will consist of 2 exams with a weight of 15% and 20% of the final mark (35%). (PO a, c and e)

The practical work will have a 5% of the final mark. (PO b, k).

REQUIREMENT:

Knowledge of the subjects: Analysis and Design of Circuits and Electromagnetic Fields

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

BASIC BIBLIOGRAPHY

- Daniel Segovia-Vargas et al Notes on Microwave course, OpenCourseWare de la Universidad Carlos III de Madrid, 2009
- David M. Pozar Microwave Engineering, John Wiley & Sons, 2007
- Robert E. Collin Foundations for Microwave Engineering, McGraw-Hill, 1992

ADDITIONAL BIBLIOGRAPHY

- Bahl y Bhartia Microwave Solid State Circuit Design, Wiley Interscience, 1988
- Gupta, K.C.; Garg, R. y Chadha, R. Computer Aided Design of Microwave Circuits, Artech House, 1981
- J.M. Miranda, J.L. Sebastián, M. Sierra, J. Margineda Ingeniería de Microondas: Técnicas Experimentales, Prentice Práctica , 2002
- Rizzi Microwave passive circuits, John Wiley.
- Wadell, B.C. Transmisión Line Design Handbook, Artech House, 1991