Universidad Zaragoza

Academic Year/course: 2024/25

30384 - High Frequency: the Basics

Syllabus Information

Academic year: 2024/25
Subject: 30384 - High Frequency: the Basics
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 581 - Bachelor's Degree in Telecommunications Technology and Services Engineering
ECTS: 6.0
Year: 4
Semester: First semester
Subject type: Optional
Module:

1. General information

It is intended to provide an introduction to the analysis and design of passive and active microwave-millimeter-wave circuits. The subject also includes the use of CAD tools for the design of such circuits; as well as an introduction to high frequency circuit measurement systems.

Since most of the telecommunication systems work in the microwave-millimeter-wave frequency range, this course is fundamental for the understanding of these systems.

It is required to have knowledge of electromagnetic theory and low-frequency electronic circuits, so it is recommended to have passed the previous subjects whose subject matter is related to such knowledge.

2. Learning results

- Learn about the applications of Microwave Engineering.
- Know the basic concepts of operation of passive microwave devices (attenuators, directional couplers, power dividers), as well as techniques for the design of microwave filters: Richard's transformation, Kuroda's identities and impedance-admittance inverters.
- Understand the basic principles of transmission line resonators.
- Understand the basic principles of linear and narrowband microwave amplifier design: maximum gain, constant power gain circumferences and low noise amplifiers gain, constant power gain circles and low noise amplifiers.
- Know the measurement systems of microwave circuits.
- Know how to work in a team, constructively criticizing the opinions of others, sharing information and knowledge with peers to find joint solutions.

3. Syllabus

Topic 1. Introduction and objectives of the subject.

Topic 2. General concept of microwave circuit.

Topic 3. Passive microwave circuits.

Topic 4. Resonators and microwave filters.

Topic 5. High frequency diodes and transistors.

Topic 6. Microwave amplifiers.

Topic 7. Optical communication systems for the transmission and/or processing of microwave signals (Microwave Photonics).

4. Academic activities

The learning process that has been designed for this subject is:

1. 46 hours of lectures.

2. 12.0 hours of in-class problems.

3. 11.0 hours of laboratory practice.

4. 11.0 hours of tutored practical work.

The program offered to the student to achieve the expected results includes the following activities:

ACTIVITY I. Theoretical presentation of the syllabus.

ACTIVITY II. Types of problems.

ACTIVITY III. Tutored practical work.

- Adaptive networks with discrete elements. The ring resonator.
- Microwave filter design.
- Design of linear and narrow band amplifiers.
- Measurement of S-parameters.
- The laser diode: Direct modulation of the laser current.

ACTIVITY IV. Laboratory practices.

1. Introduction to the high frequency circuit simulator (ADS).
2. Design of adaptive networks with discrete elements. The ring resonator.
3. Microwave filter design.
4. Design of narrow band linear amplifiers: Maximum gain and minimum noise.
5. IM/DD systems in optical communications.

This course is ***English Language Friendly***, which means that: the course sillabus is also available in english; the study and class materials are in english; the faculty is willing to conduct office hours in english; and students are allowed to take their assessments in english.

5. Assessment system

The assessment will consist of three parts:

E1. Assessment of the 5 assignments tutored during the teaching period: 10%. The delivery of the report of the tutored work of must be done before the realization of the corresponding practical in the laboratory.

E2. Assessment of the 5 laboratory reports: 30% (5*6%). Each report should be submitted before the completion of the next lab practicum.

E3. Global review: 60%. This is a 3-hour written examination.

In case the student has not completed parts E1 and E2 of the evaluation procedure, the grade will be 100% of the overall assessment exam (part E3).

6. Sustainable Development Goals

7 - Affordable and Clean Energy
8 - Decent Work and Economic Growth
9 - Industry, Innovation and Infrastructure