Universidad Zaragoza

Academic Year/course: 2024/25

61084 - High frequency devices design

Syllabus Information

Academic year: 2024/25
Subject: 61084 - High frequency devices design
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 658 - Master in Telecommunications Engineering
ECTS: 3.0
Year: 2
Semester: First semester
Subject type: Optional
Module:

1. General information

The purpose of this subject is that the student learns the elements, models and methods of analysis and design of current high frequency systems, based on the knowledge acquired in the subjects of the Master in Telecommunication Engineering. In the context of advanced high-frequency systems, the focus is on fast and accurate computational analysis and modelling of increasingly complex structures that are optimized with respect to various application-specific parameters. Relatively recent optimization techniques applied to the field of High Frequency Engineering will be presented, with the objective of pursuing designs that optimize common parameters that determine the performance of microwave transmitter and receiver systems. The approach is essentially practical and will work on the design of various high frequency devices applied to telecommunication systems.

2. Learning results

- **HA_01:** Ability to project, calculate and design products, processes and facilities in all areas of telecommunications engineering.
- **HA_04:** Ability to carry out mathematical modeling, calculation and simulation in technological and engineering centers, particularly in research, development and innovation tasks in all areas related to Telecommunications Engineering and related multidisciplinary fields.
- **HA_07**: Ability to launch, direct and manage manufacturing processes for electronic and telecommunications equipment, guaranteeing safety for people and property, the final quality of the products and their approval.
- **HA_11:** Ability to develop radio communications systems: design of antennas, equipment and subsystems, channel modeling, link calculation and planning.
- **HA_12:** Ability to implement cable, line, and satellite systems in fixed and mobile communications environments.
- **HA_22:** Ability to apply advanced knowledge of photonics and optoelectronics, as well as high frequency electronics.
- **HA_23:** Ability to develop electronic instrumentation, as well as transducers, actuators and sensors.
- **CP_06**: Permanent self-learning.
- **CP_07:** Ability to know how to communicate (orally and in writing) the conclusions - and the knowledge and ultimate reasons that support them - to specialized and non-specialized audiences in a clear and unambiguous way.

3. Syllabus

Block 0. Introduction
• Presentation of the subject.
• Basic knowledge required.
• Introduction to laboratory software.
• Introduction to Characterization Hardware (Vector Network Analyzer)
This block will be interspersed with the rest of the blocks.

Block I.
• Analysis and design of couplers of different types.
• Branch Line coupler simulation
• Branch Line application to variable attenuator in transmission.
• Branch Line application to variable attenuator in reflection.
• Branch Line application to variable phase shifter in reflection.
• Digitally controlled phase shifter design with PIN diode switches.

Block II.
• Design of symmetrical power distributors to feed antenna clusters.
• Asymmetrical power divider design.

• Design of a distribution network for an antenna array including phase shifters and attenuators Antenna array Synthesis.

4. Academic activities

The calendar of the subject, in particular the classroom hours in the laboratory (30 hours), will be defined by the centre in the academic calendar of the corresponding academic year. All class hours will take place in the laboratory.

• Master classes and practical examples: 8 hours
• Practical classes: 18 hours
Lectures with practical examples (8 hours) and practical classes (18 hours) will be held simultaneously in the laboratory.

• Statement of problems and cases to develope: 4 hours
There will be a practical case corresponding to the design of a prototype and its experimental verification (4 hours).

• Study and personal work: 43 hours.
• Assessment tests: 2 hours.

5. Assessment system

CONTINUOUS ASSESSMENT
• Laboratory Practices (70%)

The subject has an eminently practical approach, and theoretical introductions will be interspersed in the laboratory together with practices. A set of high frequency device designs will be made during the laboratory practices. In the design process the student will have to keep a laboratory notebook including each of the steps taken to achieve the optimal performance of the devices. These assignments are to be handed in throughout the term. Assignments will be evaluated on the basis of their presentation.

• Problem solving, cases and prototypes (30%)

In the third part of the term, a practical work will be proposed to deepen in some of the designs covered in the practices, or in a different design. The content will be agreed with the students and adapted to 30% of the time and crediting of the subject. The results will be presented orally to the rest of the students.

The subject is passed with an overall grade of 5 out of 10.

GLOBAL TESTS (OFFICIAL CALLS)

The student will have a global test in each one of the calls established throughout the academic year. The dates and times of the tests will be determined by the School.

The student must take the global test if they has not passed the continuous assessment.

This will consist of a final exam in the laboratory where there will be a practical test with a weight of 70% and a written test where theoretical knowledge will be assessed. It will account for 30% of the grade.

The subject is passed with an overall grade of 5 out of 10.

6. Sustainable Development Goals

9 - Industry, Innovation and Infrastructure