# COURSE DATA

## DATA SUBJECT

**Code:** 44282
**Name:** Hardware propagation
**Cycle:** Master's Degree
**ECTS Credits:** 4
**Academic year:** 2026-27

## STUDY (S)

| Degree | Center | Acad. year | Period |
|---|---|---|---|

## SUBJECT-MATTER

| Degree | Subject-matter | Character |
|---|---|---|

## COORDINATION

SANCHIS PERIS ENRIQUE J

# SUMMARY

This is a subject that provides the student an overview of the high-speed signal propagation in transmission lines.

Apart from the purely theoretical course, the contents will provide the student with general knowledge to solve engineering problems.

This is a mandatory course, which is taught in the first semester of the Master in Electronic Engineering. The total teaching load is 4 ECTS. The total workload for students is 100 hours over the semester.

# PREVIOUS KNOWLEDGE

## RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

## OTHER REQUIREMENTS

The student must have prior knowledge about the signal propagation in transmission lines

# COMPETENCES / LEARNING OUTCOMES

**2199 -**

Capacidad para el modelado matemático, cálculo y simulación en todos los ámbitos relacionados con la Ingeniería Electrónica y campos multidisciplinares afines. En especial los de tratamiento de la señal, sistemas digitales y de comunicaciones y electrónica industrial.

Capacidad para proyectar, calcular y diseñar productos, procesos e instalaciones en todos los ámbitos de la Ingeniería Electrónica y en particular los de tratamiento de la señal, sistemas digitales y de comunicaciones y electrónica industrial.

Conocer las técnicas avanzadas para la propagación de señales y datos mediante soporte físico, haciendo especial hincapié en el estudio de casos prácticos y el diseño de circuitos de microondas mediante líneas de transmisión.

Demostrar una comprensión sistemática de un campo de estudio y el dominio de las habilidades.

Diseñar un sistema, componente o proceso que cumpla unas especificaciones desde diferentes puntos de vista: electrónico, económico, social, ético y medioambiental.

Realizar un análisis crítico, evaluación y síntesis de ideas nuevas y complejas.

Ser capaz de fomentar, en contextos académicos y profesionales, el avance tecnológico, social o cultural dentro de una sociedad basada en el conocimiento.

Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.

Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.

Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.

Students should demonstrate self-directed learning skills for continued academic growth.

Take into account the economic and social context in engineering solutions, be aware of diversity and multiculturalism and ensure sustainability and respect for human rights and equality between men and women.

## DESCRIPTION OF CONTENTS

- Introduction to transmission lines.
- Model of distributed parameter. Equations of the ideal line.
- Losses in transmission lines.

## 1. Fundamentals of transmission lines.

- Introduction to transmission lines.
- Model of distributed parameter. Equations of the ideal line. - Generation of the incident wave. Reflection and transmission coefficients.

## 2. Transients. Diagrams reflections and Bergeron

- Reflection diagrams.
- Analysis of transient lines: case study
- Reflections in reactive loads and nonlinear loads. Bergeron analysis method.
- Applications: Fundamentals of reflectrometry in the time domain (TDRs)

## 3. Propagation of sinusoidal signals. Impedance matching.

- Impedance along the line
- Sinusoidal transmission.
- Standing Wave Ratio (VSWR).
- Fundamentals of the Smith chart.
- Representation of impedances in the Smith chart.
- Impedance matching using simple stubs.

## 4. Applications. Examples of transmission lines.

- Basics of signal integrity.
- Design of PCBs.
- Terminations.

# WORKLOAD

### PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Total hours | 0,00 |

### NON PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Attendance at other activities | 0,00 |
| Individual or group project | 10,00 |
| Independent study and work | 20,00 |
| Preparation of lessons | 20,00 |
| Preparation for assessment activities | 10,00 |
| Resolution of case studies | 0,00 |

| | |
|---|---|
| **Total hours** | **60,00** |

## TEACHING METHODOLOGY

The teaching methods employed in the development of the course are:

a) Theoretical activities.

Expository development of matter with the student's participation in the resolution of specific issues.

b) Practical activities.

Solving practical problems. This task will be done individually or in groups and tries to promote the autonomous work of students. To this end, the laboratory practices will be guided (laboratory scripts) so that students will have to follow the teacher's instructions and recommendations, although without the direct help of the teacher.

c) Student's personal work.

Description: Performing outside the classroom to issues and problems as well as the preparation of classes and exams (study). This task will be performed individually and try to promote self-employment.

We will use e-learning platforms (LMS) to support communication with students. Through it the student will have access to course materials used in class, as well as solving problems and exercises.

## EVALUATION

The evaluation of the subject will consist of a written test, with theoretical and practical questions, and laboratory.

## REFERENCES


- Líneas de transmisión. V. Boira. Ed. UPV, Spain.
- Circuitos de microondas con líneas de transmisión. J. Bará. Ed. UPC, Spain.
- Transmission lines and wave propagation. P. C Magnusson. CRC Press