COURSE DATA

Data Subject	
Code	44282
Name	Hardware propagation
Cycle	Master's degree
ECTS Credits	4.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
2199 - M.D. in Electronic Engineering	School of Engineering	1	First term

Subject-matter

Degree	Subject-matter	Character
2199 - M.D. in Electronic Engineering	2 - Digital systems and communications	Obligatory

Coordination

Name	Department
SANCHIS PERIS, ENRIQUE J	242 - Electronic Engineering

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

OUTCOMES

2199 - M.D. in Electronic Engineering

- 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.
- Diseñar un sistema, componente o proceso que cumpla unas especificaciones desde diferentes puntos de vista: electrónico, económico, social, ético y medioambiental.
- Demostrar una comprensión sistemática de un campo de estudio y el dominio de las habilidades.
- 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.
- 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.
- 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.
- 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.

LEARNING OUTCOMES

The student should be able to understand:

• The effect of pulse propagation in transmission lines.
• The pulse propagation in coaxial cable.
• The use of the Smith Chart.
• The basic design ideas for high speed and signal integrity.
• The different ways of using terminations lines.

DESCRIPTION OF CONTENTS

1. Fundamentals of transmission lines.

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

ACTIVITY	Hours	% To be attended
Theory classes	20,00	100
Laboratory practices	20,00	100
Development of group work	10,00	0
Study and independent work	10,00	0
Readings supplementary material	10,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	10,00	0
TOTAL	**100,00**	

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

For the evaluation of the subject in the first call, the student will choose, exclusively, between the following two options:

- Evaluation by course, consisting of the delivery of a multiple-choice questionnaire (40%), a problem bulletin (30%) and a laboratory memory (30%).

- Exam (official date of first call), consisting of a written test (70%) and a laboratory test (30%).

For the evaluation of the subject in the second call, it will be carried out by means of an exam (official date of the second call) that will consist of a written test (70%) and a laboratory test (30%).

To pass the subject in any of its forms, each of the parts of the evaluation must be passed. In case of not passing any of the parts, the final grade that will correspond will be the lowest one.

REFERENCES

Basic

- Líneas de transmisión. V. Boira. Ed. UPV, Spain.
- Circuitos de microondas con líneas de transmisión. J. Bará. Ed. UPC, Spain.

Additional

- Transmission lines and wave propagation. P. C Magnusson. CRC Press