COURSE DATA

DATA SUBJECT

Code: 46801
Name: Signal Integrity
Cycle: Master's Degree / Doctorate
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2269 - Master's Degree in Electronic Engineering	Escola Tècnica Superior d'Enginyeria	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2269 - Master's Degree in Electronic Engineering	Sistemas Digitales	COMPULSORY

COORDINATION

GONZALEZ MILLAN VICENTE

SANCHIS PERIS ENRIQUE J

SUMMARY

The subject Signal Integrity develops the necessary contents to provide the student with a global and practical vision of the problem of the propagation of high-speed signals (pulses in transient regime), typically above 200 MHz (100 Mbps) and up to 500 MHz (1 Gbps) or high frequency (signals in sinusoidal regime). The course describes the problems associated with the propagation of digital signals in this frequency range that disturb their integrity, including reflections and couplings and techniques to minimize these effects (terminations, adaptations, topologies). Concepts of power distribution and timing and thermal aspects are also introduced.The subject establishes a balance between the development of theoretical aspects and simulations that allow the phenomena described to be observed. To do this, Cadence's SigXpert and Allegro tools are used

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

There are not specified enrollment restrictions with other subjects in the curriculum.

COMPETENCES / LEARNING OUTCOMES

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Conduct a critical analysis, evaluation and synthesis of new ideas to solve problems in complex or unfamiliar environments within broader contexts in the field of electronic engineering and related multidisciplinary fields.

Create mathematical models and simulations in the field of electronic engineering and related multidisciplinary fields.

Demonstrate a systematic knowledge and a mastery of technical, personal, social and methodological skills in the field of electronic engineering and related multidisciplinary fields.

Design systems and processes that meet electronic, regulatory, economic, social, ethical and environmental specifications.

Gain the professional skills and cooperation abilities that are suitable for practising in the field of electronic engineering and related multidisciplinary fields.

Handle specialised software and hardware, as well as design, simulation and programming environments in the field of electronic engineering and related multidisciplinary fields.

Identify, formulate and solve problems in the field of electronic engineering and related multidisciplinary fields.

Interpret technical documentation and regulatory standards for equipment and systems in the field of electronic engineering and related multidisciplinary fields.

Know advanced techniques of signal and data propagation through hardware to ensure signal integrity, with an emphasis on case studies.

Project, calculate and design products, processes and installations in the field of electronic engineering and related multidisciplinary fields.

DESCRIPTION OF CONTENTS

1. Fundamentals of Signal Propagation on Transmission Lines.

- Introduction to transmission lines
- Model of distributed parameters. Ideal line equations.
- The line with losses.
- Generation of the incident wave. Coefficients of reflection and transmission.

2. Transient. Diagrams of reflections and Bergeron

- Transient analysis using reflection diagrams.
- Case studies of the analysis of the transient in lines.
- Reflection on reactive loads and nonlinear loads. Bergeron's method of analysis.
- Applications: Fundamentals of Time Domain Reflectometry (TDRS).

3. Propagation of sinusoidal signals. Impedance Matching

- Obtaining the impedance at each point of the line.
- Particular case studies in sinusoidal transmission.
- Standing wave ratio (ROE).
- Fundamentals and obtaining Smith's chart.
- Representation of impedances and calculations in the Smith diagram.
- Impedance matching using simple stubs.

4. Introduction to Signal Integrity

- Signal integrity.
- Evolution of technology.
- Analysis of interconnections.
- Spectral content.
- Signage standards.
- Localized and distributed parameters.
- Multi-conductor transmission lines.

5. Noise and crosstalk

-Introduction.
- Crosstalk.
- Crosstalk on transmission lines.
- Backplane connections.
- Simultaneous Switching Noise.

6. Terminations and connectors

- Introduction.
- Terminations.
- Connectors.
- Vias.

7. Power distribution and clock signal (PDN and CDN)

- Introduction.
- Jitter.
- Clock signal distribution.
- Power distribution.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	35,00
Laboratory	25,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	25,00
Preparation of lessons	30,00
Preparation for assessment activities	15,00
Resolution of case studies	10,00
Total hours	**90,00**

TEACHING METHODOLOGY

The teaching methodologies to be used in the development of the subject are the following:

a) Theoretical activities.Expository development of the subject with the participation of the student in the resolution of specific questions.

b) Practical activities.Resolution of practical cases. This task will be carried out individually or in groups and tries to promote the autonomous work of the students. To this end, the laboratory practices will be guided (laboratory scripts) so that students will have to follow the instructions and recommendations of the teacher, although without the direct help of the teacher.

c) The student's personal work.Description: Carrying out questions and problems outside the classroom, as well as preparing classes and exams (study). This task will be carried out individually and tries to promote autonomous work.

E-learning platforms (Aula Virtual) will be used as a communication support with students.Through it you will have access to the teaching material used in class, as well as the problems and exercises to be solved.

EVALUATION

The evaluation of the subject will be carried out by taking two written tests, both with the same weight, one for the theory part (SE1) and another for the laboratory part (SE2).

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

In any case, the system of evaluation will be ruled by the established in the Regulation of Evaluation and Qualification of the University of Valencia for Degrees and Masters.

(https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639).

REFERENCES

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- Computer Circuits Electrical Design. R. K.Poon
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- Handbook of digital techniques for high-speed design : design examples, signaling and memory technologies, fiber optics, modeling and simulation to ensure signal integrity / Tom Granberg, Prentice Hall, 2004
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- High-speed circuit board signal integrity. S. C. Thierauf. Artech House, 2004 (e-book)
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