COURSE DATA

Data Subject	
Code	46800
Name	Microelectrónica
Cycle	Master's degree
ECTS Credits	6.0
Academic year	2024 - 2025

Study (s)

Degree	Center	Acad. year	Period
2269 - Master's Degree in Electronic Engineering	School of Engineering	1	Annual

Subject-matter

Degree	Subject-matter	Character
2269 - Master's Degree in Electronic Engineering	3 - Diseño Electrónico	Obligatory

Coordination

Name	Department
CALPE MARAVILLA, JAVIER	242 - Electronic Engineering
REIG ESCRIVA, ABILIO CANDIDO	242 - Electronic Engineering

SUMMARY

The purpose of the subject is to acquire skills and familiarize them with microelectronic design. The theoretical contents required to acquire a general vision of the fundamental aspects of microelectronic design and its technological consequences will be presented. Laboratory sessions will strengthen knowledge and skills in the implementation this of design.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

No enrolment restrictions have been specified with other subjects in the curriculum requirements or previous recommendations.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

The learning results correspond to the following contents (CON) and skills (HAB), established in the syllabus:

Con2 - Know the advanced techniques of instrumentation and design of electronic, photonic and microelectronic devices.

Con5 - Interpret the technical documentation and regulatory regulations of equipment and systems in the field of Electronic Engineering and related multidisciplinary fields.

Hab1 - Identify, formulate and solve problems in the field of Electronic Engineering and related multidisciplinary fields.

Hab2 - Model and simulate mathematically in the field of Electronic Engineering and related multidisciplinary fields.

Hab3 - Project, calculate and design products, processes and facilities in the field of Electronic Engineering and related multidisciplinary fields.

Hab4 - Handle specialized software and hardware, as well as design, simulation and programming environments in the field of Electronic Engineering and related multidisciplinary fields.

Hab5 - Design systems and processes that meet specifications from different points of view: electronic, regulatory, economic, social, ethical and environmental.

DESCRIPTION OF CONTENTS

1. Introduction to microelectronics

Topic 1. Introduction to microelectronic design.
Introduction to the semiconductor industry.
Manufacturing processes and technologies.

Topic 2. CMOS design.

Manufacturing process and design criteria.
NMOS and PMOS transistors.

2. Analog microelectronics design

Topic 3. CMOS single-stage amplifiers.
Common supplier configuration.
Follower supplier configuration.
Cascodo configuration.

Topic 4. CMOS differential amplifiers.
Basic differential torque.
Differential torque with MOS loads.
Noise.

Topic 5. Basic design blocks.
Voltage and current references.
Basic current mirrors
Cascode current mirrors.
Study of current mirrors under different loads.

Topic 6. Operational amplifiers.
Gain.
CMRR.
Limitations.
Response time.

Topic 7. Conditioning and auxiliary circuits.
Converter excitation blocks.
Gain adjustment and level boost.
Input protection.
Sampling and retention circuits.
Clock distribution.
Switches and multiplexers

3. Data Converters

Topic 8. Converters.
Digital to Analogue Converters (DACs).
Basic DAC architectures.
Calibration techniques for high precision DACs.
Analogue/Digital Converters.
Basic ADC architectures.

4. Complementary technologies

Theme 9. Complementary technologies.
High-level description languages (VHDL, Verilog, SystemC).
Verification, test techniques.

5. Laboratory. Introduction

Session 1. Introduction. Characterization of MOS transistors.
Session 2. Current sources and mirrors.
Session 3. Single-stage amplifiers.
Session 4. Differential amplifiers.

6. Laboratory. Operational amplifiers. Electrical analysis.

Session 5. Operational amplifier. Introduction.
Session 6. Operational amplifier. Basic analysis.
Session 7. Operational amplifier. Advanced analysis.

7. Laboratory. Operational amplifiers. Layout

Session 8. Physical design. Location and layout of connections.
Session 9. Verification. DRC and LVS.
Session 10. Parasitic extraction. Post Layout Analysis. GDS generation.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	30,00	100
Attendance at events and external activities	5,00	0
Development of group work	5,00	0
Development of individual work	5,00	0
Study and independent work	20,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	5,00	0
Resolution of case studies	10,00	0
Resolution of online questionnaires	5,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The training activities will be carried out according to the following distribution:

Theoretical activities. Face-to-face, the topics will be developed providing a global and integrating vision, analysing in greater detail the key and most complex aspects, encouraging, at all times, the participation of the student.

Practical activities. They complement the theoretical activities with the aim of applying the basic concepts and expanding them with the knowledge and experience they acquire during the completion of the proposed work.

They include the following types of face-to-face activities:

• Problems sessions and questions in the classroom

• Discussion and problem-solving sessions and exercises previously worked on by students

• Laboratory sessions

Personal work of the student.

Carrying out issues and problems outside the classroom, as well as preparing for classes and exams (study). This task will be carried out individually and tries to promote autonomous work.

On the one hand, the completion of individual assessment questionnaires in the classroom with the presence of the teacher and, if appropriate, the evaluation of a project carried out in a group with other students. Laboratory practices are also assessable.

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

EVALUATION

SE1 - Objective test: completion of a final theoretical-practical exam or individual evaluation questionnaire in the classroom with the presence of the teacher (40%).

SE2 - Evaluation of practical activities: completion of the individual questionnaire and/or resolution of a practical case in the laboratory similar to those that have been resolved in the practical sessions taught (40%).

SE3 - Continuous evaluation: delivery of technical reports or results reports, as well as work and/or projects (20%).

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

Basic

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  [2] R.J. Baker, H.W. Li, D.E. Boyce, CMOS circuit Design, Layout and Simulation, IEEE Press Series on Microelectronic Systems.
  [3] R. Gregorian, G.C. Temes, "Analog MOS Integrated Circuits for Signal Processing". Wiley (1986)
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  [6] R. Van de Plasche, CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters, Kluwer Academic Publishers, 2nd Ed., 2003.
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  [8] P.G.A. Jespers, Integrated Converters, D to A and A to D: Architectures Analysis and Simulation, Oxford University Press, 2001.
  [9] B. Razavi, Principles of Data Conversion System Design John Wiley & Sons Inc, 1995
  [10] W. Kester, Analog-Digital Conversion, Analog Devices, Free for download.
  [11] P.E. Allen, D.R. Holberg. CMOS analog circuit design. Oxford University Press.

Additional

- [1] T. Tuma, A. Bürmen. Circuit simulation with SPICE OPUS. Theory and Practice. Birkhäuser.
  [2] R.C. Jaeger. Introduction to Microelectronic Fabrication. Addison Wesley.