

**COURSE DATA****DATA SUBJECT**

Code: 46800
Name: Microelectronics
Cycle: Doctorate / Master's Degree
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	Second quarter
3131 - PhD in Electronic Engineering	Escola de Doctorat		Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2269 - Master's Degree in Electronic Engineering	Diseño Electrónico	COMPULSORY
3131 - PhD in Electronic Engineering		

COORDINATION

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SUMMARY

The purpose of the subject is to acquire skills and familiarize them with microelectronic design. The theoretical and general vision of the fundamental aspects of microelectronic design and its technological consequences will be presented. The practical part will strengthen knowledge and skills in the implementation of this 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 / LEARNING OUTCOMES

2269 - Master's Degree in Electronic Engineering

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 instrumentation and design of electronic, photonic and microelectronic devices.

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

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

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Laboratory	30,00
Total hours	60,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	5,00
Individual or group project	10,00
Independent study and work	25,00
Preparation of lessons	15,00
Preparation for assessment activities	25,00
Resolution of case studies	10,00
Total hours	90,00

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

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

- [1] B. Razavi, Design of Analog CMOS Integrated Circuits. McGraw-Hill. [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) [4] T. C. Carusone, D. A. Jones, K. W. Martin. "Analog Integrated Circuit Design". Wiley 2Ed (2012). [5] D. M. Binkley. "Tradeoffs and Optimization in Analog CMOS Design". Wiley (2008) [6] R. Van de Plasche, CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters, Kluwer Academic Publishers, 2nd Ed., 2003. [7] R.J. Baker, CMOS Mixed-signal Circuit Design, Wiley-IEEE Press, 2002. [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.
- [1] T. Tuma, A. Bürmen. Circuit simulation with SPICE OPUS. Theory and Practice. Birkhäuser. [2] R.C. Jaeger. Introduction to Microelectronic Fabrication. Addison Wesley.