

## SUBJECT TEACHING GUIDE

G1476 - Low Voltage Power Supply and Consumption Circuits

Degree in Telecommunication Technologies Engineering

Academic year 2020-2021

1. IDENTIFYING DATA					
Degree	Degree in Telecommunication Technologies Engineering			Type and Year	Optional. Year 4
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Speciality Optional Subjects				
Course unit title and code	G1476 - Low Voltage Power Supply and Consumption Circuits				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web	<a href="https://www.teisa.unican.es/">https://www.teisa.unican.es/</a>				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. TECNOLOGIA ELECTRONICA E INGENIERIA DE SISTEMAS Y AUTOMATICA				
Name of lecturer	JOSE ANGEL MIGUEL DIAZ				
E-mail	joseangel.miguel@unican.es				
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 3. DESPACHO JOSE A. MIGUEL DIAZ (S3080)				
Other lecturers					

3.1 LEARNING OUTCOMES
- Acquiring knowledge in advanced modelling of electronic devices for low power applications.
- Understanding novel techniques to design low-power electronic circuits.
- Systematic methodology applied to low-power transconductance (OTA) and operational (OA) amplifiers design.
- Low-power amplifiers and continuous filters analysis.

#### 4. OBJECTIVES

Advanced semiconductor devices.  
 Low-voltage and low-power MOS transistor models.  
 Building block of low-voltage and low-power amplifiers.  
 Design of low-voltage and low-power voltage and transconductance amplifiers.  
 Advanced design of low-voltage and low-power operational amplifiers, continuous filters and switching capacitors circuits.

#### 6. COURSE ORGANIZATION

CONTENTS	
1	MIS and MOS structures: classic models vs. advanced models.
2	CMOS fabrication technologies and their evolution. EKV model for low-voltage and low-power MOS transistors.
3	Basic building blocks for low-voltage and low-power circuit design: single-stage amplifiers, current mirrors, differential pair, cascode and double-cascode amplifiers, and current and voltage references.
4	Low-voltage and low-power transconductance amplifier (OTA) design, comprising a comprehensive study of the differential pair, current mirrors for active biasing, and cascode amplifiers. Design of one and two-stage OTAs. Detailed analysis of MOS transistor operating regions under low-voltage biasing.
5	Low-voltage and low-power fully-differential amplifier design. Introduction to the most common continuous filter topologies. Introduction to low voltage and low-power switched-capacitor filters.
6	Introduction to ultra-low-power circuit design.

## 7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Presentations on selected topics.	Work	No	Yes	50,00
Low-voltage and low-power mixed-signal circuit design and simulation.	Laboratory evaluation	Yes	Yes	40,00
Virtual platform.	Activity evaluation with Virtual Media	No	Yes	10,00
<b>TOTAL</b>				<b>100,00</b>

### Observations

If the minimum acceptable grade is not obtained in any of the evaluation activities, then the highest possible grade would be a 4,9.

Any passing grades given during the evaluations will be valid until the "Convocatoria Extraordinaria" of the course.

In order to pass the course, a passing grade in the laboratory class is required as well.

In order to provide a safe and accessible learning environment, the course may not be in-person. If that is the case, then the course will be either an online course or a hybrid course (a mix of in-person meetings and online activities).

If the course is delivered online or hybrid, then class activities will be done via Aula Virtual (Moodle), email, Skype for Business, and/or any other software that the University of Cantabria permits or provides.

Any tutoring session/discussion with students will be delivered online or hybrid via email or the Aula Virtual's forum. If need be, the use of Skype for Business and/or any other software that the university provides or permits maybe used.

Any online or hybrid evaluations will be based on the "Evaluación con Soporte Virtual" for each graded assignment. The weight percentage for each graded assignment will remain the same.

All students must have a computer, webcam and microphone or a mobile phone with camera, access to the internet, and Skype for Business and/or any other software that the University of Cantabria provides or permits.

### Observations for part-time students

For part-time students, the percentages assigned to the evaluations are added to the written exams.

For any part-time student whose schedule is incompatible, individual online meetings will be carried out.

If any part-time student who for justified reasons cannot attended the scheduled laboratory sessions, the possibility of passing the laboratory component through practical exams that will be held during the "Convocatoria Ordinaria" and "Convocatoria Extraordinaria".

## 8. BIBLIOGRAPHY AND TEACHING MATERIALS

### BASIC

D. Stefanovic; M. Kayan, "Structured Analog CMOS Design". Springer, 2008.