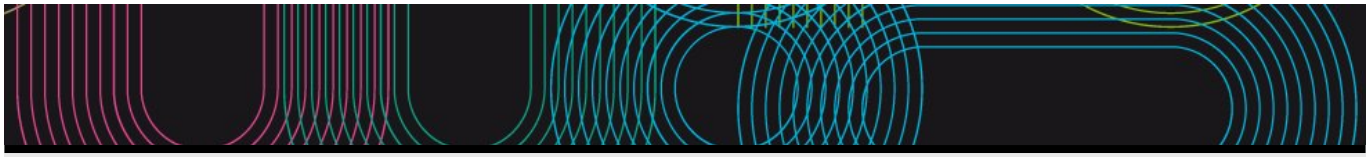

IDENTIFYING DATA				
(*)Electrónica analóxica				
Subject	(*)Electrónica analóxica			
Code	V05G300V01624			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Río Vázquez, Alfredo del			
Lecturers	Río Vázquez, Alfredo del			
E-mail	ario@uvigo.es			
Web	http://webs.uvigo.es/ario/docencia/eangrado/eangrado.htm			
General description	This subject studies the feedback concept, and its applications to amplifiers. The opamps and their applications are also studied.			

Competencies	
Code	
A51	(CE42/SE4): The ability to apply electronics as support technology in other fields and activities and not only in information and communication technologies.
A52	(CE43/SE5): The ability to design analogical and digital electronics circuits of analogical to digital conversion and vice versa, of radiofrequency, of feeding and electrical energy conversion for computing and telecommunication engineering.
A53	(CE44/SE6): The ability to understand and use feedback theory and electronic control systems.

Learning aims	
Expected results from this subject	Training and Learning Results
Knowledge of the techniques for feed-back amplifiers and oscillators.	A52 A53
Knowledge of the internal structures of the operational amplifiers and their structures.	A52 A53
Knowledge of the design of circuits based on operational amplifiers.	A52 A53
Knowledge of the design of power-supplies.	A51 A52 A53

Contents	
Topic	
Feedback amplifiers I	Feedback concept. Sample and mix networks. Feedback topologies. Feedback law.
Feedback amplifiers II	Negative and positive feedback. Parameters for the study of feedback. Benefits and draws of feedback. Effect on the uniform of gain. Effect on the harmonic distortion. Effect on the input and output impedances.

Feedback amplifiers III	Methods for the analysis: Simple or using matrix. Topology identifying. Amplifier without feedback, but with the load effect of the feedback network. The gain of the feedback amplifier. The input and the output impedances of the feedback amplifier.
Feedback amplifiers IV	Effect of the feedback on the frequency response. Bandwidth and stability. The effect of poles on the amplifier (one pole, two poles and three poles). Gain and phase margins. Nyquist criteria. Root places. Compensation methods.
Sine waveform oscillators	Barkhausen criteria. Design of a sinusoidal oscillator. RC oscillator. LC oscillator. Oscillator based on quartz crystals.
Operational amplifiers I	Internal structure of an operational amplifier. Current mirrors. Active loads. Voltage references. Technologies for the operational amplifiers: bipolars, bifet, cmos.
Operational amplifiers II	Analysis of the operational amplifier in the non inverting mode, using feedback. Voltage follower. Converters I-V and V-I. Integrator. Derivator. Applications.
Operational amplifiers III	Half-wave inverter rectifier . Full-wave inverter rectifier. Relaxation oscillator. Generator of triangle waves. Sinusoid oscillators based on the operational amplifier.
Power amplifiers	Output stages in class A, B and A-B. Full amplifier in class B. Full amplifier in class A-B. Introduction to the class-D amplifiers.
Regulated power supplies	Linear regulated power supplies. Protection to over current. Low drop-out (LDO).
Lab work 1	The effect of the feedback on a two-stage amplifier .
Lab work 2	Linear applications. Voltage-to-current converter. Integrator.
Lab work 3	Half-wave inverter rectifier. Full-wave inverter rectifier. Peack detector. Slope detector.
Lab work 4	Operational-based relaxation oscillator. Operational-based sinusoidal oscillator.
Lab work 5	Power amplifiers. Class B. Class A-B.
Lab work 6	Design of an active load. Design of a voltaje regulated supply.
(*)Repaso	(*)Repaso

Planning

	Class hours	Hours outside the classroom	Total hours
Tutored works	7	20	27
Laboratory practises	12	38	50
Master Session	15	27.5	42.5
Troubleshooting and / or exercises	4	22.5	26.5
Short answer tests	0.5	0	0.5
Troubleshooting and / or exercises	1	0	1

Short answer tests	0.5	0	0.5
Troubleshooting and / or exercises	1	0	1
Practical tests, real task execution and / or simulated.	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Tutored works	The lecturer will lead the students in order to design an amplifier.
Laboratory practises	Simulations and real assembled circuits will be tested.
Master Session	The lecturer will show some theoretical contents related to the subject.
Troubleshooting and / or exercises	The lecturer will solve some exercises related to the subject.

Personalized attention

Methodologies	Description
Troubleshooting and / or exercises	Students are permitted to interrupt the session in order to ask the lecturer for some doubt related to the session.
Tutored works	Students are permitted to interrupt the session in order to ask the lecturer for some doubt related to the session.
Laboratory practises	Students are permitted to interrupt the session in order to ask the lecturer for some doubt related to the session.
Master Session	Students are permitted to interrupt the session in order to ask the lecturer for some doubt related to the session.

Assessment

	Description	Qualification
Tutored works	Every student has to create a document about the assigned work.	10
Short answer tests	First short answer test in the classroom.	15
Troubleshooting and / or exercises	First exercise test in the classroom.	15
Short answer tests	Second short answer test.	15
Troubleshooting and / or exercises	Second exercise test.	15
Practical tests, real task execution and / or simulated.	Laboratory-work exam based on simulations and real circuits.	30

Other comments on the Evaluation

NOTE: The timing of the partial exams might suffersome changes, due to time restrictions. The exact timing will be indicatedalong the course.

CONTINUOUS EVALUATION OPTION:

The subject is evaluated in a continue way, by mean oftwo partial exams. These exams treat the theoretical aspects. In addition,there is an exam for the lab-work.

The student who passes the first partial exam willhold his/her mark along the course. This exam includes themes from one to five.

The second partial exam includes themes from six to ten.

The weight of both partials is a 60% from the total mark.

The first partial takes place in the classroom, withinthe class time. This partial is approximately 90 minutes long. The first 30minutes will be dedicated to an exam with short answers. The rest 60 minuteswill be dedicated to an exam with long answers.

Inside each partial, the 90 minutes exam and the 30minutes exam have the same weight.

In order to pass a partial exam (the first or thesecond), the student is required to obtain at least a mark of 5 over 10.

The student that passes the first partial will onlyhave to try the second partial. The second partial shares the same structurethan the first.

The student that does not pass the first partial willhave to try the first and the second partials.

The lab-work is evaluated using a unique exam, in thelaboratory. The weight is 30%.

Tutored works are assessed using a report that everystudent should be done. The weight is 10%.

When a student attends the first partial, he or sheaccepts to follow the continuous assessment.

The mark that a student obtains in the lab-work ismaintained until July, except if the student does not want. In this case, thestudent will have to do partials and lab exams in July.

In order to pass the subject, the student has toobtain a global mark (GM) of at least 5 points in ten. The global mark iscalculated following the next formula:

GM = 0.6 * TM + 0.3*LM + 0.1*RM

where

TM = theory mark ; LM = lab mark ; RM = report mark

If the student does not obtain a mark of at least 5 inthe first partial or in the second, the global mark would be the least markbetween 4 and the GM taken from the early formulae.

The first partial is preview to take place in thesixth week.

The second partial will take place the same day offinal exam.

The lab exam will take place in the lab, the day of thelast lab session.

FINAL EXAM OPTION

The students that do not follow the continuous assessment,will be assessted by means of a final exam.

The assessment of lab work takes place in the lab bymeans of an exam, during the final exams period. The lab work exam will be 2hours long. The weight of the lab work exam will be 40%.

In order to pass the subject, the student has toobtain a global mark (GM) of at least 5 points over ten. The global mark iscalculated following the next formulae:

GM = 0.6 * TM + 0.4*LM

where:

TM = theory mark ; LM = lab mark

If the student does not obtain a mark of at least 5 inthe first part or in the second part, the global mark would be the least markbetween 4 or the GM taken from the early formulae.

IMPORTANT:

If a student did not enter the continuous assessmentmode but is interested in participate in the final exam, he or she should talkwith the professor at least two weeks before the day of the exam. Contact canbe by e-mail. This help in the organization of the lab work exam.

RECOVERY EXAM

The recovery exam (June-July) shares the same structure

Sources of information

Sergio Franco, **Design with operational amplifiers and analog integrated circuits**, third edition,

Paul Horowitz y Winfield Hill, **The Art of Electronics**,

Recommendations

Subjects that are recommended to be taken simultaneously

(*)Sistemas de adquisición de datos/V05G300V01521

Subjects that it is recommended to have taken before

(*)Tecnoloxía electrónica/V05G300V01401