IDENTIFYING DATA

Analogue Electronics

Subject	Analogue Electronics
Code	V05G300V01624
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación

Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd

Teaching language	Spanish
Department	
Coordinator	Río Vázquez, Alfredo del
Lecturers	Río Vázquez, Alfredo del
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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.

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. Competencies A51, A52 and A53 will be addressed in these sessions.
Laboratory practises	Simulations and real assembled circuits will be tested. Competencies A51, A52 and A53 will be addressed in these sessions.
Master Session	The lecturer will show some theoretical contents related to the subject. Competencies A51, A52 and A53 will be addressed in these sessions.
Troubleshooting and / or exercises	The lecturer will solve some exercises related to the subject. Competencies A51, A52 and A53 will be addressed in these sessions.

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. Competencies A51, A52 and A53 will be assessed in these works.	10
Short answer tests	First short answer test in the classroom. Competencies A51, A52 and A53 will be assessed in these tests.	15
Troubleshooting and / or exercises	First exercise test in the classroom. Competencies A51, A52 and A53 will be assessed in this test.	15
Short answer tests	Second short answer test. Competencies A51, A52 and A53 will be assessed in this test.	15
Troubleshooting and / or exercises	Second exercise test. Competencies A51, A52 and A53 will be assessed in this test.	15
Practical tests, real task execution and / or simulated.	Laboratory-work exam based on simulations and real circuits. Competencies A51, A52 and A53 will be assessed in this test.	30

Other comments on the Evaluation

NOTE: The timing of the partial exams might suffer some changes, due to time restrictions. The exact timing will be indicated along the course.

CONTINUOUS EVALUATION OPTION:

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

This first partial 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 two partials take place in the classroom, within the class time. These partials are approximately 90 minutes long. The first 30 minutes will be dedicated to an exam with short answers. The rest 60 minutes will be dedicated to an exam with long answers.

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

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

The student that passes only one partial will only have to try the other one at the final exam option.

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

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

When a student attends the first partial, he or she accepts to follow the continuous assessment. Students that do not attend to the first partial will be assessed by means of a final exam.

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

In order to pass the subject, once partials have been passed, the student has to obtain a global mark (GM) of at least 5 points in ten. The global mark is calculated following the next formula:

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

where

TM = Mean value of the partial marks; LM = lab mark; RM = report mark

The first partial is preview to take place in the sixth week. The second partial will take place in the last week.

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

FINAL EXAM OPTION:

The students that do not follow the continuous assessment will be assessed by means of a final exam. The exam will consist of three parts: the first part of the themes 1 to 5, the second part of the themes 6 to 10 and the third part of lab-work in the laboratory.

In order to pass the subject, the student has to obtain a mark of at least 5 points over ten for the first and second parts. In this case, the global mark (GM) is calculated following the next formulae:

GM = 0.6 * TM + 0.4*LM

where:

TM = Average mark of the first and second part of the exam; LM = lab mark

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

IMPORTANT:

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

RECOVERY EXAM

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

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
Data Acquisition Systems/V05G300V01521

Subjects that it is recommended to have taken before
Electronic Technology/V05G300V01401

Other comments
I recommend the students to search the web for information about this subject. Electronic devices factories show interesting information. Many universities around the world hung interesting notes in the Internet. And many of them for free.