Analog Electronics II

Academic Year: (2019 / 2020) **Review date: 12/05/2020 08:08:06**

Department assigned to the subject:

Coordinating teacher: VERGAZ BENITO, RICARDO

Type: Electives ECTS Credits : 6.0

Year : 4 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Electronics Engineering Fundamentals
Analog Electronics 1
Electronics Instrumentation I
It is strongly recommended to have passed both last matters before Analog Electronics II.

OBJECTIVES

By the end of this content area, students will be able:
1. To have a coherent knowledge of the branch of engineering focused on the industrial electronics, including some at the forefront of the branch in advanced analog electronics.
2. To get the ability to apply their knowledge and understanding of analog electronics to identify, formulate and solve engineering problems and electronic systems in real applications, using established methods, and with the ability to combine different approaches to the problems.
3. To get the ability to apply their knowledge and understanding to develop and perform designs to meet specified requirements, even defined by themselves, to cover a certain necessity in an application.
4. To acquire an understanding of the different methodologies applied to the analog electronics, and an ability to use them and identify real effects in terms of stability, noise and other parameters.
5. To obtain the ability to design and conduct appropriate experiments to measure the characteristics of electronic systems, to read into the obtained data, and to draw conclusions that allow them to verify the required specifications, or alternatively to reconfigure the systems to improve them.
6. To develop the skills that are necessary to work in an electronics laboratory, and apply them in the designs and developments of advanced analog electronic systems.
7. To learn how to select and use appropriate equipment, tools and methods to develop, characterize and analyse analog electronic systems.
8. To obtain the ability to combine theory and practice to solve problems of analog electronics, analysing their functioning both on sheet and in the lab, and developing systems that can cover some specifications.
9. To get an understanding of applicable techniques and methods in advanced analog electronics, and of their limitations due to real effects, produced by the setup, parasitics, interferences, noise and other sources.

DESCRIPTION OF CONTENTS: PROGRAMME

Introduction.
I.1.- Feedback circuits: a review
I.2.- Effect in impedances and gains.

Lesson 1. Feedback circuits frequency response.
1.1.- Stability problem.
1.2.- Nyquist stability criterion.
1.3.- Compensation: theory and methods.

Lesson 2. Oscillators.
2.1.- Basic concepts. Barkhausen criterion.

2.2.- RC oscillators.
2.3.- LC and crystal oscillators.

Lesson 3. The real operational amplifier.
3.1.- Real parameters of op-amps.
3.2.- Amplifier circuits using op-amps review and effect of real parameters on them.

Lesson 4. Linear and nonlinear circuits of specific application.
4.1.- Comparators. Schmitt trigger.
4.2.- Nonlinear oscillators and timers.
4.3.- PID control using opamps.
4.4.- Fully-differential amplifiers and applications.
4.5.- Other circuits: precision rectifiers, RMS to DC, active filters overview.

Lesson 5. Specific purpose integrated circuits.
5.1.- Switched capacitors circuits, DDS, PLLs...

LEARNING ACTIVITIES AND METHODOLOGY

- Lectures to introduce fundamental concepts.
- Flipped classrooms, in which the cocepts will have introduced previously by means of videos and will be discussed in the regular classroom.
- Reduced group classes to solve problems and concepts application, in a triple methodology:
  - normal classroom: problems solution, discussion, students presentations.
  - Informatic classrooms to make simulations over actual circuits used in daylife in electronics.
  - Laboratory sessions: the key sessions, we intend that you use the most time as possible in the lab and that you learn how to use it properly, making your subsystems and systems developments of the selected Projects, under 2 teacher's supervision.

Tutorial interviews with the teachers to clarify doubst related with the Projects to be implemented.
Own student work by searching information on books and web, datasheets comprehensive reading and use of information, design, simulation of Projects.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

FIRST NOTIFICATION (January)
By continuous assessment:
60 % of the final mark based on the assessment of the developed project, split into:
- the writing of specs of the system.
- the simulations of the internal blocks.
- the simulations of the full system.
- the laboratory implementation and assessment of the system.
- the integration of systems in a real-world concept.
- the oral presentation of the system to the companions and professor.
- the answer, during the end-of-term examination, to a question about the Projects of other Groups.

40 % of the final mark by the solution of a series of problems putting into practice theoretical concepts, worked in classroom and self-learning, in a pair of examinations: one during the course (15%) and the other one at the Final Examination date (25%). A minimum mark of 3/10 is mandatory in the last one. The question about the Project of other Groups is not into that mark.

By a final test: Anyone not following continuous assessment will have the opportunity to pass by an exam that counts as 60 % of the final mark.

SECOND NOTIFICATION (June)
An examination that counts as the 100 %. Nevertheless, anyone who followed the continuous assessment during the course will get the best mark between both criteria: this one, and the one applied in January, thus this exam will count as 40 % of the final mark.

BASIC BIBLIOGRAPHY

- Analog Devices Op Amp Applications, Ed. Walter G. Jung. UC3M available link at http://www.sciencedirect.com/science/book/9780750678445, 2002

- M. H. Rashid Microelectronic circuits : analysis and design, Cengage Learning, 2011. UC3M Library: L/S 621.38.049 RAS

- National Semiconductor AN-20. An Applications Guide for Op Amps, Free online at www.national.com/analog , 2009

- Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer Analysis and Design of Analog Integrated Circuits, John Wiley & Sons, 2001. UC3M Library: L/S 621.38.049.77 GRA (3rd. ed)

- Texas Instruments Op Amps for Everyone, Ron Mancini, ed. Free online at www.ti.com , 2002

ADDITIONAL BIBLIOGRAPHY

- EDN Series for Design Engineers Analog Circuit Design: Art, Science and Personalities , Ed. Jim Williams. Butterworth-Heinemann ed. , 1991. UC3M Library L/S 621.38.049.77 ANA.

- EDN Series for Design Engineers The Art and Science of Analog Circuit Design, Ed. Jim Williams, Butterworth-Heinemann ed. , 1998. UC3M Library L/S 621.38.049.77 ART

- EDN Series for Design Engineers, Robert A. Pease. Troubleshooting Analog Circuits , Butterworth-Heinemann ed. , 1991. UC3M Library L/S 621.38.049.77 PEA

- Paul Horowitz and Winfield Hill The Art of Electronics , Cambridge University Press, 1989. UC3M Library L/S 621.38 HOR.

BASIC ELECTRONIC RESOURCES

- . electronicdesign: http://www.electronicdesign.com/technologies/analog

- . Analog Devices: http://www.analog.com/en/education/education-library/tutorials/analog-electronics.html