Electronic systems

Academic Year: (2022 / 2023) **Review date: 29-04-2022**

Department assigned to the subject: Department of Electronic Technology

Coordinating teacher: PEREZ GARCILOPEZ, ANTONIA ISABEL

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

- Linear Systems, Electronic Components and Circuits

OBJECTIVES

The aim of this course is to provide the students with a solid knowledge in a number of key horizontal techniques in electronic systems. During the development of this subject, special emphasis will be placed on the application of these techniques to specific equipment and subsystems commonly used in telecommunications, both for signal processing as well as equipment power supply. To achieve this objective, students will acquire the following specific abilities:
- Understand the operation of electronic circuits with negative feedback and their frequency response
- Analyse and evaluate the most common oscillator circuits
- Understand the functioning of real operational amplifiers and their linear and nonlinear applications
- Understand the operation of the most commonly found electronic subsystems used in signal processing and communications such as timers, VCOs and PLLs
- Understand the operation and applications of power supplies and power equipment for telecommunication systems
In terms of general abilities or skills, the following areas will be worked upon throughout the development of the subject:
- Ability to work cooperatively in a team, knowing how to adapt the requirements and working conditions of the subsystem developed so that they operate correctly within a global system which is not only electronic. This aspect will be covered by means of the development of examples and case studies.
- Ability to identify, formulate and solve problems in Engineering
- Ability to use techniques and tools required in modern engineering to reduce the equipment development time

DESCRIPTION OF CONTENTS: PROGRAMME

BLOCK 1
- Electronic Feedback Circuits
    - o Basic concepts of the theory related to feedback electronics
    - o Electronic feedback circuit topologies
    - o Calculation of the gain, input impedance and output impedance in feedback circuits.
    - o Conception of the practical method used to solve negative feedback circuits. Example
    - o Basic configurations of the beta network according to the different topologies
    - o Study of feedback circuits for each one of the different topologies.
- Frequency Analysis of Electronic Feedback Circuits
    - o Frequency analysis of a feedback amplifier
    - o Stability study of a feedback amplifier using the Bode diagram
    - o Compensation methods. Exercises
- Oscillators
    - o General configuration of an oscillator. Start up condition and oscillator maintenance
    - o RC oscillators:
    - o Amplitude limiters
    - o LC Oscillators: Colpitts, Hartley and Clapp Oscillators. Crystal Oscillators (Xtal)

BLOCK 2
- Real Operational Amplifiers and their Applications
    - o Real operational amplifier characteristics
    - o Linear applications. Active filters as linear application
    - o Non-linear applications
- Electronic Subsystems for signal processing and communications: Integrated timers and applications.

PLLs and Applications.
- The 555 integrated timer: monostable, astable and VCO modes
- PLL (Phase-Locked Loop):
  Blocks diagram and working principle
  PLL components: phase detectors, filters, VCOs
  PLL transfer function. PLL types.
  1st and 2nd order PLL. Examples.
  PLL Applications.

BLOCK 3
- Linear Voltage Regulators
  - Series- shunt feedback in linear voltage regulators
  - Basic design of a linear voltage regulator
  - Power and efficiency calculations
- Switching Voltage Regulators
  - Fundamentals of switching DC/DC Converters
  - Basic operation and design of Buck converter
  - Negative feedback in a switching DC/DC Converter
  - DC/DC and AC/DC Converters for Telecommunications. SAIs
- Energy Converters
  - Basic analysis of a photovoltaic generator
  - Description of other systems related to electrical energy generation

LEARNING ACTIVITIES AND METHODOLOGY

The teaching methodology will include:
- 48% Magisterial Classes (2.4 ECTS), where the students will be presented with the basic knowledge they must acquire. Students will be provided with lecture notes and key reference texts, which will enable them to complete and acquire a more in depth knowledge of the subject.
- 38% Problems Classes (2.4 ECTS) these are aimed at the solving of exercises and examples within the context of real case studies. These classes will be complemented with the resolution of practical exercises on behalf of the student, which in some cases may require the use of computer based simulation programs.
- 14% Laboratory Practical Sessions (1.2 ECTS), here the student will design, model and characterise electronic systems within the area of communications and real applications.

Group tutorial session. At least, a group tutorial session will be carried out during the recovery week as revision and final exam preparation. (See the weekly schedule for additional details)

ASSESSMENT SYSTEM

A continuous evaluation system will be carried out where the following will be evaluated:
1. Mandatory Laboratory Practical Sessions (20%)
The knowledge acquired by the student will be evaluated by means of the experimental implementation of several of the circuits analysed previously in the Magisterial and Problems classes. The development of the laboratory practical sessions will be carried out in groups.
2. Problem and/or quiz solving for every thematic block (20%)
Solving of problems and/or quizzes proposed for each thematic block, to be resolved individually.
3. Mandatory Final exam (60%).
Also, at the end of the course a final exam will be carried out where the global knowledge acquired by the students will be evaluated. A minimum mark will be required (4.2 over 10 points) to fulfil the requirements of continuous evaluation process.

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

BASIC BIBLIOGRAPHY

- A. S. SEDRA y K.C. SMITH Microelectronic Circuits, Oxford University Press, 1998
- J. MILLMAN, A. GRABEL Microelectronics, McGraw-Hill, 1987
- M. H. RASHID Microelectronic Circuits: Analysis and Design, CL-Engineering, 2010
- N. MOHAN First Course on Power Electronics, MN Power Electronics (MNPERE), 2009
- P. R. GRAY, R. G. MEYER Analysis and Design of Analog Integrated Circuits, John Wiley & Sons, 1993