Course guide
340098 - SEDI-D5O10 - Electronic Systems for Design

Last modified: 08/04/2024

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Lopez Garcia, Mariano

Others: Lopez Garcia, Mariano
Gaya Suñer, Pedro Francisco
Chico Villegas, Jose Pascual

PRIOR SKILLS

Autonomous learning and taking initiative in problem solvings are necessary skills in this course

REQUIREMENTS

Students registering in this subject are expected to have the subjects "Equacions Diferencials", "Calcul Avançat" and "Sistemes Elèctrics" from previous semesters passed

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE11. Knowledge of electronical fundamentals.
9. CE32. Ability to analize electrical circuits in all possible regimes.

TEACHING METHODOLOGY

Basic and theoretical concepts of electronics are provided by means of class lectures and by means of examples in the form of exercises. As for the lab, students will consolidate the main technical concepts by prototyping electronic circuits.

LEARNING OBJECTIVES OF THE SUBJECT

The aim of this subject is to provide the fundamental knowledge and to show the basics of industrial electronics. It will describe the most important technologies of electronic devices and systems available and it will explain the basic methodologies to analyze analog electronic systems.
At the end of the course students will be able to implement their own electronic prototypes.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	25.00
Hours large group	45,0	75.00

Total learning time: 60 h

CONTENTS

Chapter 1: Introduction and basic concepts

Description:
Definition of basic concepts: current and voltage, discrete and continuous signals, bipoles, power and energy, resistances.

Specific objectives:
Provide the student with the prior knowledge necessary to understand complex electronic circuits and systems.

Related activities:
Theoretical sessions that include examples with exercises and problems.

LAB 1: INSTRUMENTATION RELATED TO THE ELECTRONIC LABORATORY

Full-or-part-time: 8h
Theory classes: 4h
Laboratory classes: 2h
Self study : 2h

Chapter 2: Analisys of passive RLC systems

Description:
The chapter is divided into the following sections:
2.1 Kirchhoff's Laws
2.2 Voltage and current dividers. Superposition principle. Equivalents of Thevenin and Norton.
2.3 Temporal response of first-order systems.

Specific objectives:
The basic objective of this topic is to ensure that students acquire sufficient knowledge of the tools used for the analysis of resistance-forming circuits and passive elements in general.

Related activities:
Theoretical sessions that include examples with exercises and problems.

PRACTICE 2: TEMPORARY RESPONSE OF FIRST ORDER SYSTEMS

Full-or-part-time: 12h
Theory classes: 6h
Laboratory classes: 2h
Self study : 4h

Chapter 3: Circuits with diodes

Description:
This chapter contains the following sections:
3.1 Diode operating principle.
3.2 Diode static model and rectifier circuits.
3.3 Zener diode and voltage regulator circuits.
3.4 Voltage limiting circuits.
3.5 Led diode, photodiode and optocouplers.

Specific objectives:
The basic objective of this chapter is to ensure that the student is able to analyze simple circuits that contain general purpose diodes and Zener diodes.

Related activities:
Theory sessions with exercises and problems.

PRACTICE 3: AC-DC POWER SUPPLY

Full-or-part-time: 14h
Theory classes: 8h
Laboratory classes: 2h
Self study : 4h

Chapter 4: Bipolar transistor circuits

Description:
This chapter contains the following topics:
4.1 Static model of the transistor.
4.2 Amplifiers and switching circuits.
4.3 Voltage regulator circuits.

Specific objectives:
The main objective of this chapter is that students are able to know the principle of operation of the bipolar transistor, as well as the basic circuits when this device is used to form part of amplifiers and voltage regulator circuits.

Related activities:
Theory sessions together with exercises and problems solved in class.

Full-or-part-time: 6h
Theory classes: 4h
Self study : 2h

Chapter 5: Operational amplifiers circuits

Description:
The content of this chapter is:
5.1 Static model of the operational amplifier.
5.2 Comparators
5.3 Basic circuit configurations with operational amplifiers.

Specific objectives:
This chapter introduces the operational amplifier and the basic tools used in the analysis of circuits containing this device. The configurations used to build comparators and amplifier circuits are also studied.

Related activities:
Theory sessions with exercises solved in class.

PRACTICE 4: CIRCUITS WITH OPERATIONAL AMPLIFIERS

Full-or-part-time: 8h
Theory classes: 4h
Laboratory classes: 2h
Self study : 2h

Chapter 6: Electronic systems design

Description:
The following topics are included in this chapter:
6.1 Transformer design.
6.2 Power dissipators
6.3 Batteries

Specific objectives:
The objective of this chapter is that students know the principle of operation of transformers. Special emphasis is placed on the implications that the weight and volume of these devices have on user-oriented ergonomic design. A very similar approach is taken on power sinks and the use of batteries.

Related activities:
Theory sessions and exercises solved in class

Full-or-part-time: 8h
Theory classes: 6h
Self study : 2h

GRADING SYSTEM

Knowledge of students about electronics will be evaluated through written exams and lab activities. Theoretical concepts correspond to the 80% weight of student evaluation. As for the lab, the weight is 20%.

Concerning the theory (80%), two written tests will be available, one in the middle of the course and one at the end. The second written test will allow the recovery of the first one. These two tests may be re-evaluated according to School regulations.

Concerning the laboratory (20%), the students will develop guided practical activities and deliver the results of the measures that are expected to be obtained in each of them.

EXAMINATION RULES.

As for the written exams, students can take a scientific calculator, and can use a pencil or black/blue ballpen (the red colour is reserved for teacher corrections and annotations).
Using any kind of electronic device with Internet connection (mobile phone, Tablet, or laptop) according to the current school regulations.

BIBLIOGRAPHY

Basic:
- Thomas, Roland E; Rosa, Albert J. Circuitos y señales : introducción a los circuitos lineales y de acoplamiento. Barcelona [etc.]: Reverté, 1991. ISBN 8429134581.
- Madhu, Swaminathan; Unnikrishnan, R. Linear circuit analysis. Englewood Cliffs, N.J: Prentice-Hall, 1988. ISBN 0135367158.
- Sedra, Adel S; Smith, Kenneth Carless. Microelectronic circuits. 7th ed. New York: Oxford University Press, 2016. ISBN 9780199339143.
- Floyd, Thomas L. Fundamentos de sistemas digitales [on line]. 11a ed. Madrid: Pearson Educación, 2016 [Consultation: 19/02/2024]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6120. ISBN 9788490353004.
- Floyd, Thomas L. Principles of electric circuits : conventional current. 10th ed. Harlow, Essex: Pearson, 2022. ISBN 9781292358093.
- Franco, Sergio. Design with operational amplifiers and analog integrated circuits. 4th ed. Boston [etc.]: McGraw-Hill, 2015. ISBN 9780078028168.
- Storey, Neil. Electronics: a systems approach [on line]. 6th ed. Harlow, England ; New York: Pearson Education Limited, 2017 [Consultation: 14/02/2024]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5186355. ISBN 9781292114064.