Course guide
320100 - CDE - Electronic Devices and Circuits

Last modified: 19/04/2023

Unit in charge:	Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit:	710 - EEL - Department of Electronic Engineering.

Degree:	BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023   **ECTS Credits:** 6.0   **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer:	JOSÉ ANTONIO SORIA PÉREZ
Others:	JOSÉ ANTONIO SORIA PÉREZ LUIS JORGE FERRER ARNAU

PRIOR SKILLS

Average skills and fluent use of Linear Algebra and Infinitesimal Calculus

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE04-ESAUD. Understanding and mastery of basic concepts of linear systems and related functions and transforms, theory of electrical circuits, electronic circuits, physical principles of semiconductors and logic families, electronic and photonic devices, materials technology, and their application for solving engineering problems. (Basic training module)

Generical:
CG03-ESAUD. Knowledge of basic subjects and technologies, which enables learning of new methods and technologies, as well as providing great versatility to adapt to new situations.

TEACHING METHODOLOGY

The course is divided into two main parts: one in which technical and analytical training is acquired to understand electrical circuits, and another based on applications where, in addition to knowing the fundamentals of electronic components, real applications of electronics in the industry are seen. The first part includes the solving of exercises (individual and / or group) dedicated to the theoretical aspects of electric networks and usage of the lab instruments. In the second part two basic applications are studied: power supplies and signal amplifiers which are considered two of the first basic circuits of electronic systems in the field of audio and video.

In the lab, basic electronic prototypes are assembled to learn using the instruments in order to perform measurements at a basic level and verify the operation of circuits. These activities are carried out by groups of two students.

LEARNING OBJECTIVES OF THE SUBJECT

- Knowing how to use the laws and theorems in order to solve electric circuits with linear components (I/V sources and resistors).
- Knowing the behavior of basic electronic devices: Resistors, Capacitors and Inductors, Transformers, Diodes, Transistors (BJT and MOSFET), Voltage Regulators and Operational Amplifiers.
- Reverse Engineering: Knowing how to obtain the behavior of basic real electronic applications.
- Using simulation software to contrast theoretical and experimental data and results.
- Knowing how to read the specifications of electronic components to obtain their limitations
- Use the basic tools and instruments of the lab.
- Developing electronic dessign in printed boards (PCB) using CAD software.
- Mounting prototypes in test boards (Breadboard)
- Using the lab instruments correctly to develop electric measurements in order to verify the performance of prototypes (power supply, waveform function generator, oscilloscope and multimeter)

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours medium group	15,0	10.00
Hours small group	15,0	10.00
Hours large group	30,0	20.00

Total learning time: 150 h

CONTENTS

Topic 1: DC CIRCUIT ANALYISIS

Description:
1.1 Introduction: Representation of circuit diagrams, components, source signals, electric variables and magnitudes.
1.2 Ohm's and Kirchoff's laws (KCL, KVL).
1.3 Series and Parallel association of resitors. Voltage/Current divider.
1.4 Thevenin and Norton theorems. Changes of topology
1.5. Nodal, branch and mesh analysis.
1.6 Superposition theorem
1.7. Concepto of mobility in sources and superfluous component.

Specific objectives:
- Basic Training of circuit analysis (Level I)
- Circuit Simulation
- Correct use of the DC power supply and the multimeter.
- Basic electronic prototyping (Level I)

Related activities:
Test_NP1 - First Test
PB_NP1 - Problem solving
LAB1 - Lab activities
LAB 2 - Lab exam

Full-or-part-time: 71h
Theory classes: 18h
Laboratory classes: 6h
Self study : 47h

TOPIC 2: DC POWER SUPPLY

Description:
2.1 DC and AC diode circuit analysis with rectifier and zener diodes (Level II - Intermediate)
2.2 DC analysis with capacitor and inductor circuits (Level II - Intermediate)
2.3 Transformers.
2.4 Bridge Rectifiers.
2.5 Voltage Filters
2.6 Voltage Regulators

Specific objectives:
- Training in Circuit Analysis (Level II - Intermediate)
- Dessign and Simulation off DC Power Supplies
- Using the oscilloscope correctly
- Electronic prototyping (Level II - Intermediate)

Related activities:
Test_NP2 - Second Test
PB_NP2 - Dessign problem
LAB1 - Lab activities
LAB2 - Lab exam

Full-or-part-time: 41h
Theory classes: 13h 30m
Laboratory classes: 4h
Self study : 23h 30m

Topic 3: AC SIGNAL AMPLIFIFIERS

Description:
3.1 Circuit analysis with transistors (BJT and MOSFET) (Nivell III - Advanzed).
3.2 Biasing of a Signal Amplifier.
3.3 Concept of Input/Output Impedance.
3.4 Concept of Gain, linearity and Dynamic Range.
3.5 Análisis de circuitos con OPAMP (Nivell I - Aplicaciones Básicas)

Specific objectives:
- Training of circuit analysis (Level III - Advanced)
- Dessing and Simulation of Signal Amplifiers
- Electronic prototyping with BJT and OPAMPS (level II - Intermediate)

Related activities:
Test_NP2 - Second Test
PB_NP2 - Dessign problem
LAB1 - Lab activities
LAB2 - Lab exam

Full-or-part-time: 38h
Theory classes: 10h 30m
Laboratory classes: 4h
Self study : 23h 30m

GRADING SYSTEM

The grading of the subject (NF_COURSE) is calculated as:

NF_COURSE = 0,1·Test_NP1 + 0,2·PB_NP1 + 0.1·Test_NP2 + 0,1·PB_NP2 + 0,15·LAB1 + 0,2·LAB2 + 0,15·PRJ (1)

For those students with an unfavorable evaluation (NF_COURSE
NF = 5.0 if NF_REV = 0,5·REV + 0,15·LAB1 + 0,2·LAB2 + 0,15*PRJ >= 5.0 or NF= max(NF_COURSE;NF_REV) otherwise.

EXAMINATION RULES.

- All activities have a maximum score of 10 points.
- Carrying out all lab activities and the project (LAB1, LAB2 and PRJ included) are necessary for grading the course, or otherwise only written exams are taken into account in (1) and the maximum grade possible is (NF_COURSE - A document with formulae used during course must be downloaded from ATENEA and printed for written exams (TEST_NP1, TEST_NP2, PB_NP1, PB_P2).
- A scientific calculator can be used during the exams but all kind of devices with communication and Internet connection capabilities are strictly forbidden.

BIBLIOGRAPHY

Basic:
- Floyd, Thomas L. Principios de circuitos eléctricos. 8ª ed. México: Pearson, 2007. ISBN 9789702609674.
- Floyd, Thomas L. Dispositivos electrónicos [on line]. 8ª ed. México: Pearson, 2008 [Consultation: 15/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6756. ISBN 9789702611936.
- Prat, Lluís [et al.]. Circuitos y dispositivos electrónicos: fundamentos de electrónica. 6ª ed. Barcelona: Edicions UPC, 1999. ISBN 848301291X.

Complementary:
- Bruce Carlson, A. Circuitos: ingeniería, conceptos y análisis de circuitos eléctricos lineales. México D.F: International Thomson, 2001. ISBN 9706860339.
- Edminister, J.A.. Circuitos eléctricos. 3ª ed. Madrid: McGraw-Hill, 1997. ISBN 8448110617.
- Malvino, Albert Paul; Bates, David J. Principios de electrónica [on line]. 7ª ed. Madrid: McGraw-Hill, 2007 [Consultation: 26/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4146. ISBN 9788448156190.