Course guide
230900 - CCE - Components and Circuits

Last modified: 24/05/2024

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN ELECTRONIC ENGINEERING AND TELECOMMUNICATION (Syllabus 2018). (Compulsory subject).

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

LECTURER

Coordinating lecturer: ALBERTO ORPELLA GARCIA

Others: Primer quadrimestre:
JUAN DE DIOS CASTILLO MACHICADO - 12
ALBERTO ORPELLA GARCIA - 11, 12, 13
PABLO RAFAEL ORTEGA VILLASCLARAS - 11, 13

PRIOR SKILLS

Linear systems resolution

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE1. (ENG) GREELEC: Capacitat per a la resolució dels problemes matemàtics que poguin plantejar-se a l'enginyeria. Aptitut per aplicar els coneixements sobre àlgebra lineal, geometria, geometria diferencial, càlcul diferencial i integral, equacions diferencial i en derivades parcials, mètodes numèrics, algorítmica numèrica, estadística i optimització. (Mòdul de formació bàsica).

Generical:
CG3. (ENG) GREELEC: Coneixmetn de matèries bàsiques i tecnològíes que el capacitin per a l'aprenentatge de nous mètodes i tecnologies, així com que el dotin d'una gran versatilitat per adaptar-se a noves situacions.

Transversal:
CT6. (ENG) GREELEC:APRENENTATGE AUTÒNOM: Detectar deficiències en el propi coneixement i superarles mitjançant la reflexió crítica i l'elecció de la millor actuació per ampliar coneixements.

Basic:
CB5. (ENG) GREELEC: Que els estudiants pugin desenvolupar habillitats d'aprenentatge per empendre estudis superiors amb un alt grau d'autonomia.

TEACHING METHODOLOGY

Lectures
Application classes
Laboratory activities
Individual work
Exercises
Short answer test (Control)
Extended answer test (Final Exam)
Laboratory
Laboratory examination

LEARNING OBJECTIVES OF THE SUBJECT

Learn to analyze basic linear circuits using different possible methods. Understand the operation of nonlinear elements: Diode, bipolar transistor and operational amplifier. Study their equivalent circuits, and learn to analyze basic circuits using these models.

STUDY LOAD

Type	Hours	Percentage
Self study	85,0	56.67
Hours large group	52,0	34.67
Hours small group	13,0	8.67

Total learning time: 150 h

CONTENTS

Part 1. Introduction to electronic circuits

Description:
Electrical variables: Difference of potential, current intensity, power. Concept of circuit. Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law(KVL). Basic circuit elements. Voltage-current characteristics.

Full-or-part-time: 15h
Theory classes: 6h
Self study : 9h

Part 2. Resistive circuits. Simplification techniques

Description:
Concept of equivalent circuit. Elements in series and parallel. Resistances and sources in series and parallel. Voltage and current dividers. Irrelevant elements. Load effects. Circuit reduction techniques.

Full-or-part-time: 20h
Theory classes: 8h
Self study : 12h

Part 3. Circuit analysis methods

Description:
Node-voltage analysis method. Mesh-current analysis method. Examples

Full-or-part-time: 24h
Theory classes: 10h
Self study : 14h

Part 4. Linear circuit theorems

Description:
Concept of linearity. Superposition theorem. Thévenin and Norton equivalent circuits. Signal transfer. Maximum power transfer.

Full-or-part-time: 20h
Theory classes: 8h
Self study : 12h

Part 5. Introduction to the modeling of electronic components. Applications

Description:
Diode: ideal diode. Exponential and piecewise linear models. Circuit analysis with diodes.
Bipolar NPN Transistor: Input and Output characteristics. Working regions and equivalent circuits. Circuit analysis with bipolar transistors.
Operational amplifier: Ideal operational amplifier. Output characteristic and operating zones. Equivalent circuits. Basic circuit analysis using ideal operational amplifiers.

Full-or-part-time: 44h 40m
Theory classes: 18h
Self study : 26h 40m

Laboratory activities

Description:
Lab 0.- Presentation of the laboratory course
Lab 1.- Introduction to the multimeter, the protoboaord and circuits with resistors
Lab 2.- The power supply
Lab 3.- Measures in continuous. Voltage and current divider. The potentiometer
Lab 4.- The oscilloscope and the generator of functions
Lab 5.- Introduction to the operational amplifier (I)
Lab 6.- Introduction to the operational amplifier (II)

Full-or-part-time: 26h 20m
Laboratory classes: 13h
Self study : 13h 20m

GRADING SYSTEM

Laboratory mark (LAB): 10%
Homework (PROB): 10%
Theory midterm exam during the course (EXPAR): 30%
Theory final exam (EXFIN): 50%

Final mark (NF) is the major of the two following expressions:
NF = 0,1*LAB + 0,1*PROB + 0,3*EXPAR + 0,5*EXFIN , or
NF = 0,1*LAB + 0,1*PROB + 0,8*EXFIN , in case the result of this expression is greater than the previous one.

The reassessment only includes the theory exam of the course with a weight of 90%. Mark related to the laboratory remain the same as the previous assessment with a weight of 10%.

BIBLIOGRAPHY

Basic:
- Thomas, R.E.; Rosa, A.J.; Toussaint, G.J. The analysis and design of linear circuits. 7th ed. Hoboken, NJ: John Wiley & Sons, 2012. ISBN 9781118065587.
- Prat, L.; Bragós, R. Circuits i dispositius electrònics: fonaments d'electrònica. 2a ed. Barcelona: Edicions UPC, 2002. ISBN 8483015749.