# Course guide
# 230900 - CCE - Components and Circuits

**Last modified:** 11/04/2025

**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:** 2025 **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.