

Course guide

230004 - FE - Fundamentals of Electronics

Last modified: 17/12/2015

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

Degree: **Academic year:** 2015 **ECTS Credits:** 6.0
Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: CRISTOBAL VOZ SANCHEZ - ALBERTO ORPELLA GARCIA

Others: ANGEL RODRIGUEZ MARTINEZ - MIREYA FERNANDEZ CHIMENO - JOSEP ALTET SANAHUJES -
ALEXANDRA BERMEJO BROTO - ISIDRO MARTIN GARCIA - JOAQUIN PUIGDOLLERS
GONZALEZ - LUIS PRAT VIÑAS - PABLO RAFAEL ORTEGA VILLASCLARAS - IGNACIO TOUS
MUNTANER - JUAN MIGUEL LOPEZ GONZALEZ - PAU GARCIES SALVA - PAU MOLINAS MATA

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Generical:

1. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

Transversal:

2. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

TEACHING METHODOLOGY

Theoretical classes
Laboratory classes
Cooperative work (out of classrooms)
Individual work (out of classrooms)
Short answer controls (Test)
Long answer controls
Long answer controls (Final examination)
Laboratory

LEARNING OBJECTIVES OF THE SUBJECT

The student will know the most common components in electrical circuits and their characteristics. He will solve electrical circuits and calculate their equivalents. Basic concepts on semiconductors physics. Main electronic devices and equivalent circuit models. Introduction to the design of circuits for electronics and telecommunications. The student will identify electrical and electronic components in the laboratory and he will fabricate simple circuits. Use of instruments for measuring electrical magnitudes in the laboratory.

Results of the learning process:

He understands the basic concepts in the analysis of electrical and electronic circuits, physical principles of semiconductors and logic families, electronic and photonic devices, technology of materials and their application to solve engineering problems.

He knows and uses tools, instruments and software of the laboratories to analyze experimental data.



STUDY LOAD

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

Total learning time: 150 h

CONTENTS

Unit 1. Analysis of electrical circuits

Description:

Components and electrical circuits. Conductive elements and switches. Voltage and current independent sources. Resistance and Ohm's law. Equivalent resistance. Linear controlled sources. Electrical Power. Kirchhoff's law. Analysis of electrical circuits by the junction and loop rules. Linear circuit. Superposition. Thevenin and Norton equivalent circuits. Signal and power electrical transfer.

Full-or-part-time: 50h

Theory classes: 20h

Self study : 30h

Unit 2. The capacitor and the inductor

Description:

The capacitor as electrical element. Capacity. Equivalent capacitor. The inductor as electrical element. Induction. Equivalent inductor. Transient analysis of first order electrical circuits with capacitors and inductors. Electrical energy in capacitors and inductors.

Full-or-part-time: 12h

Theory classes: 5h

Self study : 7h

Unit 3. The junction diode and its applications

Description:

Introduction to semiconductor physics. Concept of semiconductors. The silicon case. Intrinsic and doped semiconductor. Charge carriers: the electron and the hole. Energy bands. Drift and diffusion currents. The PN junction diode. Rectifying effect. Breakdown of the diode.

The diode as an element of electronic circuits. Approximated models for the diode. Ideal and piecewise linear models. Analysis of circuits with diodes using simplified models. Applications of the diode. Rectifying, limiting and stabilizing circuits.

Full-or-part-time: 25h

Theory classes: 10h

Self study : 15h



Unit 4. The transistor and the signal amplifier

Description:

The bipolar junction transistor. Input and output characteristics. Regions of operation and basic equations. The field-effect transistor. Input and output characteristics. Regions of operation and basic equations.

Amplifying circuits based on transistors. Power supply, signal and load in electronic circuits. Biasing of the transistor. Bias point. Small signal equivalent circuit. Voltage gain, input and output resistances. Load line and dynamic range.

Full-or-part-time: 25h

Theory classes: 10h

Self study : 15h

Laboratory

Description:

The student will obtain experimental abilities for this subject in the "Electronics and physics laboratory" of 2.4 ECTS that includes also the experimental part of the subject "Physics fundamentals". The content of this joint laboratory is:

1. Presentation of the laboratory.
2. The power source and the digital multimeter.
3. Electrical measurements in DC.
4. The oscilloscope and the function generator.
5. I-V characteristics of the rectifying diode, LED and Zener.
6. Study of the I-V characteristic of the diode.
7. The bipolar junction transistors (BJT).
8. RC and RL circuits.
9. Oscillations in RLC circuits.
10. The transformer, rectifying circuits and capacitor filter.
11. Power source with BJT regulator.
12. Acoustic waves.
13. Wave interferences.

Full-or-part-time: 30h

Laboratory classes: 13h

Self study : 17h

GRADING SYSTEM

Laboratory practice: 20%

Midterms: 40%

Final exam: 40%

This course will evaluate generic competition:

- Teamwork (Elementary Level)
- Knowledge of instrumentation and experimental (Elementary Level)

BIBLIOGRAPHY

Basic:

- Prat Viñas, Ll. [et al.]. Circuits i dispositius electrònics: fonaments d'electrònica. 2a ed. Barcelona: Edicions UPC, 2002. ISBN 8483015749.

- Thomas, R. E.; Rosa, A. J. Circuitos y señales: introducción a los circuitos lineales y de acoplamiento. Barcelona: Reverté, 1991. ISBN 8429134581.

Complementary:



- Floyd, T.L. Electronics fundamentals: circuits, devices and applications. 8th ed. Upper Saddle River, NJ [etc.]: Prentice Hall, 2010. ISBN 9780135096833.
- Senturia, S.D.; Wedlock, B.D. Electronic circuits and applications. New York: John Wiley and Sons, 1975. ISBN 0471776319.
- Malik, N.R. Circuitos electrónicos: análisis, diseño y simulación. Madrid: Prentice Hall, 1996. ISBN 8489660034.