



Course guides

230036 - ECOMSE - Communication Electronics

Last modified: 18/10/2020

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

Degree: BACHELOR'S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2020 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Vidal, Eva
Mateo, Diego

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Generical:

12 CPE N3. They will be able to identify, formulate and solve engineering problems in the ICC field and will know how to develop a method for analysing and solving problems that is systematic, critical and creative.

TEACHING METHODOLOGY

Lectures
Application classes
Laboratory classes
Group work (distance)
Individual work (distance)
Exercises
Short answer tests (Control)
Long answer tests (Final Exam)
Laboratory work

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject:

The aim of this course is to give students a clear overview of the problems and issues that must be dealt with on designing electronic circuits for communications as well as a comprehensive overview of the basic concepts, technologies and theoretical foundation of analog/RF electronic design. Concepts will be worked out with examples from practical systems and hands-on exercises to be developed along the course.

Learning results of the subject:

- ¿ Understand the principles and concepts involved in designing the RF/analog part of transceiver circuits in a communication system.
- ¿ Understand the relation between receiver specifications and circuit specifications.
- ¿ Ability to analyse and design simple circuits in a RF or optical transceiver.



STUDY LOAD

Type	Hours	Percentage
Self study	85,0	56.67
Hours large group	39,0	26.00
Hours small group	26,0	17.33

Total learning time: 150 h

CONTENTS

1. General aspects of communication circuits

Description:

- 1.1. Introduction to communication circuits.
- 1.2. Basic concepts in communication circuits.
- 1.3. Figures of Merit. Non-linearities, interferences, noise, sensitivity and dynamic margin.
 - 1.3.1. Estimation of noise parameters.
 - 1.3.2. Linearity, large signal performance and spurious-free dynamic range (IP3 and SFDR).
- 1.4. Non-idealities effects at system level.
- 1.5. Passive RLC networks (resonant and impedance transformers)

Full-or-part-time: 17h 55m

Theory classes: 3h 27m

Laboratory classes: 2h

Self study : 12h 28m

2. Basic transistor stages

Description:

- 2.1. The MOS transistor. Large and small-signal models.
- 2.2. Common-source, common-drain and common-gate topologies.
- 2.3. Current mirror.
- 2.4. Differential pair.
- 2.5. The BJT transistor. Large and small-signal models.
- 2.6. Basic topologies with BJT transistors.

Full-or-part-time: 56h 21m

Theory classes: 8h 54m

Laboratory classes: 14h

Self study : 33h 27m



3. Amplifiers for receivers in communication systems

Description:

- 3.1. Bandwidth-estimation techniques.
- 3.2. Bandwidth-extension techniques.
- 3.3. Tuned amplifiers.
- 3.4. Low-noise amplifiers.
- 3.5. Input impedance matching.
- 3.6. Transimpedance amplifiers for optical communications.

Full-or-part-time: 22h 33m

Theory classes: 5h 24m

Laboratory classes: 4h

Self study : 13h 09m

4. Power amplifiers

Description:

- 4.1. General considerations.
- 4.2. Figures of Merit.
- 4.3. Impedance matching.
- 4.4. Basic power amplifiers. Class A, Class B, Class AB and Class C.
- 4.5. Switched amplifiers: Class D, Class E and Class F.
- 4.6. Linearization techniques

Full-or-part-time: 22h 33m

Theory classes: 5h 24m

Laboratory classes: 4h

Self study : 13h 09m

5. Signal generators

Description:

- 5.1. Fundamentals of oscillator design.
- 5.2. Describing function.
- 5.3. Basic LC and crystal topologies.
- 5.4. Multivibrators.
- 5.5. Voltage-controlled variable frequency oscillators.

Full-or-part-time: 7h 12m

Theory classes: 3h

Self study : 4h 12m

7. Frequency synthesizers

Description:

- 7.1. General considerations. Figures of merit.
- 7.2. Phase-Locked Loops: basic PLL.
- 7.3. First and second-order PLLs. N-integer PLLs
- 7.4. Charge-Pump PLLs.
- 7.5. Phase detectors.

Full-or-part-time: 4h 27m

Theory classes: 4h 27m



ACTIVITIES

(ENG) Proves de resposta llarga (Control)

(ENG) Exercicis

(ENG) Pràctica de laboratori

(ENG) Pràctica de laboratori

(ENG) Pràctica de laboratori

(ENG) Pràctica de laboratori

GRADING SYSTEM

Final grade based on the respective qualifications of the theory (60%) and the laboratory (40%) parts. The theory part consists in 60% from a final exam and 40% from the short exams done and the eventual works & exercises delivered during the course.

BIBLIOGRAPHY

Basic:

- Razavi, B. RF microelectronics. 2nd ed., int.ed. Upper Saddle River: Pearson Education International, 2012. ISBN 9780137134731.
- Carusone, T.C.; Johns, D.; Martin, K.W. Analog integrated circuit design. International student version. New York: John Wiley, 2013. ISBN 9781118092330.
- Lee, T.H. The design of CMOS radio-frequency integrated circuits. 2nd ed. Cambridge: Cambridge University Press, 2004. ISBN 0521835399.