Integrated Circuits and Systems for Communications

Code: 42835
ECTS Credits: 6

2024/2025

Degree	Type	Year
4313797 Telecommunication Engineering	OB	1

Contact

Name: Núria Barniol Beumala

Email: nuria.barniol@uab.cat

Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Recommendations: basic knowledge on electronic devices; theory and analysis of electrical circuits; fundamentals of microelectronics technology

Objectives and Contextualisation

Provide the concepts, techniques and tools for the design and implementation of analog integrated systems as fundamental blocks for communication systems. The studies will cover future trends of these integrated systems in terms of design and technological predictions.

Competences

- Capacity for critical reasoning and thought as means for originality in the generation, development and/or application of ideas in a research or professional context.
- Capacity for designing and manufacturing integrated circuits.
- Capacity for working in interdisciplinary teams
- Capacity to design communications components such as routers, commuters, concentrators, emitters and receivers in different bandwidths.
- Capacity to integrate new technologies and systems developed within telecommunications engineering in general and in broader, multidisciplinary contexts such as bioengineering, photovoltaic conversion, nanotechnology, telemedicine
- Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context
- Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent
- Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study

Learning Outcomes

1. Analyse the function of integrated circuits for RF from the dimensions of their components
2. Capacity for critical reasoning and thought as means for originality in the generation, development and/or application of ideas in a research or professional context.
3. Capacity for working in interdisciplinary teams
4. Define the electrical characteristics of integrated RF systems according to their application
5. Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context
6. Propose alternative circuits to improve the performance of the integrated circuits designed
7. Propose specific architectures for integrated RF systems.
8. Recognize the possibilities of integration according to the characteristics of the communication system to perform
9. Student should possess the learning skills that enable them to continue studying in a way that is largely student led or independent
10. Students should know how to apply the knowledge they have acquired and their capacity for problem solving in new or little known fields within wider (or multidisciplinary) contexts related to the area of study
11. Use standard tools effectively for integrated circuit design

Content

1. Design and analysis of the basic building blocks in CMOS integrated systems for analog applications

2.-Design of integrated circuits for radiofrequency communication systems. Basic concepts and circuits .

3. Limits and trends of the radiofrequency integrated circuits and systems

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory	15	0.6	1, 2, 4, 5, 6, 9, 10, 11
Problems	15	0.6	1, 2, 4, 5, 6, 10, 11
Theory	15	0.6	1, 2, 4, 6, 10, 11
Type: Autonomous			
Preparation of reports and oral expositions	30	1.2	1, 2, 4, 6, 10, 11
Problems solving	25	1	1, 2, 4, 6, 10, 11
Study to assimilate concepts	30	1.2	1, 2, 4, 5, 6, 9, 10

Theory: Oral exposition of the fundamentals concepts. Concepts will be partially introduced as specific-cases.

Problems: analytical resolution and simulation of problems, exercises and specific-cases .

Laboratory: Hands-on specific design tools for integrated circuit design and simulation.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exams	40%	6	0.24	1, 2, 4, 6, 7, 10
Report on practical work	30%	6	0.24	1, 2, 3, 5, 9, 10, 11
Specific written reports	30%	8	0.32	2, 3, 5, 7, 8, 9, 10

This subject does not foresee the single assessment system

The continuous assessment is based on the following qualifications:

• 1 partial exam (20%): written (first partial). recoverable activity
• 1 partial exam (20%): oral presentation (second partial). recoverable activity
• Laboratory report (written) (30%). Mandatory and non-recoverable activity.
• Delivery of analog circuit design problems along the course (30%). Non-recoverable activity.

There will be a final recovery exam, mandatory if the average of the two partial exams is still below 4. The resulting final exam score will be weighted by 40%.

The qualification "Not evaluated" will be only granted if the student does not participate in any evaluation activities (lab sessions, oral exposition, exams)

The qualification "Matrícula d'Honor" can be granted to the 5% of the students enrolled with scores that exceed the qualification of 9 in all the assessment activities and that the final qualification is still higher than 9.3.

Bibliography

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RF Microelectronics. B.Razavi. Second edition. Prentice Hall, 2012

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Radio-frequency microelectronic circuits for telecommunication applications. Papananos, Yannis E.. Kluwer Academic Publishers, 1999

CMOS mixed-signal circuit design. Baker, R. Jacob. Piscataway : IEEE Press ; New York : Wiley-Interscience, cop. 2009 2nd ed.

Radio frequency integrated circuit design. Rogers, John W. M. Boston : Artech House, 2010 2nd ed.

Analysis and design of analog integrated circuits . Paul R. Gray... [et al.New York [etc.] : John Wiley, cop. 2010

LNA-ESD co-design for fully integrated CMOS wireless receivers. Leroux, Paul. Springer, 2005

Millimeter-wave integrated circuits.Eoin Carey, Springer, cop. 2005

The design of CMOS radio-frequency integrated circuits. Lee, Thomas H., 1959- Cambridge [etc.] : Cambridge University Press, 2004. 2nd ed.

High-frequency oscillator design for integrated transceivers. Tang, Johan van der. Boston [etc.] : Kluwer Academic Publishers, cop. 2003

CMOS circuit design, layout and simulation. Baker, Li and Boyce. Ed. IEEE Press

Microelectronics Circuits, Sedra and Smith, Oxford University Press, 2010

Software

Software for the design of CMOS microelectronic circuits, Cadence

Language list

Information on the teaching languages can be checked on the CONTENTS section of the guide.