# System-on-Chip and efficient electronic circuit integration techniques

**Academic Year: ( 2020 / 2021 )** **Review date: 10-07-2020**

**Department assigned to the subject: Electronic Technology Department**

**Coordinating teacher: PATON ALVAREZ, SUSANA**

**Type: Electives ECTS Credits : 3.0**

**Year : 1 Semester : 2**

## REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

- Analog and Digital Subsystem Design (O)
- Techniques and tools for electronic systems design (O)

## OBJECTIVES

QUALIFICATIONS:

Have demonstrated knowledge and understanding that provides a basis or opportunity for originality in developing and/or applying ideas, often within a research context.

Can apply their knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) context related to their field of study.

Have the ability to integrate knowledge and handle complexity, and formulate judgments with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.

Have the learning skills to allow them to continue to study in a manner that may be largely self-directed or autonomous.

Have demonstrated the ability of understanding, making use and integrating of new technologies in electronic systems, to solve new problems or applications.

Adopting the scientific method as a fundamental working tool in both professional and research careers.

Have the ability to design electronic systems at the behavioral level, from a set of certain specifications, whether at system level, using modeling and simulation tools, or at subsystem level, using hardware description languages.

Have demonstrated knowledge of new analog and power electronics, and photonic components (including those based on new materials and structures) for improving the performance of current applications or systems.

Have the ability to handle tools, techniques and methodologies for designing advanced electronic systems or subsystems

Have the ability to design a device, system or application that meets the design objectives and specifications, using a systematic and multidisciplinary approach and integrating modules and advanced tools that are specific to the field of Electronic Engineering.

Have the ability to solve practical problems related to the block inside or outside interactions in electronic systems; including signal interferences, electromagnetic compatibility and thermal management, at the design and pre-manufacturing stage and also when re-design is required.

Students should be able to identify the relevant figures of merit and comparison techniques to obtain the best solutions to scientific and technological challenges in the field of Electronic Engineering and its applications.

Have the ability to apply optimization techniques for the development of electronic circuits and subsystems.

Have the ability to be effective in looking for information, identifying the state of the art of a technological problem in the field of Electronics System Engineering and integrating this knowledge in future systems.

Have demonstrated the knowledge of current state of the art and future trends in any of the following areas: power electronics and/or photonics components and subsystems, integrated circuits, integrated optic circuits, microsystems, nanoelectronics, identification and/or disabled people aided systems.

Learning outcomes acquired by the student:

- Knowledge on the current state-of-the-art on integrated circuits and the different fields of application
- The ability to design analog and mixed-signal circuits for different applications
- Knowledge on the different strategies to optimize power consumption in mixed signal integrated circuits
- Knowledge on specific tools for simulation, design and physical implementation (layout) of ASICs.

## DESCRIPTION OF CONTENTS: PROGRAMME

The state-of-the-art for CMOS Application Specific Integrated Circuits (ASIC) and their applications will be described stressing the implications on circuit design and introducing the concept of Systems-on-Chip (SoC), as well as some simulation and design (including layout) tools for ASICs. Different mixed signal front-end circuits for Integrated Circuits (IC) and ASICS will be described and the intended applications. These descriptions will be used to classify circuits in terms of functionality, power consumption, size and figures-of-merit such as linearity, noise immunity and so on, of capital importance for ICs and ASCIs design. Finally, techniques for power consumption reduction and performance enhancement will be presented through several circuit examples.

## LEARNING ACTIVITIES AND METHODOLOGY

Learning activities:
-Theoretical classes
-Practical classes: They will be carried out with free circuit simulation software and lay-out tools. In 2020/2021 academic year, they will be carried out individually in the classroom with a laptop, or in a synchronous online format.
-Theoretical-practical classes
-Tutorials

## ASSESSMENT SYSTEM

The evaluation system consists of the following sections:
- A test exam or short questions that is taken at the middle of the course and that assesses basic theoretical knowledge (20%).
- A collection of practical works: design exercises, simulations and lay-out of small blocks and some system (40% in total). The evaluation of this part will be based on the deliveries of the students, and may be complemented with an individual practical knowledge quiz.
- Final exam based on problems and short questions with a weight of 40%

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| **% end-of-term-examination:** | 40 |
| **% of continuous assessment (assigments, laboratory, practicals…):** | 60 |

## BASIC BIBLIOGRAPHY

- Baker, R. Jacob  CMOS: circuit design, layout, and simulation, IEEE Press, 2005

- Sansen, Willy M. C. Analog design essentials, Springer, 2006

## ADDITIONAL BIBLIOGRAPHY

- Johns, David Analog integrated circuit design, John Wiley & Sons, 1997