Integrated circuits and microelectronics

Academic Year: (2020 / 2021) **Review date: 23-07-2020**

Department assigned to the subject: Electronic Technology Department

Coordinating teacher: LOPEZ ONGIL, CELIA

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

- Electronics Engineering Fundamentals (2º)
- Digital Electronics (4º)

OBJECTIVES

This subject aims to provide the student with the basic knowledge necessary to design integrated circuits.
- Knowing the design methodology of integrated circuits. Levels of abstraction.
- Designing, simulating and synthesizing digital circuits by using Hardware Description Languages.
- Knowledge and use of computer aided design (CAD) techniques and tools for integrated circuits.
- Knowledge of the technology and manufacturing processes of integrated circuits.
- Analyzing and designing integrated circuits at the physical level.
- Knowledge of integrated circuit test techniques and how it affect the circuit design

DESCRIPTION OF CONTENTS: PROGRAMME

Firstly, there is a block dedicated to the design of digital circuits of medium-high complexity by means of hardware description languages. Second, microelectronics is studied, including transistor level design and design level for both analog and digital blocks. This second block presents current manufacturing technologies and CMOS manufacturing processes. Aspects related to the integration of mixed signal circuits are also included. Finally, there is a third block dedicated to the special considerations of IC design.

1. Introduction to integrated circuits and microelectronics. Design methodology

2. Design of digital integrated circuits and validation using hardware description languages
   - Design of medium-high complexity digital circuits with VHDL
   - Types of digital architectures: serial, parallel, pipelined
   - Validation, simulation models

3. Microelectronics. Digital Integrated Circuit Design
   - Introduction to existing manufacturing technologies. CMOS technology.
   - Transistor level design of logic gates and functions.

4. Manufacture of integrated circuits
   - Manufacturing processes
   - Layout

5. Microelectronics. Analog integrated circuit design.
   - Transistor level
   - Layout level

6. Practical considerations and testing of integrated circuits

LEARNING ACTIVITIES AND METHODOLOGY

The course will be carried out through the following activities:
1. Theoretical online classes: they aim to present the knowledge that students must acquire, as well as carrying out practical exercises to develop this knowledge in an applied way. To facilitate their development, students will receive class notes and can use basic reference texts that allow them to complete and study in depth those units in which they are most interested.
2. Classes of exercises and practices. The objective is to develop a complete practical case and to assimilate the use of simulation and synthesis tools.
3. Student study: exercises and complementary readings proposed by the teacher. Personal study.
4. Exams and other assessment tests

ASSESSMENT SYSTEM

The objective of assessment is to know the grade of accomplishment of learning objectives. Student work will be assessed in a continuous way, through exercises, practical work and exams.

- Mid-term exam: 20%
- Practical case development (classroom and laboratory): 35%
  (Attendance to laboratory sessions is compulsory)
- Exercise to deliver: 10%
- Final exam: 35% (minimum mark, 4 out of 10)

Students not following the continuous assessment process, the exam will have a value of 60% for the ordinary exam and 100% for the extraordinary exam, following the university rules.

% end-of-term-examination:	35
% of continuous assessment (assigments, laboratory, practicals…):	65

BASIC BIBLIOGRAPHY

- A. Rubio, J. Altet, X. Aragonés, J.L. González, D. Mateo, F. Moll Diseño de circuitos y sistemas integrados, Ediciones UPC, 2000
- J. M. Rabaey, A. Chandraskasan, B. Nikolic Digital integrated circuits: a design perspective, Prentice Hall.

- M. Abramovici, M.A. Breuer, A. D. Friedman Digital system testing and testable design, Computer Science Press, 1990

ADDITIONAL BIBLIOGRAPHY

- D. J. Smith HDL chip design, Doone, 1997

- N. H. Weste, D. M. Harris CMOS VLSI Design. A circuits and systems perspective, Addison-Wesley, Pearson, 2011

- R. J. Baker CMOS Circuit Design, Layout and Simulation, Wiley, 2011