Course guide
270645 - NCD - Nanoelectronic Circuit Design

Last modified: 16/07/2024

Unit in charge: Barcelona School of Informatics
Teaching unit: 701 - DAC - Department of Computer Architecture.

Degree: MASTER'S DEGREE IN INNOVATION AND RESEARCH IN INFORMATICS (Syllabus 2012). (Optional subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: RAMON CANAL CORRETGER

Others: Primer quadrimestre:
RAMON CANAL CORRETGER - 10

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEE4.1. Capability to analyze, evaluate and design computers and to propose new techniques for improvement in its architecture.

Generical:
CG3. Capacity for mathematical modeling, calculation and experimental designing in technology and companies engineering centers, particularly in research and innovation in all areas of Computer Science.

Transversal:
CTR2. SUSTAINABILITY AND SOCIAL COMMITMENT : Capability to know and understand the complexity of the typical economic and social phenomena of the welfare society. Capacity for being able to analyze and assess the social and environmental impact.

Basic:
CB7. Ability to integrate knowledges and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.

TEACHING METHODOLOGY

The main concepts of processor architecture will be introduced in the lectures. The students will complete their learning experience with the lab sessions where they will put in practice the concepts learned in the lectures.

LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

Type	Hours	Percentage
Hours large group	27,0	18.00
Hours small group	13,5	9.00
Hours medium group	13,5	9.00
Self study	96,0	64.00

Total learning time: 150 h

CONTENTS

Introduction to MOS and VLSI Technology

Description:
Introduction to the technology used to build integrated circuits, historical perspective and future projections

CMOS Design

Description:
Fundamentals of VLSI MOS-based designs. Logic gates, logic styles and basic blocks.

VLSI Design Cycle

Description:
Presentation of the VLSI Design Stages, presentation of tools and workflow.

Thermal and Energy Analysis of Microprocessors

Description:
Methods and tools for thermal and energy Analysis of Microprocessors including memory, interconnect and system level modelling.

Design Implications of Temperature and Power

Description:
Presentation of the design implications of temperature and power, presentation of the most relevant compile-time and run-time techniques to control temperature and power.

Design for Reliability

Description:
Introduction to process, voltage and temperature variations, inter-die and intra-die variations. Transient errors and permanent faults.

Technology outlook

Description:
Introduction to future emerging technologies: late-cmos and post-cmos technologies

GRADING SYSTEM

The course has two marks:
1) Essay/presentation (E)
2) The lab sessions (Lab)

The final mark will be computed as: 0,4 x Lab + 0,6 x E

BIBLIOGRAPHY

Basic:
- Weste, N.H.E.; Harris, D.M. CMOS VLSI design: a circuits and systems perspective. 4th ed. Boston: Addison Wesley, 2011. ISBN 9780321547743.
- Rabaey, J.M.; Chandrakasan, A.P.; Nikolic, B. Digital integrated circuits: a design perspective. 2nd ed. Upper Saddle River: Pearson Education, 2003. ISBN 0130909963.