ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

53001549 - High level description of systems

DEGREE PROGRAMME

05BG - Master Universitario En Electronica Industrial

ACADEMIC YEAR & SEMESTER

2018/19 - Semester 2

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	53001549 - High level description of systems
No of credits	3 ECTS
Type	Optional
Academic year ot the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	05BG - Master universitario en electronica industrial
Centre	05 - Escuela Tecnica Superior de Ingenieros Industriales
Academic year	2018-19

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Teresa Riesgo Alcaide (Subject coordinator)		teresa.riesgo@upm.es	- -

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

2.2. Research assistants

Name and surname	Email	Faculty member in charge
Mariño Andres, Rodrigo	rodrigo.marino@upm.es	Riesgo Alcaide, Teresa

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

- Design of embedded systems

- Integrated circuits and reconfigurable computing

- Electronic lab

3.2. Other recommended learning outcomes

- Basic programming

- Digital system design

4. Skills and learning outcomes *

4.1. Skills to be learned

CB07 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

CB08 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

CB09 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

CE01 - Comprender, diseñar y analizar sistemas y componentes electrónicos en el ámbito de la electrónica industrial. Modelización y caracterización de sistemas electrónicos complejos.

CE04 - Utilización de herramientas CAD para la simulación, modelado y diseño de circuitos electrónicos industriales con altas prestaciones y/o restricciones

CG01 - Haber adquirido conocimientos avanzados y demostrado, en un contexto de investigación científica y tecnológica o altamente especializado, una comprensión detallada y fundamentada de los aspectos teóricos y prácticos y de la metodología de trabajo en uno o más campos de estudio

CG03 - Saber evaluar y seleccionar la teoría científica adecuada y la metodología precisa de sus campos de estudio para formular juicios a partir de información incompleta o limitada incluyendo, cuando sea preciso y pertinente, una reflexión sobre la responsabilidad social o ética ligada a la solución que se proponga en cada caso.

CT03 - Creatividad

4.2. Learning outcomes

RA15 - Distinguir los resultados obtenidos a partir de diferentes lenguajes, como SystemC y VHDL

RA16 - Interpretar y juzgar la complejidad de un sistema y seleccionar la herramienta de diseño más apropiada

RA14 - Utilizar herramientas específicas para el diseño y simulación de circuitos integrados.

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

This subject is intended to introduce the students into system-level design techniques and optimization of hardware implementation of electronic systems.

The topics covered in the subject go from the languages and tools for system-level design to the implementation of a real example for a very trendy application like Machine Learning (on-chip, in this case).

The practical part will be done using Xilinx tools like Vivado HLS and implementation in SoPC like ZynQ

5.2. Syllabus

1. Introduction
    1.1. Design methodologies of complex digital systems
    1.2. Abstraction levels
    1.3. Outline of the course
2. Languages and tools for electronic system design
    2.1. Standards for electronic systems description
    2.2. Pros and cons of different languages
    2.3. Model-based design
3. High Level Synthesis
    3.1. General procedure: scheduling and allocation
    3.2. Data types: floating and fixed point
4. Hardware-software co-design
    4.1. HW/SW Partition. Algorithm profiling
    4.2. HW/SW Communication
5. An application example
    5.1. Machine Learning using Principal Component Analysis
    5.2. Algorithm: HW and SW
6. Hands-on labs

6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Other face-to-face activities	Assessment activities
1	**1. Introdcution** Duration: 02:00			
2	**2. Languages and tools for electronic systems design** Duration: 00:00			
3	**2.3. Model-based design** Duration: 02:00			
4	**3. High-Level Synthesis** Duration: 02:00			
5	**3. High-Level Synthesis** Duration: 02:00			
6		**Using HLS Tools** Duration: 02:00		
7	**4. HW/SW Codesign** Duration: 04:00			**Homework of HLS** Continuous assessment Duration: 02:00
8	**4. HW/SW Codesign** Duration: 04:00			
9	**5. An application example** Duration: 02:00			
10		**ML learning algorithms using HLS** Duration: 04:00		
11		**ML learning algorithms using HLS** Duration: 04:00		
12				**Implementing your own intelligent system** Continuous assessment Duration: 06:00

13				**Implementing your own intelligent system** Continuous assessment Duration: 06:00
14				**Implementing your own intelligent system** Continuous assessment Duration: 06:00
15				
16				**Questionnaire/exam** Final examination Duration: 01:00

The independent study hours are training activities during which students should spend time on individual study or individual assignments.

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The subject schedule is based on a previous theorical planning of the subject plan and might go to through experience some unexpected changes along throughout the academic year.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	Homework of HLS		Face-to-face	02:00	10%	5 / 10	CB07 CB08 CT03 CE04 CE01
12	Implementing your own intelligent system		Face-to-face	06:00	20%	5 / 10	CB07 CB08 CT03 CE04 CG01 CG03 CB09 CE01
13	Implementing your own intelligent system		Face-to-face	06:00	20%	5 / 10	CB07 CB08 CT03 CE04 CG01 CG03 CB09 CE01
14	Implementing your own intelligent system		Face-to-face	06:00	20%	5 / 10	CB07 CB08 CT03 CE04 CG01 CG03 CB09 CE01

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills

16	Questionnaire/exam		No Presential	01:00	30%	5 / 10	CB07 CB08 CT03 CE04 CG01 CG03 CB09 CE01

7.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

7.2. Assessment criteria

This subject will be evaluated based on the following aspects:

1. a homework problem that the students will have to provide and discuss in the class (individual)

2. a practical work implementing Machine Learning Algorithms by means of High Level Synthesis Tools (team work)

3. a short questionnaire/exam covering the whole subject (individual)

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Papers	Bibliography	
Xilinx Tools (Vivado)	Equipment	
PynQ boards	Equipment	
slides for the classes	Bibliography	