



| Teaching Guide | | | | |
|---------------------|---|--------|--|---------|
| Identifying Data | | | | 2018/19 |
| Subject (*) | Digital Systems I | Code | 770G01026 | |
| Study programme | Grao en Enxeñaría Electrónica Industrial e Automática | | | |
| Descriptors | | | | |
| Cycle | Period | Year | Type | Credits |
| Graduate | 2nd four-month period | Third | Obligatory | 6 |
| Language | Spanish | | | |
| Teaching method | Face-to-face | | | |
| Prerequisites | | | | |
| Department | Enxeñaría Industrial | | | |
| Coordinador | Jove Pérez, Esteban | E-mail | esteban.jove@udc.es | |
| Lecturers | Jove Pérez, Esteban Meizoso López, Maria del Carmen | E-mail | esteban.jove@udc.es carmen.meizoso@udc.es | |
| Web | | | | |
| General description | O obxectivo desta materia é que o alumno coñeza as memorias e os dispositivos lóxicos programables, así como os métodos e ferramentas de deseño de circuitos sobre dispositivos lóxicos programables. | | | |

| Study programme competences | |
|-----------------------------|--|
| Code | Study programme competences |
| A3 | Capacidade para realizar medicións, cálculos, valoracións, taxacións, peritaxes, estudos e informes. |
| A4 | Capacidade de xestión da información, manexo e aplicación das especificacións técnicas e da lexislación necesarias no exercicio da profesión. |
| A5 | Capacidade para analizar e valorar o impacto social e medioambiental das solucións técnicas actuando con ética, responsabilidade profesional e compromiso social, e buscando sempre a calidade e mellora continua. |
| A25 | Coñecer os fundamentos e aplicacións da electrónica analóxica. |
| A26 | Coñecer os fundamentos e aplicacións da electrónica dixital e microprocesadores. |
| A29 | Capacidade para deseñar sistemas electrónicos analóxicos, dixitais e de potencia. |
| A30 | Coñecer e ser capaz de modelar e simular sistemas. |
| A33 | Coñecemento aplicado de informática industrial e comunicacións. |
| B1 | Capacidade de resolver problemas con iniciativa, toma de decisións, creatividade e razoamento crítico. |
| B2 | Capacidade de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial. |
| B3 | Capacidade de traballar nun contorno multilingüe e multidisciplinar. |
| B4 | Capacidade de traballar e aprender de forma autónoma e con iniciativa. |
| B5 | Capacidade para empregar as técnicas, habilidades e ferramentas da enxeñaría necesarias para a práctica desta. |
| B6 | Capacidade de usar adecuadamente os recursos de información e aplicar as tecnoloxías da información e as comunicacións na enxeñaría. |
| B7 | Capacidade para traballar de forma colaborativa e de motivar un grupo de traballo. |
| C2 | Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro. |
| C3 | Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida. |
| C6 | Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse. |

| Learning outcomes | | | |
|---|----------|--|-----------------------------|
| Learning outcomes | | | Study programme competences |
| Programa dispositivos lóxicos programables e configurables e utiliza con soltura a suas ferramentas de desenvolvemento. | | | A3 A30 A33 |
| | B1 B3 | | C3 |



| | | | |
|--|-------------------|----------------|----------|
| Coñece a realización electrónica dos circuitos convertidores A/D y D/A e sabe elegir o máis adecuado en cada aplicación. | A4 A5 | B5 B6 | C2 C6 |
| Distingue os tipos de circuitos lóxicos programables e dispositivos de memoria. | A25 A26 A29 | | |
| Coñece as técnicas de conexión de periféricos básicos, deseña o seus circuitos. | A26 A30 | B2 B4 B7 | |

| Contents | |
|---|---|
| Topic | Sub-topic |
| Subject 1. Sequential synchronous systems design | Finite state machines. Analysis and synthesis . VHDL description. |
| Subject 2. Introduction to Programmable Logic | Programmable circuits features. Steps of design. Applications. |
| Subject 3. PLD CoolRunner II architecture | Function Blocks. Macrocells. I/O Blocks. Timing model. |
| Subject 4. Digital systems design with CPLDs. | Synthesis: Examples of macros codes. Synthesis Report. Options. Translate. Fit:Options. Timing report Secuencial systems design: Clock signals. Synchronous circuits design:counters, control circuits, asynchornous inputs, metaestability. Interface between synchronous systems and other circuits. Design of complex systems: Method and practical application. |
| Subject 5. Architecture of the FPGAs of the family Spartan 3 E of Xilinx | Logic resources.CLB. Internal memories. Clock Circuits. Multipliers. E/S technologies. |
| Subject 6. Synchronous design with FPGAs | Synchronous design methodology. |
| Subject 7: Working with files | File declaration. Reading and writing files. Open and close files. Package std_logic_textio. Examples. |
| Tema 8. Diseño de un controlador VGA | DA converter for VGA into the Nexys 2. Standard VGA. Controller design. |
| Subject 8. Design of arithmetic systems with programmable logic | Adders. Subtracters. Multipliers. Dividers |
| Subject 9. Techniques for improving the performance of synchronous systems. | Duplicating states. Pipelining. |
| Contidos da memoria de verificación relacionados cos temas da asignatura | <ul style="list-style-type: none"> · Programación básica en VHDL: Temas 1 e 2. · Deseño con dispositivos electrónicos configurables: Temas 3, 4 e 6. · Circuitos de memoria. Buses. Temas 5, 6 y 7. · Conversión A/D y D/A. Tema 6 e 9. · Ferramentas de desenvolvemento de sistemas lóxicos programables: Temas 4, 6, 8, 9 e 10. · Deseño electrónico digital: Temas 4, 6, 8 e 9. · Transmisión de datos. Temas 8 y 10. |

| Planning | | | | |
|--------------------------------|--|----------------------|-------------------------------|-------------|
| Methodologies / tests | Competencies | Ordinary class hours | Student?s personal work hours | Total hours |
| Guest lecture / keynote speech | A26 | 21 | 30 | 51 |
| Laboratory practice | A29 | 19 | 32 | 51 |
| Supervised projects | A3 A4 A5 A25 A30 A33 B1 B2 B3 B7 C2 C6 | 7 | 21 | 28 |
| Problem solving | B4 B5 B6 C3 | 4 | 0 | 4 |
| Objective test | A26 A29 B1 | 5 | 10 | 15 |
| Personalized attention | | 1 | 0 | 1 |



(*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

| Methodologies | |
|--------------------------------|--|
| Methodologies | Description |
| Guest lecture / keynote speech | Exposición oral e mediante o uso de medios audiovisuais. |
| Laboratory practice | Desenrolo de prácticas de aplicación dos coñecementos teóricos adquiridos. Manexo do software de simulación e deseño de circuitos dixitais. |
| Supervised projects | Traballos de realización individual ou en grupo para o deseño dun circuito de complexidade media. |
| Problem solving | Sesions de realización de exercicios por parte dos alumnos e o profesor. |
| Objective test | Probas de avaliación que poderán incluír preguntas sobre dos contidos teóricos da asignatura, así como exercicios ou problemas relacionados cos seus contidos. |

| Personalized attention | |
|---|---|
| Methodologies | Description |
| Problem solving Guest lecture / keynote speech Laboratory practice Supervised projects | Os profesores atenderán persoalmente as dúbidas sobre calquera das actividades desenvolvidas ao longo do curso. O horario de tutorías será publicado ao comezo do cuadrimestre na páxina web do centro. |

| Assessment | | | |
|---------------------|--|---|---------------|
| Methodologies | Competencies | Description | Qualification |
| Supervised projects | A3 A4 A5 A25 A30 A33 B1 B2 B3 B7 C2 C6 | Work designing a digital system of medium complexity. The correct application of theoretical concepts to the work performed will be evaluated. It is necessary to submit an explanatory report, make an oral presentation and answer correctly the questions made by the teachers. | 40 |
| Objective test | A26 A29 B1 | There will be 2 objective tests to be performed individually for each student. The first will take place once explained the first 5 issues. It will mean the 30% of the final grade. The second test will be the final exam 1st opportunity and can have the following weights: - 30% for those students who decide to do the test of the second part. - 60% for those students who decide to do the test of the first and second parts. In that case, the grade obtained in the first objective test is discarded. | 60 |
| Others | | | |

Assessment comments



The scores for the evaluable tasks are only valid for the academic year in which they are made.

Objective tests may include short-answer questions and / or test, problem solving on paper or circuit design with the ISE software.

To achieve maximum grade at project, the following issues will be considered:

- The designed circuits must work perfectly in all its aspects (functional and temporal simulation).
- The documentation and presentation must be clear.
- The students must explain the reasons to make the design and answer correctly the questions made by the teacher regarding the project.

Final grade

The final grade is usually calculated as:

$$\text{Final grade} = 0.3 \times \text{objective test 1 grade} + 0.4 \times \text{project grade} + 0.3 \times \text{objective test 2 grade}$$

Those students who do not have qualification in the 1st objective test, or, to resort very low scores can choose to make the 2nd objective test (the test will be different in this case). In this case the final grade will be:

$$\text{Final grade} = 0.4 \times \text{project grade} + 0.6 \times \text{objective test 2 grade}$$

Second opportunity

The second time, an objective test that can consist of theoretical and practical questions, written exercises, issues and implementation of a circuit in one of the Laboratory boards will be performed.

Sources of information

| | |
|----------------------|--|
| Basic | <ul style="list-style-type: none"> - Jacobo Álvarez Ruiz de Ojeda (2004). Diseño Digital con Lógica Programable. Santiago de Compostela. Tórculo - Jacobo Álvarez Ruiz de Ojeda (2012). Diseño digital con FPGAs. Madrid : Vision Ebooks |
| Complementary | <ul style="list-style-type: none"> - Roy W. Goody (2001). OrCAD PSpice for Windows. Prentice Hall - Tocci. Ronald J. (1996). Sistemas Digitales. Prentice Hall |

Recommendations

Subjects that it is recommended to have taken before

Fundamentals of Electricity/770G01013

Fundamentals of Electronic Circuits/770G01018

Analog Electronics/770G01022

Digital Electronics/770G01023

Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus

Digital Systems II/770G01034

Other comments

Nesta asignatura dase por suposto que o alumno sabe programar en linguaxe VHDL, e manexa o entorno de deseño ISE Web Pack de Xilinx, polo que para matricularse con posibilidades de éxito é preciso haber cursado con aproveitamento Electrónica Dixital, ou ben haber adquirido esos coñecementos previamente.

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.