# Universida<sub>de</sub>Vigo

## IDENTIFYING DATA
### Application Design with micro-controllers

| | | | | |
|---|---|---|---|---|
| Subject | Application Design with micro-controllers | | | |
| Code | V05G300V01921 | | | |
| Study programme | Degree in Telecommunications Technologies Engineering - In extinction | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Optional | 4th | 1st |
| Teaching language | #EnglishFriendly Spanish Galician | | | |
| Department | | | | |
| Coordinator | Costas Pérez, Lucía | | | |
| Lecturers | Costas Pérez, Lucía Valdés Peña, María Dolores | | | |
| E-mail | lcostas@uvigo.es | | | |
| Web | http://cursos.faitic.uvigo.es/moodle3_1920/course/view.php?id=34 | | | |
| General description | Design and development of microcontroller-based applications, including design methodologies to develop real time applications, peripheral components configuration and connectivity. The scope of these contents will be adapted to the academic level reached by the students. Teachers will speak in spanish or galician language. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English. | | | |

## Competencies

| Code | |
|---|---|
| C58 | (CE58/OP1) The ability to design hardware and software systems based on microcontrollers. |
| C59 | (CE59/OP2) The ability to use software tools for microcontrollers simulation. |

## Learning outcomes

| Expected results from this subject | Training and Learning Results |
|---|---|
| Ability to know in deep the configuration methodologies of real time microcontrollers. | C58 |
| Ability to know in deep the hardware design of the microcontroller-based electronic systems. | C58 |
| Ability to know in deep the software design of the microcontroller-based electronic systems. | C58 C59 |
| Ability to go deeper into the development of microcontroller-based electronic systems. | C58 C59 |

## Contents

| Topic | |
|---|---|
| Introduction. Previous topics review. | Introduction. Previous topics review. PIC18F45K20. Internal Structure. Arithmetic and Logic Unit. Control Unit. Program memory. Data memory. Peripherals. Watch Dog Timer (WDT). |
| Instruction set. Addressing modes. | Introduction: Instruction Set. Transfer Instructions. Arithmetic Instructions. Logic Instructions. Jumps. Addressing Modes. |
| Timers. | Introduction. Timers/Counters: TMR0/TMR1/TMR2/TMR3. |
| Excepctions and interrupts. | Introduction. Excepctions. Interrupts. Interrupt Response. Registers. |
| Analog interface. | Introduction. ADC. ADC Operation. Analog Comparator Module. |
| Compare Mode. | Introduction. Capture Mode. Compare Mode. PWM. ECCP1: Enhanced Mode. |

| MSSP: Master Synchronous Serial Port SPI. I2C | Introduction. Registers. SPI Mode. I2C Mode. |
|---|---|
| Power-Managed modes. | Introduction. Different Modes. Switching between modes. |
| Input/Output. | Introduction. I/O Structure. Ports (A B C D E). Configuration Registers. Parallel Slave Port. Signal Coupling. |

## Planning

| | Class hours | Hours outside the classroom | Total hours |
|---|---|---|---|
| Laboratory practical | 12 | 38 | 50 |
| Lecturing | 12 | 33 | 45 |
| Problem solving | 5 | 15 | 20 |
| Project based learning | 7 | 22 | 29 |
| Problem and/or exercise solving | 2 | 0 | 2 |
| Problem and/or exercise solving | 2 | 0 | 2 |
| Laboratory practice | 2 | 0 | 2 |

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

## Methodologies

| | Description |
|---|---|
| Laboratory practical | The students will perform simulations and electronic circuits. The student develops the competencies CE58 and CE59. |
| Lecturing | The lecturer will explain in the classroom the subject contens. The student develops the competency CE58. |
| Problem solving | The lecturer will solve exercices related to the subject contens. The student develops the competencies CE58 and E59. |
| Project based learning | The students have to develop a project. The lecturers will help and monitor them. The student develops the competencies CE58 and CE59. |

## Personalized assistance

| Methodologies | Description |
|---|---|
| Project based learning | The Laboratory teacher will resolve the doubts of students at the schedule established and published on the school website. |
| Laboratory practical | The Laboratory teacher will resolve the doubts of students at the schedule established and published on the school website. |
| Lecturing | The teacher will resolve the doubts of students at the schedule established and published on the school website. |
| Problem solving | The teacher will resolve the doubts of students at the schedule established and published on the school website. |

## Assessment

| | Description | Qualification | Training and Learning Results |
|---|---|---|---|
| Project based learning | Students will be asked to elaborate a report related to the project they have to carry out. The lecturer will also assess individually the student's work developed during the laboratory sessions. Competencies CE58 and CE59 are assessed. | 40 | C58 C59 |
| Problem and/or exercise solving | Exam to evaluate the knowledge acquired by the student after the first part of the subject. It is carried out in a classroom session. Competency CE58 is assessed. | 20 | C58 |
| Problem and/or exercise solving | Exam to evaluate the knowledge acquired by the student related to the second part of the subject. Competency CE58 is assessed. | 20 | C58 |
| Laboratory practice | The tasks developed during the lab sessions will be included and assessed in the project. Competencies C58 and CE59 are assessed. | 20 | C58 C59 |

## Other comments on the Evaluation

CONTINUOUS ASSESSMENT:

A continuous assessment learning scheme will be offered to the students:

- Two partial exams will be held related to the theory (A sessions). - The student has to elaborate a report describing the project (B and C sessions).

The first partial exam will take place in the classroom . If the student passes this part, he/she is not required to retake it. In this case, after finishing the term, he/she has to take only the second partial exam. The date will be specified in the academic calendar.

Teachers will speak in spanish or galician language. Usually, exams will be written in spanish.
In partial exams, a minimum score (5 out of 10) is required in order to get a pass. In order to assess the project, the lecturer will consider the quality of the final report (40%), the work in the laboratory and the student s behavior (60%).
To pass the subject, it is necessary that the mark of each one of the exams or the project are equal or greater than 5 over 10. The final mark (FM) is calculated as the weighted average of the three individual marks. The formula will apply a weight of 40% to the theory mark (TM) and a 60 % to the project mark (PM):

$$FM = 0,4*TM + 0,6*PM \quad (1)$$

The mínimum passing score required in order to get a pass in the subject is 5. In case the students do not pass any of the tasks of the subject, the final mark (FM2) will be:
FM2= Minimum{4.5, FM}

Being FM the mark applying (1).

When a student takes the first partial exam, it is considered that he/she choose the continuous assessment scheme.

Second call: The assessment policy in this call follows the same scheme, the students have to take the exam and present the monitored project.

EXAM-ONLY ASSESSMENT (SECOND CALL AND END-OF-PROGRAM CALL):

Students who refuse the continuous assessment scheme will be assessed by means of a final exam to evaluate the theory. The exam will be the same for them as for the students who fail the first partial exam. The assessment of the laboratory for these students will be carried out by means of a laboratory exam. The date will be fixed within the examination period. In this case, the final mark (FM) is calculated as the weighted average of the two individual marks. The formula will apply a weight of 50% to the theory mark (TM) and a 50% to the laboratory mark (LM):

$$FM = 0,5*TM + 0,5*LM \quad (2)$$

To pass the subject, it is necessary that the mark of each one of the exams are equal or greater than 5 over 10. The minimum passing score required in order to get a pass in the subject is 5.

In case the students do not pass any of the tasks of the subject, the final mark (FM2) will be:

FM2= Minimum{4.5, FM}

Being FM the mark applying (2).

IMPORTANT REMARK: Students who refuse the continuous assessment scheme have to contact the lecturer at least two weeks before the exam date.

| Sources of information |
| --- |

**Basic Bibliography**

http://ww1.microchip.com/downloads/en/DeviceDoc/41303F.pdf, **PIC18FXXK20 Data Sheet**,

**Complementary Bibliography**

F. E. Valdés Pérez, R. Pallás Areni, **Microcontroladores. Fundamentos y Aplicaciones con PIC.**, Marcombo,

http://ww1.microchip.com/downloads/en/DeviceDoc/52116A.pdf, **PICkit 3 In-Circuit Debugger/Programmer User s Guide**,

http://ww1.microchip.com/downloads/en/DeviceDoc/41370C.pdf, **PICkit 3 Debug Express PIC18F45K20  MPLAB® C Lessons**,

| Recommendations |
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**Subjects that it is recommended to have taken before**

Programmable Electronic Circuits/V05G300V01502
Electronic Instrumentation and Sensors/V05G300V01621

| Contingency plan |
| --- |

## Description

In case of online tuition, then the planning will be as follows:

A, B y C will be carried out using the Campus Remoto. If it is possible, hardware resources will be supplied to the students in order to:

- Solve exercices related to the subject. The teacher will try to guide the debugging process.

- Develop the project. B and C sessions will be used to present the project and to solve the doubt of students.

The evaluation will be carried out as follows:

- Exams will be carried out using the Campus Remoto.

- The assessment policy will be maintained.

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained

* Teaching methodologies modified

* Non-attendance mechanisms for student attention (tutoring)

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Tests that are modified
[Previous test] => [New test]

* New tests

* Additional Information