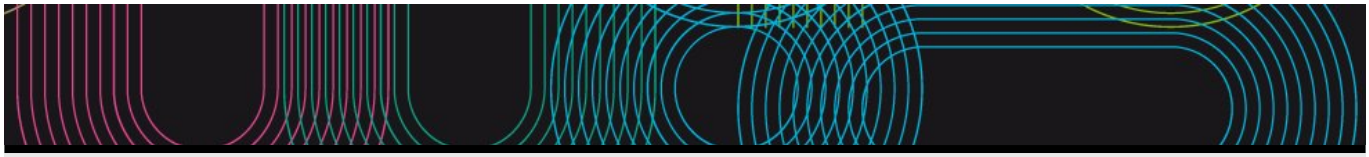

IDENTIFYING DATA				
Application Design with micro-controllers				
Subject	Application Design with micro-controllers			
Code	V05G301V01406			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Costas Pérez, Lucía			
Lecturers	Costas Pérez, Lucía Valdés Peña, María Dolores			
E-mail	lcostas@uvigo.es			
Web	http://moovi.uvigo.gal/course/view.php?id=378			
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. Exams will be written in spanish.			

Training and Learning Results	
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.

Expected results from this subject	Training and Learning Results
To know in deep the configuration methodologies of real time microcontrollers.	C58
To know in deep the hardware design of the microcontroller-based electronic systems.	C58
To know in deep the software design of the microcontroller-based electronic systems.	C58 C59
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.

C languaje programming.	The XC8 compiler for PIC.
Project:	Practical activities of laboratory of development of applications based in microcontrollers. Configuration of peripherals. Management of interruptions. Connection and management of external peripherals.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	11	23	34
Problem solving	8	25	33
Project based learning	21	60	81
Problem and/or exercise solving	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
Lecturing	The lecturer will explain in the classroom the subject contens. The student develops the competency C58 (CE58).
Problem solving	The lecturer will solve exercices related to the subject contens. Software to be used: MPLAB X The student develops the competencies C58 and C59 (CE58 and CE59) .
Project based learning	The students have to develop a project. The lecturers will help and monitor them. Software to be used: MPLAB X The student develops the competencies C58 and C59 (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 following websites https://moovi.uvigo.gal/user/profile.php?id=11303
Lecturing	The teacher will resolve the doubts of students at the schedule established and published on the on the following website https://moovi.uvigo.gal/user/profile.php?id=11301.
Problem solving	The teacher will resolve the doubts of students at the schedule established and published on the on the following website https://moovi.uvigo.gal/user/profile.php?id=11301.

Assessment			
	Description	Qualification	Training and Learning Results
Problem solving	Students will be asked to program in C languaje. Competencies C58 and C59 (CE58 and CE59) are assessed.	20	C58 C59
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 C58 and C59 (CE58 and CE59) are assessed.	50	C58 C59
Problem and/or exercise solving	Exam to evaluate the knowledge acquired by the student. Competency C58 (CE58) is assessed.	30	C58

Other comments on the Evaluation

CONTINUOUS ASSESSMENT:Ordinary exam:

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

- An exam will be held related to the theory (A sessions).- The student has to solve C languaje programming exercices (A sessions).
- The student has to elaborate a report describing the project (B and C sessions).

Teachers will speak in spanish or galician language. Exams will be written in spanish.
The exam date will be specified in the academic calendar. A minimum score (5 out of 10) is required in order to get a pass.

The project will be comprised in two parts. In the first, the student will work with basic peripherals (25% of the final mark) and in the second the student will work with complex peripherals (25% of the final mark). In order to assess the project, the lecturer will consider the work in the laboratory and the student□s behaviorfor the first part and the quality of the final report (40%) and the work in the laboratory and the student□s behavior (60%) in the second.
To pass the subject, it is necessary that the mark of the exam, the C programming exercices and 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 30% to the theory mark (TM), 20% to the C programming exercices mark (CM) and a 50 % to the project mark (PM):

FM = 0,3*TM + 0,2*CM + 0,5*PM (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{4.9, FM}

Being FM the mark applying (1).

One month after the start of the new school year, when a student attend the three first laboratory classes it is considered that he/she choose the continuous assessment scheme.

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

GLOBAL ASSESSMEN AND END-OF-PROGRAM EXAM:

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 follow the continuous scheme. The assessment of the laboratory for these students will be carried out by means of a laboratory exam. In this exam, the student has to solve asembly and C languaje programming exercices. 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 20% to the theory mark (TM) and a 70% to the laboratory mark (LM):

FM = 0,3*TM + 0,7*LM (2)

To pass the subject, it is necessary that the mark of each 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{4.9, 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**,

http://ww1.microchip.com/downloads/en/devicedoc/50002053g.pdf, **MPLAB® XC8 C CompilerUser□s Guide**,

https://ww1.microchip.com/downloads/en/DeviceDoc/50002737C%20XC8%20C%20Compiler%20UG%20for%20PIC.pdf, **MPLAB® XC8 C Compiler User□s Guide for PIC® MCU**,

Recommendations

Subjects that it is recommended to have taken before

Programmable Electronic Circuits/V05G301V01302
Electronic Instrumentation and Sensors/V05G301V01316