



Universitat de Lleida

DEGREE CURRICULUM
SYSTEMS INTEGRATION I

Coordination: TRESANCHEZ RIBES, MARCEL

Academic year 2016-17

Subject's general information

Subject name	SYSTEMS INTEGRATION I			
Code	102130			
Semester	1st Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Typology	Modality
	Bachelor's Degree in Automation and Industrial Electronic Engineering	4	OPTIONAL	Attendance-based
ECTS credits	6			
Groups	1GG			
Theoretical credits	2			
Practical credits	4			
Coordination	TRESANCHEZ RIBES, MARCEL			
Department	INFORMATICA I ENGINYERIA INDUSTRIAL			
Teaching load distribution between lectures and independent student work	Total load: 150h - 60h of lectures (40%) - 90h of independent student work (60%)			
Important information on data processing	Consult this link for more information.			
Language	Speaking: As required (Catalan, Spanish or English). Materials and resources: English. Student workload: English.			
Distribution of credits	Theoretical sessions: 1 ECTS Experimental training sessions: 3 ECTS Practical sessions: 2 ECTS			
Office and hour of attention	Robotics Lab (2.04-EPS building). Monday 10:00-11:00 AM.			

Professor/a (s/es)	Adreça electrònica professor/a (s/es)	Crèdits	Horari de tutoria/lloc
TRESANCHEZ RIBES, MARCEL	mtresanchez@diei.udl.cat	7,2	Wensday 17-18h, 2.07 EPS

Learning objectives

Learning the internal working of a high-performance microcontroller of 32 bits.

Being able to program any peripheral of a 32-bit microcontroller for an automated specific task.

Knowing the ARM Cortex-M architecture and its application in microcontrollers of 32 bits.

Understanding the operation with sensors, MEMS sensors and actuators systems by means of low cost microcontrollers.

Learning the use of the main intra-board communication busses for integrated circuits.

Acquire necessary knowledge to be able to design and program a intelligent integrated system.

Competences

Strategic Competences of the UdL

UdL2. Command of a foreign language.

UdL3. Mastering ICT's.

Cross-disciplinary competences

EPS4. To have the skills required to undertake new studies or improve the training with self-direction.

EPS9. Capacity for unidisciplinary and multidisciplinary teamwork.

Specific competences

GEEIA21. Knowledge of the basics and applications of the digital electronics and microprocessors.

GEEIA25. Knowledge and capacity for modelling and simulation of systems.

GEEIA27. Knowledge of principles and applications of robotic systems.

Subject contents

1. Introduction to embedded systems
2. Working principles of a microcontroller
3. ARM Cortex-M architecture
4. STM32F4 microcontrollers
5. STM32F4Discovery kit
6. STM32F407VGT6 MCU
7. CMSIS files & libraries
8. Digital I/O
9. System Clock Configurations
10. SWV and ITM Debugging with printf
11. Interrupts (NVIC) and EXTI
12. System timer (SysTick)
13. The USART Peripheral
14. Analog I/O (ADC and DAC peripherals)
15. MCU Timers
16. I2C communication
17. SPI communication

Methodology

The subject will be developed by conducting several experimental works to be carried out in the electronics lab 2.05 (2nd floor) of the Polytechnic School (EPS).

Learning systems integration will be carried out by STMicroelectronics development tools, mainly with STM32F4 - Discovery.

Development kits will be provided entirely by the school where each student will work individually.

Practical exercises will be based on microcontroller programming using C language development environments.

The sessions will be divided into three consecutive stages repeated for each of the contents of the subject:

- Sessions of theory (classroom): Preliminary theoretical concepts.
- Experimental training sessions (electronics lab): Acquire skills with teacher support.
- Practice sessions (electronics lab) : Individual student work with exercises and activities.

Development plan

Week	Description	Classroom Activity	Classroom Hours	Student workload Hours
1	Presentation	Masterclass	2	0
	Lesson 1: Lecture	Masterclass	2	3
2	Lesson 2: Lecture	Masterclass	2	3
2	Lesson 3: Lecture	Masterclass	2	3
3	Lesson 4: Lecture	Masterclass	2	5
3-4	Lesson 5-6: Lecture/Experimental	Experimentation	4	4
4	Lesson 7-8: Experimental	Experimentation	4	6
5	Lesson 8: Practices	Practical exercise 1	2	5
5	Lesson 9: Experimental	Experimentation	2	3
6	Lesson 10-11: Experimental	Experimentation	4	4
7	Lesson 10-11: Practices	Practical exercise 2	2	8
8	Lesson 12: Experimental	Experimentation	2	2
8	Lesson 13: Experimental	Experimentation	2	2
9	Evaluation exam 1	Practices doubts	2	0
10	Lesson 14: Experimental	Experimentation	2	2
10	Lesson 12-14: Practices	Practical exercise 3	2	8
11	Lesson 15-16: Lecture/Experimental	Experimentation	4	5
12	Lesson 15-16: Practices	Practical exercise 4	2	8
12	Lesson 17: Experimental	Experimentation	2	3
13-14	Final project	Practical exercise 5	8	10
15-16	Evaluation exam 2	Practices doubts	2	0
17	Tutorials	Tutorials	2	0
18	make-up exam	Evaluation	2	6

Evaluation

The course assessment will take place continuously and be based on the weighted evaluation of the reports of the activities undertaken throughout the course.

These experimental exercises should be carried out individually. Each student will have available the electronics devices required to work with the proposed exercises at home and at hours of electronics laboratory.

The practical exercises are composed for four practical tasks and one final project. The difficulty of the activities will be increased as regarding on the punctuation weight of final qualification: 0.5, 1, 1.5, and 2 points respectively. Finally, there will be a final project that will be focused on the global knowledge acquired. This project will be carried out in workgroups and will have a weight about final qualification of 50% (5 points).

Bibliography

STM32 32-bit ARM Cortex MCUs

<http://www.st.com/web/en/catalog/mmc/FM141/SC1169>

STM32F4Discovery - STMicroelectronics

<http://www.st.com/web/catalog/tools/FM116/SC959/SS1532/PF252419>

Atollic TrueSTUDIO

<http://www.atollic.com/index.php/truestudio>

ARM Cortex-M architecture

<http://www.arm.com/products/processors/cortex-m/>