



Universitat de Lleida

## DEGREE CURRICULUM

# **SYSTEMS INTEGRATION I**

Coordination: Marcel Tresanchez Ribes

Academic year 2015-16

## Subject's general information

<b>Subject name</b>	SYSTEMS INTEGRATION I
<b>Code</b>	102130
<b>Semester</b>	1st Q. Continued evaluation
<b>Typology</b>	Optative
<b>ECTS credits</b>	6
<b>Groups</b>	1
<b>Theoretical credits</b>	2
<b>Practical credits</b>	4
<b>Coordination</b>	Marcel Tresanchez Ribes
<b>Office and hour of attention</b>	Robotics Lab (2.04-EPS building). Monday 10:00-11:00 AM.
<b>Department</b>	Computer Science and Industrial Engineering
<b>Modality</b>	Presencial
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.
<b>Language</b>	Speaking: As required (Catalan, Spanish or English). Materials and resources: English. Student workload: English.
<b>Degree</b>	Degree in Automation and Industrial Electronic Engineering
<b>Distribution of credits</b>	Theoretical sessions: 1 ECTS Experimental training sessions: 3 ECTS Practical sessions: 2 ECTS
<b>Office and hour of attention</b>	Robotics Lab (2.04-EPS building). Monday 10:00-11:00 AM.
<b>E-mail addresses</b>	mtresanchez@diei.udl.cat

Marcel Tresanchez Ribes

## 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.

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

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.

## Development plan

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).

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.

## 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.

## 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/>