



## Course guide

# 820226 - IIEIA - Industrial Informatics

Last modified: 02/10/2025

**Unit in charge:** Barcelona East School of Engineering

**Teaching unit:** 707 - ESAII - Department of Automatic Control.

**Degree:** BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).

**Academic year:** 2025    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

## LECTURER

**Coordinating lecturer:** ALEJANDRO ROLÁN BLANCO - SEBASTIAN TORNIL SIN

**Others:** Primer quadrimestre:

ALEJANDRO ROLÁN BLANCO - Grup: T11, Grup: T12

DANIEL ROMERO PEREZ - Grup: T13, Grup: T14

SEBASTIAN TORNIL SIN - Grup: T11, Grup: T12, Grup: T13, Grup: T14

## PRIOR SKILLS

1. Basic background on electronic systems.

2. Basic background on digital electronics.

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

### Specific:

3. Apply their knowledge to industrial informatics and communications.

### Transversal:

1. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

## TEACHING METHODOLOGY

The course uses the methodology of exhibitions in 28% (theoretical and laboratory sessions), monitoring of activities aimed at 12%, individual in 17.3%, the project-based learning by 40% evaluation sessions and 2.7%.

## LEARNING OBJECTIVES OF THE SUBJECT

1. To introduce students basic concepts of microcontrollers, its architecture, its programming and the connection with the elements of their environment.
2. To acquire skills to design, deploy and implement electronic systems based on microcontrollers.



## STUDY LOAD

| Type              | Hours | Percentage |
|-------------------|-------|------------|
| Hours large group | 45,0  | 30.00      |
| Self study        | 90,0  | 60.00      |
| Hours small group | 15,0  | 10.00      |

**Total learning time:** 150 h

## CONTENTS

### Unit 1: Introduction

**Description:**

Course overview.  
Microprocessor system.  
Central processing unit (CPU).  
Memory.  
Input/output module.  
Buses.  
Microprocessors and microcontrollers.  
Families of commercial microcontrollers.

**Related competencies :**

CEEIA-28. Apply their knowledge to industrial informatics and communications.

**Full-or-part-time:** 9h

Theory classes: 3h  
Laboratory classes: 3h  
Self study : 3h

### Unit 4: Programming in C51

**Description:**

Introduction to C language.  
General structure and syntax.  
Data types in C51.  
Expressions and operators.  
Access to the µC's internal resources.  
Flow control structures.  
Functions.  
Application examples.

**Related competencies :**

CEEIA-28. Apply their knowledge to industrial informatics and communications.

**Full-or-part-time:** 18h

Theory classes: 8h  
Laboratory classes: 2h  
Self study : 8h



## Unit 5: Ports and external devices

### Description:

Introduction.  
Ports' internal structure.  
Digital devices.  
Push-buttons/switches.  
LEDs.  
Large electrical loads.  
Connection of devices int buses.  
Matrix keypads.  
7SEG displays.

### Related competencies :

CEEIA-28. Apply their knowledge to industrial informatics and communications.

### Full-or-part-time: 10h

Theory classes: 4h  
Laboratory classes: 2h  
Self study : 4h

## Unit 6: Interruptions and timers

### Description:

Interruptions in 8051 family.  
Sources of interruption.  
Interrupt enable and interrupt priority.  
Interrupt service routine (ISR).  
Interrupt examples.  
Timers in 8051 family.  
Timer operation modes.  
Interrupt overflow routine.  
Timer examples.

### Related competencies :

CEEIA-28. Apply their knowledge to industrial informatics and communications.

### Full-or-part-time: 12h

Theory classes: 5h  
Laboratory classes: 2h  
Self study : 5h



## Unit 2: 8051 Architecture

**Description:**

Intel® 8051 family.  
8051 internal architecture.  
8051 memory and internal registers.  
Manufacturers of µCs compatible with 8051.  
AT89C5131A-M Atmel® microcontroller.

**Related competencies :**

CEEIA-28. Apply their knowledge to industrial informatics and communications.

**Full-or-part-time:** 8h

Theory classes: 3h  
Laboratory classes: 2h  
Self study : 3h

## Unit 3: Assembler programming

**Description:**

Introduction.  
Addressing modes.  
Instructions of 8051 family.  
The programming model.  
Application examples.

**Related competencies :**

CEEIA-28. Apply their knowledge to industrial informatics and communications.

**Full-or-part-time:** 18h

Theory classes: 8h  
Laboratory classes: 2h  
Self study : 8h

## Unit 7: Acquisition and signal conversion

**Description:**

Introduction.  
Sensors: types and characteristics.  
Signal conditioning.  
A/D converters (ADC).  
Data acquisition architectures.  
Application examples.

**Related competencies :**

CEEIA-28. Apply their knowledge to industrial informatics and communications.

**Full-or-part-time:** 18h

Theory classes: 8h  
Laboratory classes: 2h  
Self study : 8h



### Final team project

**Description:**

Design, prototyping and programming of a microcontroller-based system.

**Related competencies :**

05 TEQ N3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

**Full-or-part-time:** 57h

Theory classes: 6h

Self study : 51h

### GRADING SYSTEM

Midterm exam: 20%

Final exam: 40%

Laboratory: 20%

Final project: 20%

### EXAMINATION RULES.

The evaluation method of this course meets the current academic regulations to be qualified as: NOT REASSESSABLE

### BIBLIOGRAPHY

**Basic:**

- Matas Alcalá, José; Ramos Lara, Rafael. Microcontroladores MCS-51 y MCS-251 [on line]. Barcelona: Edicions UPC, 2001 [Consultation: 29/05/2020]. Available on: <http://hdl.handle.net/2099.3/36202>. ISBN 8483014548.
- González Vázquez, José Adolfo; García Calvo, Amancio. Introducción a los microcontroladores : hardware, software y aplicaciones. Madrid [etc.]: McGraw-Hill, 1992. ISBN 8476158033.

**Complementary:**

- Yeralan, Sencer; Emery, Helen. Programming and Interfacing the 8051 Microcontroller in C and Assembly. Gainesville: Rigel Corporation, 2000. ISBN 9780963325716.
- Kernighan, Brian W.; Ritchie, Dennis M. The C programming language. 2nd ed. New Jersey: Prentice Hall, 1988. ISBN 0131103628.

### RESOURCES

**Other resources:**

1. Subject notes made by the intervening teachers (uploaded to Atenea).
2. Lab reports (uploaded to Atenea).
3. Guidelines to elaborate the non-classroom project and needed software (uploaded to Atenea).