



Course guides

820226 - IIEIA - Industrial Computer Science

Last modified: 19/06/2020

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: 2020 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: SEBASTIAN TORNIL SIN - ANTONIO CALOMARDE PALOMINO

Others:

Primer quadrimestre:
ANTONIO CALOMARDE PALOMINO - T11, T12, T13
EDMUNDO GUERRA PARADAS - T11, T12, T13

Segon quadrimestre:
ANTONIO CALOMARDE PALOMINO - M13, M14, M15
EDMUNDO GUERRA PARADAS - M11, M12
SEBASTIAN TORNIL SIN - M11, M12, M13, M14, M15

PRIOR SKILLS

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



STUDY LOAD

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

Total learning time: 150 h

CONTENTS

Tema 1: Introduction

Description:

Course overview.
History and future of microcontrollers.
Binary and hexadecimal codes.

Related competencies :

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

Full-or-part-time: 2h

Theory classes: 1h
Self study : 1h

Tema 2: The C programming language

Description:

Basic blocks and syntax
Flow control.
Strings and matrices.
Pointers.
Structs.

Related activities:

- Individual study
- Solving exercises
- Laboratory session

Related competencies :

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

Full-or-part-time: 14h

Theory classes: 6h
Laboratory classes: 2h
Self study : 6h



Tema 3: Estructura dels microcontroladors.

Description:

Block diagram.
Processor registers.
Memory and addressing.
Instruction set.

Specific objectives:

At the end of this module, the student should be able to describe all the internal subsystems of a microcontroller.

Related activities:

- Individual study
- Solving exercises
- Laboratory session

Related competencies :

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

Full-or-part-time: 14h

Theory classes: 6h
Laboratory classes: 2h
Self study : 6h

Tema 4: Digital inputs and outputs

Description:

Hardware.
Programming.

Related activities:

- Individual study
- Solving exercises
- Laboratory session

Related competencies :

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

Full-or-part-time: 14h

Theory classes: 6h
Laboratory classes: 2h
Self study : 6h



Tema 5: Interrupts and low power characteristics.

Description:

Interrupts?
Programming with interrupts.
Examples.

Related activities:

- Individual study.
- Solving exercises.
- Searching for information.
- Laboratory sessions.

Related competencies :

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

Full-or-part-time: 14h

Theory classes: 6h
Laboratory classes: 2h
Self study : 6h

Tema 6: Analog inputs and outputs.

Description:

Analog to digital conversion.
Digital to analog conversion.
Programming and examples.

Related activities:

- Estudi individual
- Resolució d'exercicis
- Pràctiques de laboratori

Related competencies :

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

Full-or-part-time: 14h

Theory classes: 6h
Laboratory classes: 2h
Self study : 6h



Tema 7: Timers and PWM

Description:

Compare mode.
Capture mode.
Pulse width modulation.

Related activities:

- Individual study
- Solving exercises
- Laboratory session

Related competencies :

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

Full-or-part-time: 14h

Theory classes: 6h
Laboratory classes: 2h
Self study : 6h

Tema 8: Serial communications

Description:

UART
SPI bus
I2C bus

Specific objectives:

- Individual study
- Solving exercises
- Laboratory session

Related competencies :

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

Full-or-part-time: 14h

Theory classes: 6h
Laboratory classes: 2h
Self study : 6h

Tema 9: Conceptes avançats

Description:

Direct Memory Access.
High performance and low power.

Specific objectives:

- Individual study
- Solving exercises.

Related competencies :

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

Full-or-part-time: 3h

Theory classes: 1h
Self study : 2h



Final team project.

Description:

Design and prototyping 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: 47h

Theory classes: 1h

Self study : 46h

GRADING SYSTEM

Exercises: 10%

Midterm exam: 25%

Final exam: 25%

Laboratory: 20%

Final project: 20%

EXAMINATION RULES.

The evaluation method of this course meets the current academic regulations to be qualified as: NO REVALUABLE

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; Garcia Calvo, Amancio. Introducción a los microcontroladores : hardware, software y aplicaciones. Madrid [etc.]: McGraw-Hill, 1992. ISBN 8476158033.
- Yiu, Joseph. The Definitive Guide to ARM® CORTEX®-M3 and CORTEX®-M4 Processors. Amsterdam: Elsevier, 2014. ISBN 9780124080829.
- Yiu, Joseph. The Definitive Guide to Arm® Cortex®-M0 and Cortex-M0+ Processors. Amsterdam: Elsevier, 2015. ISBN 9780128032770.

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.