

Course guide

820226 - IIEIA - Industrial Computer Science

Last modified: 13/06/2024

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: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Tornil Sin, Sebastian
Rolán Blanco, Alejandro

Others: SEBASTIAN TORNIL SIN - Teoria
DANIEL ROMERO PEREZ - Teoria i pràctiques
DOLORES BLANCO ALMAZAN - Pràctiques
ALEJANDRO ROLAN BLANCO - Pràctiques

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 2: 8051 Architecture

Description:

Intel® 8051 family.
8051 internal architecture.
8051 memory and internal registers.
Manufacturers of μ Cs 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 4: Programming in C51

Description:

Introduction to C language.
General structure and syntax.
Data types in C51.
Expressions and operators.
Access to the μ C'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 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: 35%
Laboratory: 20%
Final project: 25%

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; Garcia 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).