



## Course guide

### 320042 - DP - Programmable Devices

**Last modified:** 19/04/2023

**Unit in charge:** Terrassa School of Industrial, Aerospace and Audiovisual Engineering  
**Teaching unit:** 710 - EEL - Department of Electronic Engineering.

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

**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** Spanish

#### LECTURER

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**Coordinating lecturer:** Gabriel José Capellá Frau

**Others:** Gabriel José Capellá Frau

#### PRIOR SKILLS

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It is highly advisable to have passed the subject entitled Digital Electronics

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

1. ELO: Knowledge of the foundations and applications of digital electronics and microprocessors

**Transversal:**

2. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
4. 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

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- Face-to-face lecture sessions.
- Face-to-face practical class work sessions.
- Face-to-face practical laboratory work sessions.
- Independent learning and exercises.
- Preparation and completion of group activities subject to assessment.

In the face-to-face lecture sessions, the lecturer will introduce the basic theory, concepts, methods and results for the subject and use examples to facilitate students' understanding.

Practical class work will be covered in three types of sessions:

- a) Sessions in which the lecturer will provide students with guidelines to analyse data for solving problems by applying methods, concepts and theoretical results (80%).
- b) Sessions in which students give presentations of group work (8%).
- c) Examination sessions (12%).

Practical laboratory work will be covered in two types of sessions:

- a) Sessions in which the lecturer will provide students with guidelines to design applications in order to solve the assigned problems (90%).
- b) Examination sessions (10%).

Students will be expected to study in their own time so that they are familiar with concepts and are able to solve the exercises set. In groups of five, students will carry out projects and present them publicly.

## LEARNING OBJECTIVES OF THE SUBJECT

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In this subject, students become familiar with the design of microprocessor-based electronic systems, as well as the hardware- and software-related aspects of these systems. The basic aspects of these systems are introduced using examples of systems developed on the basis of the 8051 microcontroller family.

To Build on the specific and transversal competencies associated with coursework, as described below.

## STUDY LOAD

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Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	15,0	10.00
Hours small group	30,0	20.00
Hours medium group	15,0	10.00

**Total learning time:** 150 h



## CONTENTS

### TOPIC 1: INTRODUCTION

**Description:**

- 1.1. Microprocessor-based Systems
- 1.2. Block Diagram of a Microprocessor System
- 1.3. Programming Language
- 1.4. Microprocessor operation

**Related activities:**

- Introduction to the programming environment for microprocessor-based systems.

**Full-or-part-time:** 10h 30m

Theory classes: 1h 30m

Practical classes: 1h 30m

Laboratory classes: 3h

Self study : 4h 30m

### TOPIC 2: MICROPROCESSOR STRUCTURE

**Description:**

- 2.1. Microprocessor structures.
- 2.2. Internal structure of the 8051 family.
- 2.3. Logical map of memory and registers.
- 2.4. Addressing mode.
- 2.5. Development environments.
- 2.6. Assembly language instructions.
- 2.7. Programming microprocessors in C.

**Related activities:**

- Explanation of the answer to multiple-choice question.
- Drawing up multiple-choice questions
- Basic programming exercises in assembler and C languages.

**Full-or-part-time:** 38h

Theory classes: 6h

Practical classes: 6h

Laboratory classes: 10h

Self study : 16h

### TOPIC 3: CONNECTION OF MEMORY AND PERIPHERALS

**Description:**

- 3.1. Connection of external memories.
- 3.2. Connection of peripherals.
- 3.3. CPU and peripheral synchronisation: polling and interruptions.

**Related activities:**

- Management of and communication with internal and external peripherals by means of polling and interrupt synchronisation.
- Explanation of the answer to multiple-choice questions.
- Drawing up multiple-choice questions

**Full-or-part-time:** 21h

Theory classes: 3h

Practical classes: 3h

Laboratory classes: 6h

Self study : 9h



## TOPIC 4: SYSTEM PERIPHERALS

### Description:

- 4.1. Introduction.
- 4.2. General purpose input/output (GPIO) ports.
- 4.3. Timers.
- 4.4. Series interface.
- 4.5. A/D D/A converters.
- 4.6. Hexadecimal keyboards.
- 4.7. LCD displays.

### Related activities:

- Programming exercises involving multiple peripherals.

### Full-or-part-time: 37h

- Theory classes: 4h 30m
- Practical classes: 4h 30m
- Laboratory classes: 12h
- Self study : 16h

## GRADING SYSTEM

- First examination: 25%
- Second examination: 45%
- Laboratory: 20%
- Assignments submitted: 10%. This assesment is linked to the team-working skill.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.

If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

## BIBLIOGRAPHY

### Basic:

- Mazidi, M. A.; Mazidi, J. G.; McKinlay, R. D. The microcontroller and embedded systems: using Assembly and C. 2nd ed. Upper Saddle River, NJ: Pearson/Prentice Hall, 2006. ISBN 9780131194021.
- MacKenzie, I. Scott [et al.]. Microcontrolador 8051. 4a ed. México: Pearson Educación, 2007. ISBN 9789702610212.
- Odant, Bernard. Microcontroladores 8051 y 8052. Madrid: Paraninfo, 1995. ISBN 8428321884.

### Complementary:

- Steiner, Craig. The 8051/8052 microcontroller: architecture, assembly language, and hardware interfacing. Boca Raton, Florida: Universal, 2005. ISBN 9781581124590.

## RESOURCES

### Computer material:

- Evaluation version of uvision2 Keil software. Evaluation version of microvision2 software by Keil Elcktronic GmbH