Course guide
820051 - DCPE - Design and Implementation of Electronic Prototypes

Last modified: 04/06/2026

Unit in charge: Barcelona East School of Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: ALFONSO CONESA ROCA - HERMINIO MARTINEZ GARCIA

Others: Segon quadrimestre:
ALFONSO CONESA ROCA - Grup: M11

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Design analogue, digital and power systems.
2. Understand the applications of electronic instrumentation.
3. Model and simulate systems.

Transversal:
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.

TEACHING METHODOLOGY

The subject is oriented to a PBL (Project Based Learning) methodology.
The student performs two hours of theory class (large group) in the classroom and two hours of laboratory (small group) a week.
The work in the first weeks of the large group (classes of theory) is with expository methodology by the teacher of introduction to the subject and computer tools that will be used during the course. Subsequently develops the theoretical material necessary for the justification of the electronic designs to be made during the course. From the middle of the course to the end, the large group classes gradually cease to be expository by the teacher and are freely available to work in groups of the developments to be carried out by the students. It is a methodology of collaboration in small groups with which students implement, supervised by the teacher, the work project (or projects) in progress.
The work of the small group (laboratory classes) in the first weeks is in pairs in the laboratory, carrying out the development of a minimum microcontroller system that will be the base or core of the work project to be designed. After this first phase of work in the laboratory, we proceed to the design work, also with collaborative methodology supervised by the teacher, but in groups larger than 4 or 5 students, with the aim of getting the proper implementation of the final project.
The number of working groups and the number of projects developed during the course is a function of the number of students enrolled.

LEARNING OBJECTIVES OF THE SUBJECT

The subject "Design and Construction of Electronic Prototypes" (DCPE - 820051) is presented as optional subject. It is aimed to students interested in developing their skills in the design and implementation of electronic applications in the industrial field.
The main aims of DCPE are to present to students the techniques typically used for development and construction of electronic circuits and prototypes. Will be introduced a schematic and board design software (EAGLE) and a microcontroller programming software (preferably PICs). It also aims to explore different practical topics on electronic design not sufficiently developed in similar subjects on the studies. The proposed project work has to be multidisciplinary in electronics, with contents of digital electronics, analog electronics and power electronics.
The student must obtain a technical-scientific basis in order to (together with analysis) design, synthesize, simulate, physically implement and verify electronic circuits and prototypes.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

1.- Introduction to Design and Construction of Electronic Prototyping.

Description:
Presentation of the project to be carried by the class.
Introduction to the design of printed circuit boards (PCB) EAGLE: Introduction to schematic capture, board design and autorouter.
Presentation of the web addresses of distributors and manufacturers of electronic components.

Full-or-part-time: 20h
Theory classes: 4h
Laboratory classes: 4h
Self study : 12h

2.- The Process of Conception and Design of Electronic Prototyping. Practical Example.

Description:
Detailed description of the prototype to perform. Assigning tasks.
Selection and design of electronic circuits and components to perform.
Analysis according to manufacturer specifications of the critical components of the prototype.
Introduction to Programming PICs.

Full-or-part-time: 30h
Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

4.- Design and layout of Photolithographs.

Description:
Design of the printed circuit board. Standards and design limitations.
Presentation of the schematic and its discussion.
Presentation of the boards and its discussion.
Presentation of the PIC programming and its discussion.

Full-or-part-time: 20h
Theory classes: 4h
Laboratory classes: 4h
Self study : 12h

3.- Mounting on Protoboard and/or perforated plates.

Description:
Design and optimization of critical system circuits by using protoboards or perforated plates.
Programming PICs .
Schematic final proposal to be implemented.

Full-or-part-time: 20h
Theory classes: 4h
Laboratory classes: 4h
Self study : 12h

5.- PCBs Construction.

Description:
Performing the different printed circuit boards.
Starting method of assembly and testing.

Full-or-part-time: 10h
Theory classes: 2h
Laboratory classes: 2h
Self study : 6h

6.- Construction and Verification of Electronic Prototype.

Description:
Guidelines for verification and testing of prototype electronic.
Final characterization of the electronic prototype. Testing errors.
Study of the critical points of design and its possible improvement.

Full-or-part-time: 50h
Theory classes: 10h
Laboratory classes: 10h
Self study : 30h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

The evaluation of the subject will be obtained from the following points with the indicated weight:
a.- Introduction to the laboratory: 10%,
b.- Control: 10%,
c.- Course follow-up notes: 30%,
d.- Verification and degree of finishing: 40%,
d.- Final Report: 10%.

EXAMINATION RULES.

The performance of the different tests consists of:
a.- The evaluation of the accomplishment, in the first weeks of the course, of a minimum system with microcontroller. This design has the purpose of introducing the student to the I.C. that will center the designs or projects that will be realized later in the laboratory.
b.- Monitoring control: written test based on the theory of design and calculation of electronic prototypes designed.
c.- The notes of follow-up of the course are assessments of the teacher in important aspects such as the autonomous work quality of the group, assessment of schematics and layouts, presentations made in class, degree of individual involvement observed, weld quality, ...
d.- The verification and degree of finish corresponds to the assessment of the final work done.
e.- The final report compiles all the activity generated by the group in the realization of the assigned project.

BIBLIOGRAPHY

Basic:
- Bueno Martín, A.; Soto Gorroño, A. I. de. Desarrollo y construcción de protipos electrónicos : tutoriales OrCAD 10 y LPKF 5 de ayuda al diseño. Barcelona: Marcombo, cop. 2005. ISBN 8426713637.
- Palacios Municio, E.; Fernando Remiro, D.; López Pérez, L. J. Microcontrolador PIC16F84 : desarrollo de proyectos. 3ª ed. Madrid: RA-MA, 2009. ISBN 9788478979172.

RESOURCES

Hyperlink:
- Moodle ATENEA: http://atenea.upc.edu/moodle/