Course guide
320014 - SEL - Electronic Systems

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 CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: Daniel Arumí

Others: Lluís Ferrer, Víctor Suñé, Llorenç Marín, Daniel Pérez.

PRIOR SKILLS

Students must have passed Physics in the first year. They will also be expected to have passed Electrical Systems in the third semester.
Students must also be sufficiently fluent in spoken and written English to follow the subject in English. As a guideline, they should have passed the First Certificate in English, the English Aptitude Certificate awarded by the Escola Oficial d'Idiomes or an equivalent qualification.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE11-INDUS. Knowledge of the basics of electronics. (Common module in the industrial branch)

Generical:
CG05-INDUS. Knowledge for carrying out measurements, calculations, valuations, appraisals, expert opinions, studies, reports, work plans, and other similar tasks.

TEACHING METHODOLOGY

Theory lectures: Expository sessions where the lecturer will introduce the theoretical fundamentals of the subject, explain the content and how it ties in with previous or subsequent topics in the subject. Concepts and their development will be presented clearly and concisely with examples to illustrate them so that they are fully understood. The lectures will be held using a whiteboard and / or computer resources. When slides are used, they will be available in Atenea. Short-term activities will be introduced to encourage students participation.
Problem solving lectures: The aim of these sessions is to consolidate theoretical knowledge, as well as to introduce specific applications in professional and academic environments.. The learning process is focused on the student. The different stages in problem solving: initial approach, development and results will be tackled. The concepts of critical thinking and coherent analysis will be looked at in depth for their application to problems and their results.
Laboratory session

LEARNING OBJECTIVES OF THE SUBJECT

Students who pass the subject will have learnt to understand, analyse and use the electronic systems typically employed in the field of industrial engineering.
Therefore, students must have acquired the theoretical and practical knowledge, abilities and skills required to understand and analyse digital and analogue systems and their connections using the relevant conversions.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

TOPIC 0: INTRODUCTION TO THE SUBJECT

Description:
Introduction to the subject and presentation of the syllabus. Assessment regulations and and recommended reading list, Definitions. Electronic Systems. Electronic Instrumentation System.
Fields of application of digital and analogue electronic systems (the world of industrial engineering in the textile sector, mechanics, chemistry, electricity and electronics, and automation)

Related activities:
ACTIVITY 1: Theory lectures
ACTIVITY 4.1: First exam.

Full-or-part-time: 0h 30m
Theory classes: 0h 30m

title english

Description:
Concept of bit, 'nibble', 'byte' and 'word'.
Binary numbers.
Other number systems. Convertion between binary sistems.

Related activities:
ACTIVITY 1: Theory lectures
ACTIVITY 2: Problem solving lectures.
ACTIVITY 4.1: First exam.

Full-or-part-time: 3h 30m
Theory classes: 1h
Practical classes: 0h 30m
Self study : 2h

TOPIC 2: INTRODUCTION TO MICROPROCESSOR-BASED SYSTEMS

Description:
Basic elements: CPUs. Input/output ports. Memories.
Connections: data, address and control buses.
Types of memories: RAM and ROM.
Microcontrollers. Arduino

Related activities:
ACTIVITY 1: Theory lectures
ACTIVITY 3.2: Microcontroller based applications.
ACTIVITY 4.1: First exam.

Full-or-part-time: 15h
Theory classes: 2h
Laboratory classes: 5h
Self study : 8h

TOPIC 3: INTRODUCTION TO DIGITAL ELECTRONICS

Description:
Logic functions. The truth table. Logic gates and their symbols.
Boolean Algebra. Laws and theorems. Duality. De Morgan's laws.
Simplifications and synthesis of logic functions. The Karnaugh map. The sum of products and the product of sums.

Related activities:
ACTIVITY 1: Theory lectures
ACTIVITY 3.1: Introduction to the lab.
ACTIVITY 3.2: Microcontroller based applications.
ACTIVITY 4.1: First exam.

Full-or-part-time: 21h
Theory classes: 4h 30m
Practical classes: 2h 30m
Laboratory classes: 2h
Self study : 12h

TOPIC 4: COMBINATIONAL LOGIC

Description:
Multiplexer (MUX) and Demultiplexer (DEMUX).
Decoders and encoders

Related activities:
ACTIVITY 1: Theory lectures
ACTIVITY 2: Problem solving lectures.
ACTIVITY 3.2: Microcontroller based applications.
ACTIVITY 4.1: First exam.

Full-or-part-time: 18h 30m
Theory classes: 3h 30m
Practical classes: 2h
Laboratory classes: 1h
Self study : 12h

TOPIC 5: SEQUENTIAL SYSTEMS

Description:
The concept of a sequential system. The clock signal. Chronograms. J-K, T and D flip-flops.
Registers. Serial and parallel input and output.
Synchronous counters: Binary and random modulus.
Applications: digital clocks, introduction to parallel-serial conversion.

Related activities:
ACTIVITY 1: Theory lectures
ACTIVITY 2: Problem solving lectures.
ACTIVITY 3.2: Microcontroller based applications.
ACTIVITY 4.1: First exam.

Full-or-part-time: 19h
Theory classes: 4h
Practical classes: 2h
Laboratory classes: 1h
Self study : 12h

TOPIC 6: OPERATIONAL AMPLIFIERS

Description:
Amplification. Ideal amplifiers. The ideal operational amplifier.
Application of op-amps in linear operation (basic configurations).
Application of op-amps in non-linear operation (comparator.

Related activities:
ACTIVITY 1: Theory lectures
ACTIVITY 2: Problem solving lectures.
ACTIVITY 3.3: Experimentation based on op-amps and semiconductor devices circuits.
ACTIVITY 4.2: Second exam.

Full-or-part-time: 30h
Theory classes: 5h 30m
Practical classes: 3h 30m
Laboratory classes: 3h
Self study : 18h

TOPIC 7: CIRCUITS WITH DIODES AND TRANSISTORS

Description:
Introduction to, general characteristics and operation of an ideal diode.
Introduction to, general characteristics and operation of an ideal bipolar and field-effect transistor.

Related activities:
ACTIVITY 1: Theory lectures
ACTIVITY 2: Problem solving lectures.
ACTIVITY 3.3: Experimentation based on op-amps and semiconductor devices circuits.
ACTIVITY 4.2: Second exam.

Full-or-part-time: 26h 30m
Theory classes: 5h 30m
Practical classes: 3h
Laboratory classes: 2h
Self study : 16h

TOPIC 8: INTRODUCTION TO SIGNAL PROCESSING

Description:
Sensors.
Analog-to-digital conversion.
Digital-to-analog conversion.
Data acquisition boards.

Related activities:
ACTIVITY 1: Theory lectures
ACTIVITY 2: Problem solving lectures.
ACTIVITY 3.3: Experimentation based on op-amps and semiconductor devices circuits.
ACTIVITY 4.2: Second exam.

Full-or-part-time: 16h
Theory classes: 3h 30m
Practical classes: 1h 30m
Laboratory classes: 1h
Self study : 10h

ACTIVITIES

ACTIVITY 1: Theory lectures

Full-or-part-time: 24h 30m
Theory classes: 24h 30m

ACTIVITY 2: Problem solving lectures.

Full-or-part-time: 15h
Practical classes: 15h

ACTIVITY 3.1: Introduction to the lab.

Full-or-part-time: 4h
Laboratory classes: 2h
Self study: 2h

ACTIVITY 3.2: Microcontroller based applications.

Full-or-part-time: 15h
Laboratory classes: 7h
Self study: 8h

ACTIVITY 3.3: Experimentation based on op-amps and semiconductor devices circuits.

Full-or-part-time: 13h
Laboratory classes: 6h
Self study: 7h

ACTIVITY 4.1: First exam

Full-or-part-time: 37h 30m
Theory classes: 2h 30m
Self study: 35h

ACTIVITY 4.2: Second exam.

Full-or-part-time: 41h
Theory classes: 3h
Self study: 38h

GRADING SYSTEM

(i) 1st exam (37.5%) + 2nd exam (37.5%)+ Lab (25%).
Lab: Mark obtained due to the work carried out during the lab sessions and the corresponding lab reports.
(ii) In case of make-up exam (reconducció):
1r exam_R (37.5%) + 2nd exam (37.5%)+ Lab (25%).
where 1r exam_R= min[5, max(1st exam, make-up exam)]

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 (questionnaire and 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.

EXAMINATION RULES.

BIBLIOGRAPHY

Basic:
- Floyd, Thomas L. Dispositivos electrónicos [on line]. 8a ed. México: Pearson Educación, 2008 [Consultation: 09/05/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6756. ISBN 9789702611936.
- Floyd, Thomas L. Electronics fundamentals : circuits, devices, and applications. 8th ed. Upper Saddle River, NJ [etc.]: Prentice Hall, cop. 2010. ISBN 9780135096833.
- Floyd, Thomas L. Fundamentos de sistemas digitales [on line]. 11a ed. Madrid: Pearson Educación, 2016 [Consultation: 09/05/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6120.
- Malik, Norbert R. Circuitos electrónicos : análisis, diseño y simulación. Madrid: Prentice Hall, 1996. ISBN 8489660034.
- Storey, Neil. Electronics : a systems approach [on line]. Sixth edition. Harlow: Pearson Education, 2017 [Consultation: 10/10/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5186355. ISBN 9781292114064.

Complementary:
- Malvino, Albert Paul; Bates, David J. Principios de electrónica [on line]. 7a ed. Madrid: McGraw-Hill, cop. 2007 [Consultation: 11/05/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4146. ISBN 9788448156190.
- Ruiz Robredo, Gustavo A. Electrónica básica para ingenieros. Santander: Universidad de Cantabria, 2009. ISBN 9788481025446.
- Wakerly, John F. Diseño digital : principios y prácticas. 3a ed. México: Pearson Educación, 2001. ISBN 9789702607205.