

## 320014 - SEL - Electronic Systems

Coordinating unit:	205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit:	710 - EEL - Department of Electronic Engineering
Academic year:	2019
Degree:	BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory) BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory) BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Teaching unit Compulsory) BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory) BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits:	6
Teaching languages:	Catalan, English

### Teaching staff

Coordinator:	Antoni Arias -Montserrat Corbalán
Others:	Lluís Ferrer, Víctor Suñé

### 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:

1. IND\_COMMON: Basic electronic knowledge

Transversal:

2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.
3. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
4. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

## 320014 - SEL - Electronic Systems

### Teaching methodology

In the lectures, 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 aim of the applied sessions is to consolidate theoretical knowledge, as well as to introduce specific applications in professional and academic environments. The various 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.

In the laboratory, students will be expected to go over the concepts they have learnt about in the theoretical and applied sessions. Given the transversal nature of the subject as it is common to all the areas of specialisation, a computer design, analysis and simulation tool (Multisim) will be used in the laboratory sessions.

### 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.

The use of a computer assisted design system (NI Multisim) is considered essential.

### Study load

Total learning time: 150h	Hours large group:	30h	20.00%
	Hours medium group:	15h	10.00%
	Hours small group:	15h	10.00%
	Guided activities:	6h	4.00%
	Self study:	84h	56.00%

## 320014 - SEL - Electronic Systems

### Content

<p>TOPIC 0: INTRODUCTION TO THE SUBJECT</p>	<p>Learning time: 1h Theory classes: 1h</p>
<p>Description: Introduction to the subject.</p> <p>Related activities: AV0</p> <p>Specific objectives:</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- Presentation of the content of the subject and the syllabus (theoretical, applied, laboratory and directed activities).</li> <li>- Discussion of the compulsory and recommended reading list, as well as the computer assisted design tool (NI Multisim).</li> </ul> <p>Assessment regulations</p>	
<p>TOPIC 1: INTRODUCTION TO DIGITAL ELECTRONICS</p>	<p>Learning time: 14h Theory classes: 4h Practical classes: 2h Laboratory classes: 2h Self study : 6h</p>
<p>Description: To give students an introduction to the discipline of electronics through the basic concepts on which digital electronics is based.</p> <p>Related activities: AV1.1 (THEORY), AV1.2 (APPLICATION), AV1.3(LABORATORY), AV1.4 (INDEPENDENT STUDY)</p> <p>Specific objectives:</p> <ul style="list-style-type: none"> <li>Logic functions of a single variable and of two variables. The truth table and the logic symbol.</li> <li>The principal laws and theorems. Duality. De Morgan's laws.</li> <li>Simplifications and synthesis of logic variables. The Karnaugh map. The sum of products and the product of sums. The concept of sufficiency.</li> <li>Decimal, binary hexadecimal and BCD number systems. Conversion between systems.</li> </ul>	

## 320014 - SEL - Electronic Systems

<p><b>TOPIC 2: COMBINATIONAL LOGIC</b></p>	<p>Learning time: 17h</p> <p>Theory classes: 3h 30m Practical classes: 3h Laboratory classes: 2h Self study : 8h 30m</p>
<p>Description: To understand combinational systems.</p> <p>Related activities: AV 2.1 (THEORY), AV 2.2(APPLICATION), AV 2.3 (LABORATORY), AV2.4 (INDEPENDENT STUDY), AV 2.4 (INDEPENDENT GROUP WORK).</p> <p>Specific objectives:</p> <ul style="list-style-type: none"> <li>- Decoders and Coders</li> <li>- Multiplexes and Demultiplexer.</li> <li>- Parity generators</li> <li>- Applications: BCD to 7-segment, input/output selection in uProcessors System-Based, numeric keypad control, BCD numbers mutiplexing with 7-segment, Error detection in data transfer</li> </ul>	
<p><b>TOPIC 3: SEQUENTIAL SYSTEMS</b></p>	<p>Learning time: 25h</p> <p>Theory classes: 6h 30m Practical classes: 2h Laboratory classes: 4h Self study : 12h 30m</p>
<p>Description: Sequential systems</p> <p>Related activities: AV3.1 (THEORY), AV3.2 (APPLICATION), AV3.3.1 (LABORATORY), AV3.3.2 (LABORATORY), AV3.4 (INDEPENDENT STUDY), AV3.5 (INDEPENDENT GROUP WORK).</p> <p>Specific objectives:</p> <p>The concept of a sequential system. The clock signal. The chronogram. J-K, T and D flip-flops. Registries. Serial and parallel input and output. Asynchronous computers. Binary and random modules. Applications: digital clocks, introduction to parallel serial conversion, incremental encoder for angular (and velocity) position of a motor shaft.</p>	

## 320014 - SEL - Electronic Systems

<p><b>TOPIC 4: INTRODUCTION TO MICROPROCESSOR-BASED SYSTEMS</b></p>	<p>Learning time: 2h Theory classes: 2h</p>
<p>Description: Sequential systems</p> <p>Related activities: AV4.1 (THEORY)</p> <p>Specific objectives: Basic elements: CPUs. Input/output ports. Memories. Connections: data, address and control buses. Types of memories: RAM and ROM.</p>	
<p><b>TOPIC 5: INTRODUCTION TO SIGNAL PROCESSING</b></p>	<p>Learning time: 11h Theory classes: 2h 30m Practical classes: 1h Laboratory classes: 2h Self study : 5h 30m</p>
<p>Description: Sequential systems</p> <p>Related activities: AV5.1 (THEORY), AV5.2 (APPLICATION), AV5.3 (LABORATORY), AV5.4 (INDEPENDENT STUDY), AV5.5 (INDEPENDENT GROUP WORK).</p> <p>Specific objectives: Analogue-digital conversion. Digital-analogue conversion. Business cards.</p>	

## 320014 - SEL - Electronic Systems

<p><b>TOPIC 6: ELECTRONIC FUNCTIONS</b></p>	<p>Learning time: 29h</p> <p>Theory classes: 6h 30m Practical classes: 4h Laboratory classes: 4h Self study : 14h 30m</p>
<p>Description: Sequential systems</p> <p>Related activities: AV6.1 (THEORY), AV6.2 (APPLICATION), AV6.3 (LABORATORY), AV6.4 (INDEPENDENT STUDY), AV6.5 (INDEPENDENT GROUP WORK).</p> <p>Specific objectives: Amplification. Ideal amplifiers. The ideal operational amplifier. Application of op-amps to mathematical operations (addition, subtraction, multiplication, division, integration and derivation). Industrial electronic measurements: transducers, signal adjustment and transmission. Application of op-amps in non-linear operation (comparator, comparator with hysteresis).</p>	
<p><b>TOPIC 7: CIRCUITS WITH DIODES AND TRANSISTORS</b></p>	<p>Learning time: 15h</p> <p>Theory classes: 4h Practical classes: 3h Laboratory classes: 1h Self study : 7h</p>
<p>Description: Sequential systems</p> <p>Related activities: AV7.1 (THEORY), AV7.2 (APPLICATION), AV7.3 (LABORATORY), AV7.4 (INDEPENDENT STUDY)</p> <p>Specific objectives: Introduction to, general characteristics and the operation of an ideal diode. Introduction to, general characteristics and operation of an ideal transistor. Alternating and direct current power supplies. The concept of mass and Vcc.</p>	

## 320014 - SEL - Electronic Systems

### Planning of activities

AV 0: PRESENTATION OF COURSE	Hours: 1h Theory classes: 1h
AV 1.1: THEORY	Hours: 4h Theory classes: 4h
AV 1.2: APPLICATION	Hours: 2h Practical classes: 2h
AV 1.3: LAB PRACTICE	Hours: 2h Laboratory classes: 2h
AV 1.4: INDIVIDUAL ACTIVITY	Hours: 6h Self study: 6h
AV 2.1: THEORY	Hours: 3h 30m Theory classes: 3h 30m
AV 2.2: APPLICATION	Hours: 3h Practical classes: 3h
AV 2.3: LAB. PRACTICE 1	Hours: 2h Laboratory classes: 2h
AV 2.4: INDIVIDUAL ACTIVITY NO FACE	Hours: 6h Self study: 6h
AV 2.5: ACTIVITY GROUP NO FACE	Hours: 2h Self study: 2h

## 320014 - SEL - Electronic Systems

AV 3.1: THEORY	Hours: 6h 30m Theory classes: 6h 30m
AV 3.2: APPLICATION	Hours: 2h Practical classes: 2h
3.3.1 AV: LAB. PRACTICE 2	Hours: 2h Laboratory classes: 2h
3.3.2 AV: LAB. PRACTICE 3	Hours: 2h Laboratory classes: 2h
AV 3.4: INDIVIDUAL ACTIVITY NO FACE	Hours: 8h 30m Self study: 8h 30m
AV 3.5: ACTIVITY IN GROUP	Hours: 4h Self study: 4h
AV 4.1: THEORY	Hours: 2h Theory classes: 2h
AV 5.1: THEORY	Hours: 2h 30m Theory classes: 2h 30m
AV 5.2: APPLICATION	Hours: 1h Practical classes: 1h
AV 5.3: LABORATORY. PRACTICE 4	Hours: 2h Laboratory classes: 2h



## 320014 - SEL - Electronic Systems

AV 5.4: INDIVIDUAL ACTIVITY NO FACE	Hours: 3h 30m Self study: 3h 30m
AV 5.5: ACTIVITY GROUP NO FACE	Hours: 2h Self study: 2h
AV 6.1: THEORY	Hours: 6h 30m Theory classes: 6h 30m
AV 6.2: APPLICATION	Hours: 4h Practical classes: 4h
AV 6.3: LABORATORY. PRACTICE 5	Hours: 4h Laboratory classes: 4h
AV 6.4: INDIVIDUAL ACTIVITY	Hours: 10h 30m Self study: 10h 30m
AV 6.5: ACTIVITY GROUP	Hours: 4h Theory classes: 4h
AV 7.1: THEORY	Hours: 4h Theory classes: 4h
AV 7.2: APPLICATION	Hours: 3h Theory classes: 3h
7.3 AV: LAB. VISIT TO A LAB	Hours: 1h Theory classes: 1h

## 320014 - SEL - Electronic Systems

7.4 AV: INDIVIDUAL ACTIVITY	Hours: 7h Self study: 7h
AV AD.1: ADDRESSED ACTIVITY	Hours: 1h Guided activities: 1h
AV AD.2: ADDRESSED ACTIVITY	Hours: 1h Guided activities: 1h
AV AD.3: ADDRESSED ACTIVITY	Hours: 1h Guided activities: 1h
AV AD.4: ADDRESSED ACTIVITY	Hours: 1h Guided activities: 1h
AV AD.5: ADDRESSED ACTIVITY	Hours: 1h Guided activities: 1h
AV AD.6: ADDRESSED ACTIVITY	Hours: 1h Guided activities: 1h
AV ADNP: ADDRESSED GROUP ACTIVITY	Hours: 18h Self study: 18h

### Qualification system

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.

## 320014 - SEL - Electronic Systems

### Regulations for carrying out activities

1st exam. Roughly, it will consist of a test up to 30 questions with 4 possible answers and one problem. All exam without calculator, nor phone, nor smart watch neither notes.

2nd exam. Roughly, it will consist of a test up to 30 questions with 4 possible answers and one problem. Test without calculator, nor phone, nor smart watch neither notes. Problem: neither notes, nor phone, nor smart watch, only a non-programmable calculator. Additionally, there will be a laboratory exam test up to 15 questions.

Recovery (Catch-up) 1st exam. Roughly, it will consist of a test up to 30 questions with 4 possible answers. It will be done along with the 2nd exam. Only the students that did not passed the 1st exam have the right to attend. It will be done without calculator, nor mobile, nor smart watch or similar devices and without notes.

### Bibliography

#### Basic:

Floyd, Thomas L. Fundamentos de sistemas digitales [on line]. 9a ed. Madrid: Prentice Hall, 2006 [Consultation: 04/10/2018]. Available on: <[http://www.ingebook.com/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=6120](http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6120)>. ISBN 9788483220856.

Malvino, Albert Paul. Principios de electrónica [on line]. 7a ed. Madrid: McGraw-Hill, 2007 [Consultation: 04/10/2018]. Available on: <[http://www.ingebook.com/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=4146](http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4146)>. ISBN 9788448156190.

Malik, Norbert R. Circuitos electrónicos: análisis, diseño y simulación. Madrid: Prentice Hall, 1996. ISBN 8489660034.

#### Complementary:

Wakerly, John F. Diseño digital: principios y prácticas. 3a ed. México: Pearson Educación, 2001. ISBN 9701704045.

Ruiz Robredo, G. A. Electrónica básica para ingenieros. Oviedo: Universidad de Cantabria, 2009. ISBN 9788481025446.