

Course guide

330521 - SEL - Electronic Systems

Last modified: 04/05/2023

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree: BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Compulsory subject).

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

LECTURER

Coordinating lecturer: Barcons Xixons, Victor

Others: Pala Schonwalder, Pere

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CE10. Knowledge of the fundamentals and applications of analog electronics, digital, microprocessors and power electronics.

Generical:

CG1. Ability to write and develop projects in the field of automotive engineering for the construction, renovation, repair, maintenance, recycling, manufacture, installation, assembly or operation of: structures, mechanical equipment, energy installations, electrical and electronic installations, plants and industrial plants and manufacturing and automation processes.

CG2. Capacity for management of the activities that are the subject of the engineering projects described in the previous section.

CG3. Knowledge of basic and technological subjects that will enable students to learn new methods and theories and that will endow them with the versatility needed to adapt to new situations.

CG4. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of automotive engineering.

CG10. The ability to work in a multilingual and multidisciplinary environment.

Transversal:

1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
3. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.
4. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
5. 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.

Basic:

CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

CB4. Students can transmit information, ideas, problems and solutions to a specialized and non-specialized audience.

TEACHING METHODOLOGY

MD1, Master Class or Conference (EXP)
MD2, Problem Solving and Case Study (RP)
MD3, Practical work in a laboratory or workshop (TP)
MD7, Evaluation Activities (EV)

LEARNING OBJECTIVES OF THE SUBJECT

The course aims to provide the student with the specific knowledge about electronics in the automotive sector. The different learning objectives are:

- Understand the operating principles of electronic systems.
- Study the most common electronic signals, as well as their fundamental equations.
- Use electronic instrumentation appropriately for the experimental analysis of circuits, equipment and electronic systems.
- Know the principles of operation of analog electronic equipment.
- Know the main sensors, actuators, conditioning circuits (amplifiers and filters) and their applications in the automotive industry.
- Study the digitalization of electronic signals (AD, DA and PWM converters) and know their problems.
- Know the operation and applications of the Microcontrollers.
- Know the basics and applications of electronic power converters.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

Title of content 1: Introduction to Electronic Systems

Description:

Electronic signals and their frequent treatment. Basic concepts of electronics and semiconductors. The functional block diagram. Electronic instrumentation.

Specific objectives:

- Understand and understand the operating principles of electronic systems.
- Know the most common electronic signals, as well as their fundamental equations.
- Use electronic instrumentation appropriately for the experimental analysis of circuits, equipment and electronic systems.

Related activities:

Activity 1: Practices of the Electronic Systems laboratory.
Activity 2: Individual assessment test.
Activity 4: Individual work.

Full-or-part-time: 26h

Theory classes: 8h
Laboratory classes: 2h
Self study : 16h



Title of content 2: Analog Electronics.

Description:

Introduction to analog electronics. Sensors Actuators. Analog signals conditioning: amplifiers and filters.

Specific objectives:

- Know the principles of operation of analog electronic equipment.
- Know the main sensors, actuators, conditioning circuits (amplifiers and filters) and their applications in the automotive industry.

Related activities:

Activity 1: Practices of the Electronic Systems laboratory.
Activity 2: Individual assessment test.
Activity 4: Individual work.

Full-or-part-time: 34h

Theory classes: 10h

Laboratory classes: 4h

Self study : 20h

Title of content 3: Digital Electronics.

Description:

Principles of digital electronics. Analog-Digital and Digital-Analog Conversion. Structure of Microcontrollers. Electronic Control Units (ECUs). Interconnection of ECUs.

Specific objectives:

- Study the digitalization of electronic signals (AD, DA and PWM converters) and know their problems.
- Know the operation and applications of the Microcontrollers.

Related activities:

Activity 1: Practices of the Electronic Systems laboratory.
Activity 3: Individual assessment test.
Activity 4: Individual work.

Full-or-part-time: 51h

Theory classes: 15h

Laboratory classes: 6h

Self study : 30h

Title of content 4: Power Electronics.

Description:

Fundamentals of electronic conversion of electrical power. Rectifiers. DC/DC Converters. Inverters. Frequency converters.

Specific objectives:

Fundamentals of electronic conversion of electrical power. Rectifiers. DC/DC Converters. Inverters. Frequency converters.

Related activities:

Activity 1: Practices of the Electronic Systems laboratory.
Activity 3: Individual assessment test.
Activity 4: Individual work.

Full-or-part-time: 39h

Theory classes: 12h

Laboratory classes: 3h

Self study : 24h



ACTIVITIES

Title of the activity 1: Practices of the Electronic Systems laboratory.

Description:

Practical sessions developed in laboratories throughout the course. Contents:

- Electronic instrumentation: digital oscilloscope, signal generator, power supply and multimeter.
- Gain and zero amplifier. Frequency response.
- Analog filters: FFT analysis.
- Sensors and actuators.
- Microcontrollers: Arduino.
- Digitalisation of analog signals.
- Digital communications: RS232.
- Speed regulation of DC and AC motors.

Specific objectives:

Development of techniques and strategies for reasoning for analysis

Written and oral communication

Teamwork

Solvent use of information resources

Third language

Material:

Equipment, models and instrumentation of the Electronics/Automotive Laboratory

Delivery:

30% of the qualification

Full-or-part-time: 45h

Laboratory classes: 15h

Self study: 30h

Title of the activity 2: Individual assessment test.

Description:

Written test of individual assessment on contents 1 and 2 of the course.

Specific objectives:

Development of techniques and strategies for reasoning for analysis

Third language

Material:

Form and scientific calculator.

Delivery:

30% of the qualification

Full-or-part-time: 22h

Theory classes: 2h

Self study: 20h



Title of the activity 3: Individual assessment test.

Description:

Written test of individual assessment on contents 3 and 4 of the course.

Specific objectives:

Development of techniques and strategies for reasoning for analysis
Third language

Material:

Form and scientific calculator.

Delivery:

30% of the qualification

Full-or-part-time: 22h

Theory classes: 2h

Self study: 20h

Title of the activity 4: Research work

Description:

Preparation of different information search work:

- Search and manufacture of block diagrams of electronic systems.
- Search of sensors and actuators suitable for a specific application.
- Search and interpretation of the manufacturer's characteristics of different electronic devices.

Specific objectives:

Development of techniques and strategies for reasoning for analysis
Written communication
Teamwork
Solvent use of information resources
Third language

Material:

On the virtual campus "ATENEA", Internet searches and bibliography

Delivery:

10% of the qualification

Full-or-part-time: 20h

Self study: 20h

GRADING SYSTEM

EV1, Written proof of knowledge control (PE). 60%

EV3, Work done throughout the course (TR). 25%

EV4, Assistance and participation in classes and laboratories (AP). 5%

EV5, Performance and quality of group work (TG). 10%

EXAMINATION RULES.

Activities not delivered do not qualify.



BIBLIOGRAPHY

Basic:

- Denton, Tom. Electric and hybrid vehicles. Milton Park, Abingdon, Oxon: Routledge, 2016. ISBN 9781315731612.
- Denton, Tom. Automobile electrical and electronic systems [on line]. 5th ed. Milton Park, Abingdon, Oxon: Routledge, 2017 [Consultation: 27/05/2022]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?docID=1244526>. ISBN 9781315856629.

Complementary:

- Bosch automotive electrics and automotive electronics: systems and components, networking and hybrid drive [on line]. Wiesbaden: Springer Fachmedien Wiesbaden, 2014 [Consultation: 19/11/2020]. Available on: <http://dx.doi.org/10.1007/978-3-658-01784-2>. ISBN 9783658017842.
- Emadi, Ali. Advanced electric drive vehicles [on line]. Boca Raton: CRC Press, 2015 [Consultation: 27/05/2022]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?docID=1696870>. ISBN 9781466597693.

RESOURCES

Other resources:

On "ATENEA" digital campus