Course guide
330067 - 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 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).

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

LECTURER

Coordinating lecturer: VICTOR BARCONS XIXONS

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Knowledge and use of circuit theory.
2. Knowledge of the basics of electronics.

Transversal:
3. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
4. EFFECTIVE USE OF INFORMATI0N 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.
5. 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.

TEACHING METHODOLOGY

The hours of directed learning that are carried out in a medium group, consist, on the one hand, in doing lectures in which the teacher makes a brief presentation to introduce the general learning objectives related to the basic concepts of the subject, which are combined with cooperative learning techniques, in which a resolution of practical exercises is proposed from which it is tried to motivate and involve the student to actively participate in their learning. Students can access all support material via ATENEA.
The hours of directed learning that are carried out in a small group, consist of carrying out 6 laboratory practices, which are done in pairs, and allow the development of basic instrumental skills in an electronics laboratory, as well as initiating the student in the application of the method scientist in problem solving.
In general, after each session, assignments are proposed outside the class, which must be worked either individually or in groups and which are the basis of autonomous learning. It is also necessary to consider other hours of autonomous learning such as those dedicated to oriented reading, solving the proposed problems or self-learning questionnaires of the different contents through the virtual campus ATENEA.

LEARNING OBJECTIVES OF THE SUBJECT

Upon completion of the Electronic Systems course, the student must be able to:
- Know, understand and use the operating principles of electronic systems.
- Know and understand electronic signals, as well as their fundamental equations.
- Analyze and carry out measurements in electronic systems.
- Properly use electronic instrumentation for the experimentation of electronic circuits, equipment and systems.
- Analyze the operation of analog, digital and power electronic systems.
- Know the main analog sensors and actuators and their industrial applications.
- Study the digitization of electronic signals (A / D and D / A) and know its problems.
- Know the fundamentals and applications of power converters.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	10.00
Hours large group	45,0	30.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

1. ELECTRONIC SYSTEMS: FUNDAMENTAL CONCEPTS

Description:
1.1. The functional block diagram.
1.2. Basic concepts of electricity.
1.3. Electronic signals: frequency treatment.
1.4. Electronics basics: semiconductors.
1.5. Electronic instrumentation.
1.6. Disciplines of industrial electronics.

Specific objectives:
- Know and understand electronic signals, as well as their fundamental equations.
- Analyze and carry out measurements in electronic circuits, equipment and systems.
- Properly use electronic instrumentation for the experimentation of electronic circuits, equipment and systems.

Related activities:
Activity 1: Electronic Systems laboratory practices.
Activity 2: Individual evaluation test.
Activity 4: Individual work.

Full-or-part-time: 26h
Theory classes: 8h
Laboratory classes: 2h
Self study : 16h

2. ANALOG ELECTRONICS

Description:
2.1. Amplification.
2.2. Analog filters.
2.3. Analog sensors and actuators.

Specific objectives:
- Understand and assimilate the basic concepts of analog electronics.
- Analyze characteristics and use amplifier circuits.
- Know and understand understand the operation of the main types of filters.
- Know the main analog sensors and actuators and their industrial applications.

Related activities:
Activity 1: Electronic Systems laboratory practices.
Activity 2: Individual evaluation test.
Activity 4: Individual work.

Full-or-part-time: 34h
Theory classes: 10h
Laboratory classes: 4h
Self study : 20h

3. DIGITAL ELECTRONICS

Description:
3.1. Voltage levels: logic families.
3.2. Numbering systems.
3.3. Combinational logic functions.
3.4. Sequential logic functions.
3.5. Digital sensors.
3.6. Analog-Digital and Digital-Analog Conversion.
3.7. Digital processors.
3.8. Digital communications.

Specific objectives:
- Understand and assimilate the basic concepts of digital electronics.
- Know the combinational and sequential logic functions and their applications.
- Study the digitization of electronic signals (A / D and D / A) and know its problems.
- Know the different types of digital processors and their typical applications.
- Know and classify the different types of digital communications existing in the industrial world.

Related activities:
Activity 1: Electronic Systems laboratory practices.
Activity 2: Individual evaluation test.
Activity 4: Individual work.

Full-or-part-time: 51h
Theory classes: 15h
Laboratory classes: 6h
Self study : 30h

4. POWER ELECTRONICS

Description:
4.1. Rectifiers.
4.2. DC / DC converters: linear and switched.
4.3. Curlers.
4.4. AC / AC converters: Variable-frequency drives (VFD).

Specific objectives:
- Understand and assimilate the basic concepts of power conversion.
- Know the fundamentals and applications of power converters.
- Correctly interpret the specifications of the power converter manufacturers.

Related activities:
Activity 1: Electronic Systems laboratory practices.
Activity 3: Individual evaluation test.
Activity 4: Individual work.

Full-or-part-time: 39h
Theory classes: 12h
Laboratory classes: 3h
Self study : 24h

ACTIVITIES

1. ELECTRONIC SYSTEMS LABORATORY PRACTICES

Description:
These practical sessions serve for the student to reinforce, in the laboratory, the concepts that reaching face-to-face classes. It is done in a group of two students. The following sections are developed in the different practical sessions:
- Electronic instrumentation: digital oscilloscope, signal generator, power supply and multimeter.
- Charging and discharging of a capacitor through a resistor.
- Study of an amplifier with gain and zero. Frequency response.
- Analog filters: analysis with FFT.
- Analog sensors and comparators with / without hysteresis.
- Digital sensors: relative encoder.
- Digitization of an analog signal.
- Digital communications: RS232.
- Speed regulation of DC and AC motors.

Specific objectives:
- Knowledge of the basic instruments and the specific material of an electronics laboratory.
- Know, understand and use the operating principles of electronic systems.
- Observe the behavior of an amplifier and a filter with the frequency.
- Determine the operation and applications of different types of industrial sensors.
- Study the A-D and D-A conversion.
- Know a generic digital transmission.
- Carry out a complete electronic assembly, connecting different power converters.

Material:
Practice guide.
Bibliography.

Delivery:
Preliminary and final report.
Oral communication student / teacher.
Represents a part of the continuous evaluation: 30%.

Full-or-part-time: 45h
Laboratory classes: 15h
Self study: 30h

2. WRITTEN TEST

Description:
Individual test in the classroom related to the learning objectives of the subject contents.

Specific objectives:
Evaluate the general achievement of the objectives of the contents 1, 2.

Material:
Statement of the test delivered at the time of the test.

Delivery:
The resolved test is delivered to the teacher.
Represents a part of the continuous evaluation of the specific contents of the subject: 30%.

Full-or-part-time: 27h
Laboratory classes: 2h
Self study: 25h

3. WRITTEN TEST

Description:
Individual test in the classroom related to the learning objectives of the subject contents.

Specific objectives:
Evaluate the general achievement of the objectives of contents 3 and 4.

Material:
Statement of the test delivered at the time of the test.

Delivery:
The resolved test is delivered to the teacher.
Represents a part of the continuous evaluation of the specific contents of the subject: 30%.

Full-or-part-time: 18h
Theory classes: 1h
Self study: 17h

4. INDIVIDUAL WORK

Description:
These work activities serve for the student to reinforce, in a non-face-to-face way, the concepts that they reach to face-to-face classes. It is done individually. The following sections are developed in the different activities:
- Search and preparation of block diagrams of electronic systems.
- Search for suitable sensors and actuators for a certain industrial application.
- Search and interpretation of characteristics of the manufacturer of different electronic equipment.

Specific objectives:
- Properly use information search tools to find information about electronic equipment and systems.
- Understand the specifications given by the manufacturers of electronic equipment and systems.

Material:
Statement of the activities posted in the space of the subject on the virtual campus.
Internet searches.
Bibliography.

Delivery:
Report.
Represents a part of the continuous evaluation: 10%.

Full-or-part-time: 15h
Theory classes: 1h
Guided activities: 14h

GRADING SYSTEM

- Activity 1: Electronic Systems Laboratory Practices: 30%
- Activity 2: Written test: 30%
- Activity 3: Written test: 30%
- Activity 4: Individual work: 10%

EXAMINATION RULES.

If any of the laboratory or continuous assessment activities is not performed, it will be considered as not scored.

BIBLIOGRAPHY

Basic:
- Frenzel, Louis E. Electronics explained: the new systems approach to learning electronics [on line]. Burlington: Newnes, 2010 [Consultation: 10/06/2022]. Available on: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9781856177009/electronics-explained. ISBN 1856177009.
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Complementary:
- Kybett, H.; Boysen, E. All new electronics self-teaching guide. 3rd ed. Indianapolis: Wiley, 2008. ISBN 9780470289617.
- Trzynadlowski, Andrzej M. Introduction to modern power electronics. 2nd ed. Hoboken: Wiley, 2010. ISBN 9780470401033.

RESOURCES

Other resources:
Electronic equipment and systems datasheets available on the Internet.