



Course guide

390215 - CSE - Electronic Circuits and Systems

Last modified: 29/06/2023

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN BIOSYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).

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

LECTURER

Coordinating lecturer: Marcos Quílez Figuerola

Others: Marcos Quílez Figuerola
Ernesto Serrano Finetti

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. Fundamental and application of analogical and digital electronics.

Transversal:

2. 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.

TEACHING METHODOLOGY

The following methodologies are used:

- Participative master class.
- Cooperative learning and team-work
- PBL (Problem Based Learning)
- Guided self-learning
- Autoevaluation and coevaluation

LEARNING OBJECTIVES OF THE SUBJECT

This course is to provide the student with the knowledge improve his understanding of electronic circuits and systems in the field of biosystems engineering.

In this area, many of the measurement applications are based on the electrical properties of biological materials. For this reason, skills to analyze and discuss circuit models of biological culture and biological tissues are also provided.

By the end of the course the student will be able to:

Once the subject is passed, the student will be able to:

- Explain the relationship between information, signal and electronic circuits.
- Identify and distinguish continuous and discrete quantities of interest in the field of biological systems.
- Represent or code these quantities using analog or digital electrical signals.
- Explain the difference between analog and digital electronic circuits.
- Identify the main elements that make up an electronic measurement and control system.
- Develop simple circuit models to describe common measurement situations in the engineering of biological systems and analyze them.
- Analyze circuit models of crops and biological tissues
- Perform electrical impedance and bioelectrical impedance calculations.
- Measure voltages and currents in an electrical circuit.
- Implement and use a simple measurement system by using a set of sensors, an acquisition data system and a personal computer.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	20,0	13.33
Hours large group	40,0	26.67

Total learning time: 150 h

CONTENTS

Unit 1: Fundamentals

Description:

- 1.1 Information, signals and systems
- 1.2 Architecture of electronic systems
- 1.3 Circuit analysis and modelling

Related activities:

- Activity 1: Theory classes
- Activity 2: Guided exercises classes
- Activity 3: Non-presencial exercise resolution
- Activity 4: Individual tests
- Activity 5: Laboratory classes

Related competencies :

CE-SB-21.3. Fundamental and application of analogical and digital electronics.

Full-or-part-time: 9h

- Theory classes: 3h
- Laboratory classes: 1h
- Self study : 5h



title english

Description:

- 2.1 Input and output devices
- 2.2 Amplification of small signals
- 2.3 Digital data acquisition
- 2.4 Experiment automation

Related activities:

- Activity 1: Theory classes
- Activity 2: Guided exercises classes
- Activity 3: Non-presencial exercise resolution
- Activity 4: Individual tests
- Activity 5: Laboratory classes

Related competencies :

CE-SB-21.3. Fundamental and application of analogical and digital electronics.

Full-or-part-time: 61h

Theory classes: 16h

Laboratory classes: 7h

Self study : 38h

title english

Description:

- 3.1 Electrical impedance
- 3.2 Frequency response

Related activities:

- Activity 1: Theory classes
- Activity 2: Guided exercises classes
- Activity 3: Non-presencial exercise resolution
- Activity 4: Individual tests
- Activity 5: Laboratory classes

Related competencies :

CE-SB-21.3. Fundamental and application of analogical and digital electronics.

Full-or-part-time: 24h

Theory classes: 6h

Laboratory classes: 4h

Self study : 14h



title english

Description:

In this unit, common situations that arise from the use of electronic instrumentation in laboratories and facilities of the biotechnology industry are studied. Models are proposed and analyzed to understand how the measurement results are affected by specifications and non-ideal behaviour of equipment.

Related activities:

Activity 1: Theory classes

Activity 2: Guided exercises classes

Activity 3: Non-presencial exercise resolution

Activity 4: Individual tests

Activity 5: Laboratory classes

Related competencies :

CE-SB-21.3. Fundamental and application of analogical and digital electronics.

Full-or-part-time: 56h

Theory classes: 15h

Laboratory classes: 8h

Self study : 33h

ACTIVITIES

ACTIVITY 1: Theory classes

Related competencies :

CE-SB-21.3. Fundamental and application of analogical and digital electronics.

Full-or-part-time: 72h

Theory classes: 36h

Self study: 36h

Activity 2: Guided exercises classes

Related competencies :

CE-SB-21.3. Fundamental and application of analogical and digital electronics.

Full-or-part-time: 24h

Laboratory classes: 12h

Self study: 12h

Activity 3: Non-presencial exercise resolution

Related competencies :

CE-SB-21.3. Fundamental and application of analogical and digital electronics.

Full-or-part-time: 34h

Self study: 34h



ACTIVITY 4: Individual test

Related competencies :

CE-SB-21.3. Fundamental and application of analogical and digital electronics.

Full-or-part-time: 4h

Theory classes: 4h

Activity 5: Laboratory classes

Related competencies :

CE-SB-21.3. Fundamental and application of analogical and digital electronics.

04 COE N2. 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.

Full-or-part-time: 16h

Laboratory classes: 8h

Self study: 8h

GRADING SYSTEM

The final mark is calculated as weighed sumation of the following marks:

N1: mark of the first individual test, with a 30 % contribution.

N2: mark of the second individual test, with a 40 % contribution

N3: mark of the exercices from activities 2 and 3, with a 20 % contribution.

N4: mark of the laboratori classes, with a 10 % contribution.

$$N_{\text{final}} = 0,30 N1 + 0,40 N2 + 0,20 N3 + 0,10 N4$$

Beacuse of its content, the first individual test (N1) has a more instrumental character, while the second individual test (N2) emphasizes on the application of the techniques learned in the first part of the course. Thus, if a student fails the mid-term test, but passes the end-of-term test, it is understood that he has finally reached the minimum knowledge of the modeling and analysis techniques presented and evaluated in the first part of the semester. Consequently, those students who failed the mid-term test, and obtained an N2 grade equal to or higher than 5, will be considered to have overcome the mid-term test with a grade N1=5.

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EXAMINATION RULES.

The laboratory activities will be carried out in the Physics Laboratory of the EEABB (L204). The use and safety rules for this facility must be followed.



BIBLIOGRAPHY

Basic:

- Blackburn, James A. Modern instrumentation for scientists and engineers. New York ; Barcelona [etc.]: Springer, 2001. ISBN 9780387950563.
- Pallás Areny, Ramón. Adquisición y distribución de señales. Barcelona: Marcombo. Boixareu, 1993. ISBN 8426709184.
- Irwin, J. David. Análisis básico de circuitos en ingeniería. 6ª ed. México [etc.]: Limusa Wiley, 2003. ISBN 9681862953.
- Hayt, William Hart; Kemmerly, Jack E.; Durbin, Steven M. Análisis de circuitos en ingeniería [on line]. 7ª ed. México D.F. [etc.]: McGraw Hill, 2007 [Consultation: 26/07/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8725. ISBN 9701061071.

Complementary:

- Bugg, David Vernon. Electronics : circuits, amplifiers and gates. 2nd ed. Boca Raton [etc.]: CRC Press Taylor & Francis Group, 2006. ISBN 9780750310376.
- 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.