

Course guide 390215 - CSE - Electronic Circuits and Systems

Last modified: 21/01/2025

Unit in charge: Teaching unit:	Barcelona School of Agri-Food and Biosystems Engineering 710 - EEL - Department of Electronic Engineering.		
Degree:	BACHELOR'S DEGREE IN BIOSYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).		
Academic year: 2024	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

The course aims to provide the necessary knowledge for students to improve their understanding of electronic circuits and systems applied to the field of biosystems engineering. This objective seeks to contribute to the students' education to successfully address the challenges of digitalization and the digital transformation of the sector.

In this context, many measurement applications are based on the electrical properties of biological materials. For this reason, the course also provides tools to analyze and interpret electrical models related to biological tissues and cultures.

By the end of the course, students will be able to:

- Explain the relationship between information, signals, and electronic circuits.
- Identify and distinguish between continuous and discrete quantities relevant to biological systems.
- Represent or encode these quantities using analog or digital electrical signals.
- Explain the differences between analog and digital electronic circuits.
- Identify the main components of an electronic measurement and acquisition system.
- Develop and analyze simple circuit models to describe common measurement scenarios in biosystems engineering.
- Analyze circuit models of biological cultures and tissues.
- Perform electrical impedance and bioelectrical impedance calculations.
- Measure voltages and currents in electrical circuits.
- Implement and operate a basic measurement system using sensors, a data acquisition system, and a personal computer.

STUDY LOAD

Туре	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 analisys 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: 10h Theory classes: 3h Laboratory classes: 1h Self study : 6h



Unit 2: Electric properties of biological materials and tissues

Description:

2.1 Electrical impedance2.2 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: 47h

Theory classes: 11h Laboratory classes: 8h Self study : 28h

Unit 3: Electronic circuits and systems for biosystems engineering

Description:

- 3.1 Input and output devices3.2 Amplification of small signals3.3 Filtering and noise reduction3.4 Digital data acquisition
- 3.5 Experiment automation
- 3.6 Power supply for electronic systems

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: 93h

Theory classes: 26h Laboratory classes: 11h Self study : 56h

ACTIVITIES

ACTIVITY 1: Theory classes

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

Full-or-part-time: 72h Self study: 36h Theory classes: 36h



Activity 2: Guided excercices classes

Related competencies :

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

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

Activity 3: Non-presential 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 Self study: 8h Laboratory classes: 8h



GRADING SYSTEM

The final grade is calculated as a weighted sum of the following components:

N1: Mid-term exam. Grade from the first individual test, contributing 30%.

N2: Final exam. Grade from the second individual test, contributing 40%.

N3: Activities and follow-up tests. Grade from activities 2 and 3, contributing 20%. This component is designed to encourage consistent work throughout the term.

N4: Laboratory sessions. Grade from the laboratory classes, contributing 10%.

The final grade is calculated using the formula:

Nfinal = 0.30 N1+0.40 N2+0.20 N3+0.10 N4

Due to its content, the mid-term exam (N1) has a more instrumental focus, while the final exam (N2) emphasizes the application of techniques introduced in the first part of the course. Therefore, if a student fails the mid-term exam but passes the final exam, it is understood that they have ultimately achieved the minimum required knowledge of the modeling and analysis techniques covered and assessed in the first part of the semester.

Consequently, students who fail the mid-term exam but achieve a grade of 5 or higher on the final exam (N2) will be considered to have passed the mid-term exam with a grade of N1 = 5.

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.

- 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.

- 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.

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]. A v a i l a b l e o n :

https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5186 355. ISBN 9781292114064.