Course guide
820222 - EAEIA - Analogue Electronics

Last modified: 04/06/2026

Unit in charge: Barcelona East School of Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: HERMINIO MARTINEZ GARCIA

Others:

Primer quadrimestre:
ENCARNACIÓN GARCÍA VÍLCHEZ - Grup: T15, Grup: T16, Grup: T17
HERMINIO MARTINEZ GARCIA - Grup: T11, Grup: T12, Grup: T13, Grup: T14, Grup: T15, Grup: T16, Grup: T17, Grup: T18
NOELIA VAQUERO GALLARDO - Grup: T13, Grup: T14
FERNANDO LUIS VAZQUEZ LABRADOR - Grup: T11, Grup: T12

Segon quadrimestre:
MANUEL ANDRÉS MANZANARES BROTONS - Grup: M13, Grup: M22, Grup: M23
HERMINIO MARTINEZ GARCIA - Grup: M11, Grup: M12, Grup: M13, Grup: M14, Grup: M15, Grup: M24, Grup: M25
NOELIA VAQUERO GALLARDO - Grup: M21, Grup: M22, Grup: M23, Grup: M24, Grup: M25
FERNANDO LUIS VAZQUEZ LABRADOR - Grup: M11, Grup: M12, Grup: M21

PRIOR SKILLS

The skills acquired in the following courses of the Bachelor's Degree in Industrial Electronics and Automation Engineering (EIA):

- Electronic Systems (STI - 820017).
- Circuit Theory and Electrical Machines (TCME - 820225).
- Electronics Technology (TE-EIA - 820231).

REQUIREMENTS

REGULACIÓ AUTOMÀTICA - Corequisit
SISTEMES ELECTRÒNICS - Prerequisit
TECNOLOGIA ELECTRÒNICA - Corequisit
TEORIA DE CIRCUITS I MÀQUINES ELÈCTRIQUES - Prerequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Design analogue, digital and power systems.
3. Understand the applications of electronic instrumentation.
4. Understand the fundamentals and applications of analogue electronics.

Transversal:
10. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

Two theory classes per week with a total of 3.0 h/week, which encompass matter of theory and problems, and 1 h/set. of laboratory classes, grouped into fortnightly sessions.

Additionally, throughout the semester, different classes will be held (schedule will be announced at the beginning of term) with the whole group or part thereof in order to explain, develop and assess cross (generic) competences assigned to the subject.

The course uses:

- Lecture methodology by 40%.
- Individual work by 30% .
- Work in groups by 30 %.

The student will develop, in groups of, at most, 2 students, a project of the course design, simulation, and/or implementation related to the content of the course.

LEARNING OBJECTIVES OF THE SUBJECT

1.- To know the different types, internal structures, operation and application circuits of commercial devices and integrated circuits for analog signal processing (VFOAs, OTAs, CCIs, CCIIs, CFOAs, etc.).
2.- To know the main electrical characteristics and practical limitations (static and dynamic) of the main commercial integrated circuits for analog signal processing.
3.- To understand the concept of 'saturated state' and 'non-saturated state', 'linear electronic function' and 'non-linear electronic function'.
4.- To know how to analyze, design, simulate, and implement basic and advanced analog systems that implement linear and nonlinear generation of waveforms and sinusoidal oscillators, regulators and voltage references, etc.
5.- To know the synthesis of analog and digital filtering structures, the principle of switched capacitor circuits (SC), and the classification and types of SC circuits.
6.- To develop skills in simulation techniques and experimental measurement in analog electronic circuits and systems.
7.- Autonomous learning and the development of student teamwork.
8.- To use English in advanced information search (manufacturers datasheets, IEEE journal articles, etc.), regarding the presentation of written and oral work in the course.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

1.- Analysis and Design of Operational Amplifer Internal Structures.

Description:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 10h
Theory classes: 5h
Self study : 5h

2.- Practical Limitations of Analog Integrated Circuits.

Description:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Specific objectives:
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Related competencies :
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 8h
Theory classes: 3h
Self study : 5h

3.- Alternatives to VFOA: Commercial Analog Integrated Circuits (OTA, CCI, CCII, CFOA, etc.). Types, Characteristics, and Classification.

Description:
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Specific objectives:
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Related competencies :
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 8h
Theory classes: 3h
Self study : 5h

4.- Implementation of Linear and Non-Linear Electronic Functions by Means of Analog Integrated Circuits Operating in Non-Saturation and Saturation Zones.

Description:
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Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
CEEIA-23. Understand the applications of electronic instrumentation.
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 12h 30m
Theory classes: 3h 30m
Laboratory classes: 4h
Self study : 5h

5.- Frequency Response of Transistor Amplifiers.

Description:
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Specific objectives:
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Related competencies :
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 14h
Theory classes: 4h
Self study : 10h

6.- Transistor and VFOA Feedback Amplifiers: Effects of the Negative and Positive Feedback.

Description:
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Specific objectives:
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Related competencies :
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 8h
Theory classes: 3h
Self study : 5h

7.- Time Circuits, Signal Generation and Sinusoidal Oscillators.

Description:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
CEEIA-23. Understand the applications of electronic instrumentation.
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 18h
Theory classes: 4h
Laboratory classes: 4h
Self study : 10h

8.- Continuous and Discrete Transfer Functions: 's' and 'z' Transforms for Electrical Filter.

Description:
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Specific objectives:
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Related competencies :
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 8h 30m
Theory classes: 3h 30m
Self study : 5h

9.- Continuous-Time and Digital Active Filtering Cells. Design and Analysis of High-Order Filters by Means of Polynomials, Tables, and Software.

Description:
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Specific objectives:
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Related competencies :
CEEIA-23. Understand the applications of electronic instrumentation.
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 19h
Theory classes: 5h
Laboratory classes: 4h
Self study : 10h

10.- Switched-Capacitor Circuits (SCC) and Programmable Analog Devices (FPAAs).

Description:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
CEEIA-23. Understand the applications of electronic instrumentation.
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 11h
Theory classes: 3h
Laboratory classes: 3h
Self study : 5h

11.- Power Amplification: Output Stages.

Description:
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Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 13h
Theory classes: 3h
Self study : 10h

12.- Current and Voltage Regulators and References.

Description:
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Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 13h
Theory classes: 3h
Self study : 10h

13.- Other Important Applications of the Analog Electronics.

Description:
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Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
CEEIA-20. Understand the fundamentals and applications of analogue electronics.
CEEIA-24. Design analogue, digital and power systems.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 7h
Theory classes: 2h
Self study : 5h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

The grade or scoring of the course will be carried out according to:

• Midterm exams: 20 %.
• Final exam: 40 %.
• Course project (project to design, simulate, and implement analog electronic systems): 20 %.
• Laboratory activities and tests: 20 %.

All these tasks will also serve to assess the cross (generic) competences assigned to the course.

This course does not have re-assessment test ("prova de reavaluació").

EXAMINATION RULES.

The implementation of the different tests consists of:

• Midterm exams: written tests, theoretical or sizing problems of solar energy testing, and analysis and/or synthesis (design) of analog electronic systems.
• Final exam: written, theoretical and/or sizing problems of solar energy test, and analysis and synthesis (design) of analog electronic systems.
• Course project: The course project will involve conducting course design work, sizing and/or simulation related to the contents of the subject.
• Activities, testing and laboratory experiments: Laboratory experiences and activities on Electronics Engineering.

Thanks to all these tasks, the cross (generic) competences assigned to the course will be also evaluated.

BIBLIOGRAPHY

Basic:
- Clayton, George; Winder, Steve. Operational amplifiers [on line]. 5th ed. Oxford [etc.]: Newnes, 2003 [Consultation: 29/04/2020]. Available on: https://www.sciencedirect.com/science/book/9780750659147. ISBN 0750659149.
- Coughlin, Robert F.; Driscoll, Frederick F. Amplificadores operacionales y circuitos integrados lineales. 3ª ed. México [etc.]: Prentice-hall Hispano Americana, 1999. ISBN 9701702670.
- Franco, Sergio. Diseño con amplificadores operacionales y circuitos integrados analógicos. México [etc.]: McGraw-Hill, 2005. ISBN 9701045955.
- Fiore, James M. Amplificadores operacionales y circuitos integrados lineales : teoría y aplicación. Madrid: Thomson, cop. 2002. ISBN 8497320999.
- Pérez García, Miguel Ángel. Instrumentación electrónica. Madrid: Paraninfo, cop. 2014. ISBN 9788428337021.

Complementary:
- Op amp applications handbook. Amsterdam: Newnes, 2004. ISBN 9780750678445.
- Malik, Norbert R. Circuitos electrónicos : análisis, diseño y simulación. Madrid [etc.]: Prentice Hall, cop. 1996. ISBN 8489660034.
- Rashid, M. H.. Circuitos microelectrónicos : análisis y diseño. Madrid: International Thomson, 2002. ISBN 8497320573.
- Sedra, Adel S.; Smith, Kenneth Carless. Circuitos microelectrónicos. 5ª ed.. México: Oxford University Press, 2006. ISBN 9701054725.
- Gayakwad, Ramakant A.. OP-AMPS and linear integrated circuits. 4th ed. Englewood Cliffs, NJ [etc.]: Prentice-Hall, cop. 2000. ISBN 0132808684.
- Mancini, Ron. Op amps for everyone : design reference [on line]. Boston: Newnes, 2001 [Consultation: 29/04/2020]. Available on: https://www.cypress.com/file/65366/download. ISBN 0750677015.

RESOURCES

Hyperlink:
- Moodle ATENEA: http://atenea.upc.edu/moodle/

Other resources:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.