

## Course guide

### 230023 - AE - Acoustics and Electroacoustics

**Last modified:** 25/05/2023

<b>Unit in charge:</b>	Barcelona School of Telecommunications Engineering	
<b>Teaching unit:</b>	739 - TSC - Department of Signal Theory and Communications.	
<b>Degree:</b>	BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject). BACHELOR'S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Optional subject).	
<b>Academic year:</b> 2023	<b>ECTS Credits:</b> 6.0	<b>Languages:</b> Catalan, Spanish, English

#### LECTURER

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<b>Coordinating lecturer:</b>	Consultar aquí / See here: <a href="https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura">https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura</a>
<b>Others:</b>	Consultar aquí / See here: <a href="https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma">https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma</a>

#### PRIOR SKILLS

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Basic principles of physics

#### REQUIREMENTS

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#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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##### Generical:

12 CPE N3. They will be able to identify, formulate and solve engineering problems in the ICC field and will know how to develop a method for analysing and solving problems that is systematic, critical and creative.

#### TEACHING METHODOLOGY

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Directed activities  
Application classes  
Lecturing classes  
Laboratory classes  
Group work (no classroom attendance)  
Individual work (no classroom attendance)  
Problems with short answer (exam)  
Problems with long answer (exam)

## LEARNING OBJECTIVES OF THE SUBJECT

Providing the students with basic knowledge of the theory of sound regarding the creating and propagation of sound waves in free space. Studying the behaviour of sound in closed spaces and state the criteria for acoustical conditioning and isolation.

Providing the students with basic knowledge of electroacoustic transducers, public address systems, loudspeaker systems and sound reinforcement systems.

Learning results:

Being able to carry out engineering projects about isolation and acoustic conditioning of indoor spaces and public address systems.

Being familiar with the specifications, analysis and selection of electroacoustic transducers.

Understanding and being able to use systems for measuring, analysing and controlling noise and vibrations.

Being able to carry out studies concerning environmental acoustics and knowing underwater acoustic systems.

Studying with books and papers in English and being able to write a technical report in English or participate in technical reunions in English.

Posing problems correctly on the basis of the proposed text and identifying possible solutions. Applying the correct solution method and recognizing the correct solution.

Identifying, modeling and posing problems on the basis of open situations. Exploring and applying alternatives to solve them.

Knowing how to use approximations

## STUDY LOAD

Type	Hours	Percentage
Hours small group	26,0	17.33
Hours large group	39,0	26.00
Self study	85,0	56.67

**Total learning time:** 150 h

## CONTENTS

### Theme 1: Basic principles of sound

#### Description:

Definition, creation and propagation of sound. Representation of sound. Classification of sounds. Isophonic curves. Sound measurements. Weighting filters.

Types of sound sources. Superposition of sounds.

Laboratory

Acoustical measurements with sound pressure meter

**Full-or-part-time:** 26h

Theory classes: 8h

Practical classes: 2h

Laboratory classes: 4h

Self study : 12h

## Theme 2. Architectural and environmental acoustics

### Description:

Geometrical acoustics, statistical acoustics, wave acoustics.

Environmental acoustics, Noise index, acoustical barriers and diffraction. Noise regulations.

Refraction and reflection. Masking by reverberation and noise.

Laboratory

Measuring absorption coefficients in reverberant chamber.

Acoustical computer simulations

Acoustical room measurements

**Full-or-part-time:** 48h

Theory classes: 10h

Practical classes: 2h

Laboratory classes: 12h

Self study : 24h

## Theme 3. Acoustical isolation

### Description:

Airborne and structural noise.

Indirect paths of noise transmission (flanking)

Calculation methods for global acoustical isolation

**Full-or-part-time:** 13h

Theory classes: 2h

Practical classes: 2h

Self study : 9h

## Theme 4. Microphones

### Description:

Basic characteristics.

Classification of microphones according to directivity and manufacturing technology.

**Full-or-part-time:** 16h

Theory classes: 2h

Practical classes: 2h

Self study : 12h

## Theme 5. Loudspeakers

### Description:

Principles of sound radiation.

Basic characteristics of loudspeakers

Types of loudspeakers.

**Full-or-part-time:** 16h

Theory classes: 2h

Practical classes: 2h

Self study : 12h

## ACTIVITIES

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### PROBLEMS WITH SHORT ANSWERS

**Description:**

Exam

**Full-or-part-time:** 2h

Theory classes: 2h

### Laboratory practice

**Description:**

Theme 1. Basic principles of sound

Laboratory:

- Measurements with sound pressure meter

**Full-or-part-time:** 4h

Practical classes: 4h

### Laboratory practice

**Description:**

Theme 2. Architectural and environmental acoustics

Laboratories:

- Measuring absorption coefficients in reverberant room
- Acoustical computer simulations
- Acoustical measurements in rooms

**Full-or-part-time:** 12h

Practical classes: 12h

### Laboratory practice

**Description:**

Theme 4. Introduction to audiovisual systems

Laboratory:

- Recording studio

**Full-or-part-time:** 4h

Practical classes: 4h



### Laboratory practice

**Description:**

Theme 7. Loudspeaker systems

Laboratory:

- Electroacoustical computer simulations

**Full-or-part-time:** 6h

Practical classes: 6h

### PROBLEMS WITH LONG ANSWERS

**Description:**

exam

## GRADING SYSTEM

First partial exam: 40%

Second partial exam: 40% (on the date indicated on the exam calendar)

Laboratory work: 20%

This course will evaluate generic competition:

- Third language (intermediate level)

Ability to identify, formulate and solve engineering problems (intermediate level)

## EXAMINATION RULES.

The laboratory work will be not re-evaluable.

## BIBLIOGRAPHY

**Basic:**

- Ballou, G. Handbook for sound engineers [on line]. 5th ed. Burlington, MA: Focal Press, 2015 [Consultation: 07/07/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1983402>. ISBN 9781135016654.
- Rayburn, R.A. Eargle's the microphone book : from mono to stereo to surround - a guide to microphone design and application [on line]. 3rd ed. Oxford: Focal, 2011 [Consultation: 22/06/2015]. Available on: <http://www.sciencedirect.com/science/book/9780240820750>. ISBN 9780240820750.
- Kinsler, L.E. [et al.]. Fundamentos de acústica. Nueva ed. México, DF: Limusa : Noriega, 1990. ISBN 9681820266.
- Long, M. Architectural acoustics [on line]. 2nd ed. Amsterdam: Elsevier Academic Press, 2014 [Consultation: 01/04/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1629232>. ISBN 9780123982582.
- Carrión, A. Diseño acústico de espacios arquitectónicos [on line]. Barcelona: Edicions UPC, 1998 [Consultation: 27/01/2015]. Available on: <http://hdl.handle.net/2099.3/36341>. ISBN 8483012529.
- Colloms, M. High performance loudspeakers : optimising high fidelity loudspeaker systems [on line]. 7th ed. Hoboken, NJ: John Wiley & Sons, 2018 [Consultation: 14/04/2021]. Available on: <https://onlinelibrary.wiley.com/doi/book/10.1002/9781118706275>. ISBN 9781118706275.

**Complementary:**

- Barron, M. Auditorium acoustics and architectural design. 2nd ed. London ; New York: Spon Press, 2010. ISBN 9780419245100.
- Davis, D.; Patronis, E.; Brown, P. Sound system engineering. 4th ed. Burlington: Elsevier Focal Press, 2013. ISBN 9780240818467.