Course guides
230023 - AE - Acoustics and Electroacoustics

Last modified: 06/05/2020

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2020 **ECTS Credits:** 6.0 **Languages:** Catalan, English, Spanish

LECTURER

Coordinating lecturer: ALEXANDER HELDRING

Others: ALEXANDER HELDRING
Joan M. Gené Bernaus

PRIOR SKILLS

Basic principles of physics

REQUIREMENTS

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DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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

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 acustical 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 large group	39,0	26.00
Hours small group	26,0	17.33
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

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. 6th ed. Chichester [etc.]: John Wiley, 2005. ISBN 0470094303.

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.