Last update: 19-07-2019

230023 - AE - Acoustics and Electroacoustics

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 739 - TSC - Department of Signal Theory and Communications

Academic year: 2019

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

ECTS credits: 6 Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: ALEXANDER HELDRING

Others: ALEXANDER HELDRING

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.

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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

Total learning time: 150h	Hours large group:	39h	26.00%
	Hours small group:	26h	17.33%
	Self study:	85h	56.67%

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Content

Theme 1: Basic principles of sound

Learning time: 26h

Theory classes: 8h
Practical classes: 2h
Laboratory classes: 4h
Self study : 12h

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

Theme 2. Architectural and environmental acoustics

Learning time: 48h

Theory classes: 10h
Practical classes: 2h
Laboratory classes: 12h
Self study : 24h

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

Theme 3. Acoustical isolation

Learning time: 13h

Theory classes: 2h
Practical classes: 2h
Self study : 9h

Description:
Airborne and structural noise.
Indirect paths of noise transmission (flanking)
Calculation methods for global acoustical isolation

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Theme 4. Introduction to audiovisual systems	Learning time: 12h Theory classes: 1h Practical classes: 1h Laboratory classes: 4h Self study : 6h

Description:
Audiovisual requirements.
Audiovisual systems: infrastructure, audio, video, control and dynamic signalling.

Laboratory
Recording studio

Theme 5. Microphones	Learning time: 16h Theory classes: 2h Practical classes: 2h Self study : 12h

Description:
Basic characteristics.
Classification of microphones according to directivity and manufacturing technology.

Theme 6. Loudspeakers	Learning time: 16h Theory classes: 2h Practical classes: 2h Self study : 12h

Description:
Principles of sound radiation.
Basic characteristics of loudspeakers
Types of loudspeakers.

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Theme 7. Loudspeaker systems	Learning time: 19h Theory classes: 2h Practical classes: 2h Laboratory classes: 6h Self study : 9h

Description:
Direct radiation systems.
Horn radiators.

Laboratory
Electroacoustical computer simulations

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Planning of activities

PROBLEMS WITH SHORT ANSWERS	Hours: 2h Theory classes: 2h
Description: Exam	

Laboratory practice	Hours: 4h Practical classes: 4h
Description: Theme 1. Basic principles of sound Laboratory: - Measurements with sound pressure meter	

Laboratory practice	Hours: 12h Practical classes: 12h
Description: Theme 2. Architectural and environmental acoustics Laboratories: - Measuring absorption coefficients in reverberant room - Acoustical computer simulations - Acoustical measurements in rooms	

Laboratory practice	Hours: 4h Practical classes: 4h
Description: Theme 4. Introduction to audiovisual systems Laboratory: - Recording studio	

Laboratory practice	Hours: 6h Practical classes: 6h

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Description:
Theme 7. Loudspeaker systems

Laboratory:
- Electroacoustical computer simulations

PROBLEMS WITH LONG ANSWERS

Description:
exam

Qualification 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)

Regulations for carrying out activities

The laboratory work will be not re-evaluable.

Bibliography

Basic:

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.

Long, M. Architectural acoustics [on line]. 2nd ed. Amsterdam: Elsevier Academic Press, 2014 [Consultation: 28/05/2018]. Available on: <http://site.ebrary.com/lib/upcatalunya/detail.action?docID=10835971>. 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.

Ballou, G. Handbook for sound engineers [on line]. 4th ed. Boston [etc.]: Focal Press, 2008 [Consultation: 30/01/2015]. Available on: <http://www.sciencedirect.com/science/book/9780240809694>. ISBN 9780240809694.

Colloms, M. High performance loudspeakers. 6th ed. Chichester [etc.]: John Wiley, 2005. ISBN 0470094303.

Kinsler, L.E. [et al.]. Fundamentos de acústica. Nueva ed. México, DF: Limusa : Noriega, 1990. ISBN 9681820266.

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.