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230203 - AE2 - Acoustics and Electroacoustics II

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 Optional)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Optional)

ECTS credits: 6 Teaching languages: Catalan

Teaching staff

Coordinator: ANTONIO CARRION ISBERT.

Others: ANTONIO CARRION ISBERT - ALEXANDER HELDRING

Prior skills

Basic principles of physics

Requirements

Acoustics and Electroacoustics (AE)

Degree competences to which the subject contributes

Generical:

2. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

Transversal:

1. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.
3. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
4. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Teaching methodology

Teaching methodology
Application classes
Expositive classes
Laboratory classes
Group work
Individual work
Extended-response test (final exam)
Laboratory practice

Learning objectives of the subject

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Provide students with the advanced knowledge about the theory of sound from the poin of view of the generation and the propagation of sound waves in free space. Studying the behavior of sound in enclosed spaces and provide specific criteria for their acoustic conditions and isolation.

Provide students with the advanced knowledge about electroacoustic transducers, loudspeaker systems and sound reinforcement systems.

Result of learning:

The student knows how to perform advanced engineering projects about room acoustics and acoustic isolation of buildings and electroacoustic installations.
He/she becomes familiar with the specification, analysis and selection of electroacoustic transducers.
He/she knows and manages advanced systems for measurement, analysis and control of noise and vibration.
The student is able to carry out advanced studies in the field of environmental acoustics and know underwater acoustic systems.

He/she studies with books and articles in English and he/she can write a report or technical work in English and participate in a technical meeting held in this language.
The student raises the problem correctly from the proposed statement and he/she identifies the options for resolution.
The student applies the appropriate resolution method and he/she identifies the correction of the solution.
The student Identifies models and he/she raises problems from open situations. The student explores and apply the alternatives for it resolution. He/she drives approaches.

Study load

Total learning time: 150h	Hours large group:	39h	26.00%
	Hours small group:	13h	8.67%
	Self study:	98h	65.33%

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Content

THEME I. SOUND PROPAGATION IN AIR

Learning time: 8h

Theory classes: 2h
Self study : 6h

Description:
Frequency bands
Absorption, refraction and diffraction of sound in air
Sound sources localization

THEME II. ARCHITECTURAL ACOUSTICS (II)

Learning time: 40h

Theory classes: 10h
Laboratory classes: 8h
Self study : 22h

Description:
Introduction
Reverberation time calculation formulas. Early Decay Time (EDT).
Acoustic absorption evaluation ¿w
Acoustic design of theatres
Acoustic design of concert halls
QRD one-dimensional acoustic diffusers
Design practical example

THEME III. ENVIRONMENTAL ACOUSTICS

Learning time: 8h

Theory classes: 2h
Self study : 6h

Description:
Definition
Presentation of noise source types
Noise Maps
Regulations
Materials and type solutions
Acoustic simulation
Measurement methodology

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THEME IV. ACOUSTIC IMPACT

Learning time: 9h

Theory classes: 2h
Laboratory classes: 1h
Self study : 6h

Description:
Definition
Presentation of noise sources related to activities and facilities
Outdoor acoustic impact
- Regulations
- Materials and type solutions
- Acoustic simulation
Indoor acoustic impact
- Regulations
- Materials and type solutions
- Prediction and calculation
- Vibrations
Measurement methodology

THEME V. NOISE CONTROL

Learning time: 12h

Theory classes: 3h
Self study : 9h

Description:
Definition
Acoustic Objectives
Presentation of noise sources
Materials and type solutions
Calculation procedure according to ASHRAE
Calculation practical example

THEME VI. SOUND INSULATION (II)

Learning time: 5h

Theory classes: 1h
Laboratory classes: 1h
Self study : 3h

Description:
Definitions
Numerical Objectives
Certification sheets
Practical cases

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THEME VII. SOUND REINFORCEMENT

Learning time: 56h

Theory classes: 17h
Laboratory classes: 3h
Self study : 36h

Description:
Audio system: definition
Types of loudspeakers and loudspeaker systems. Basic technical features.
Loudspeaker systems typologies
Applications of loudspeaker systems
Electroacoustic simulation
Electroacoustic measurement methodology

THEME VIII. VARIABLE ACOUSTICS THROUGH ACTIVE ACOUSTIC SYSTEMS

Learning time: 8h

Theory classes: 2h
Self study : 6h

Description:
Variable acoustics through passive acoustic systems vs. variable acoustics through active acoustic systems
Basic principles of active variable acoustic systems
Venue requirements for using active variable acoustic systems
Performance of active variable acoustic systems
Practical example
Final evaluations

THEME IX. AURALIZATION

Learning time: 4h

Theory classes: 1h
Self study : 3h

Description:
Basic principle of auralization
Auralization process
- Anechoic files
- Binaural impulse response
- Convolution
Practical cases

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Planning of activities

(ENG) LABORATORY PRACTICE THEME III	Hours: 9h Laboratory classes: 9h
Description: Room acoustic design simulation	

(ENG) LABORATORY PRACTICE THEME IV	Hours: 2h Laboratory classes: 2h
Description: Sound insulation measurements	

(ENG) LABORATORY PRACTICE THEME V	Hours: 2h Theory classes: 2h
Description: Acoustic impact measurements	

Qualification system

Final exam: 60%
Laboratory: 40%

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.

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Bibliography

Basic:

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Vér, I.L.; Beranek, L.L. (eds.). Noise and vibration control engineering: principles and applications. 2nd ed. New York: John Wiley & Sons, 2006. ISBN 9780471449423.

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.

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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.

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

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