Course guides
230203 - AE2 - Acoustics and Electroacoustics II

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). (Optional subject).
BACHELOR’S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).
Academic year: 2019  ECTS Credits: 6.0  Languages: Catalan

LECTURER

Coordinating lecturer: 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

Provide students with the advanced knowledge about the theory of sound from the point 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>13</td>
<td>8.67</td>
</tr>
<tr>
<td>Self study</td>
<td>98</td>
<td>65.33</td>
</tr>
<tr>
<td>Hours large group</td>
<td>39</td>
<td>26.00</td>
</tr>
</tbody>
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Total learning time: 150 h

CONTENTS

THEME I. SOUND PROPAGATION IN AIR
Description:
Frequency bands, Absorption, refraction and diffraction of sound in air, Sound sources localization

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

THEME III. ENVIRONMENTAL ACOUSTICS
Description:
Definition, Presentation of noise source types, Noise Maps, Regulations, Materials and type solutions, Acoustic simulation, Measurement methodology

THEME IV. ACOUSTIC IMPACT
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

**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)

**Description:**
- Definitions
- Numerical Objectives
- Certification sheets
- Practical cases

## THEME VII. SOUND REINFORCEMENT

**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

**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

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

## ACTIVITIES

### (ENG) LABORATORY PRACTICE THEME III

**Description:**
- Room acoustic design simulation

**Full-or-part-time:** 9 h
- Laboratory classes: 9h

### (ENG) LABORATORY PRACTICE THEME IV

**Description:**
- Sound insulation measurements

**Full-or-part-time:** 2 h
- Laboratory classes: 2h
(ENG) LABORATORY PRACTICE THEME V

Description:
Acoustic impact measurements

Full-or-part-time: 2 h
Theory classes: 2h

GRADING 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)

EXAMINATION RULES.

The laboratory work will be not re-evaluable.

BIBLIOGRAPHY

Basic:

Complementary: