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: 2018
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: ANTONIO CARRION ISBERT
Others: - ANTONIO CARRION ISBERT - ALEXANDER HELDRING

Prior skills
Basic principles of physics

Requirements
-

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

Learning results:
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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**

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>39h</th>
<th>26.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group:</td>
<td>26h</td>
<td>17.33%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>85h</td>
<td>56.67%</td>
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</tbody>
</table>
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## Content

### Theme 1: Basic principles of sound

<table>
<thead>
<tr>
<th>Learning time: 26h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 8h</td>
</tr>
<tr>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>Laboratory classes: 4h</td>
</tr>
<tr>
<td>Self study : 12h</td>
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</tbody>
</table>

**Description:**

Laboratory
Acoustical measurements with sound pressure meter

### Theme 2. Architectural and environmental acoustics

<table>
<thead>
<tr>
<th>Learning time: 48h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 10h</td>
</tr>
<tr>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>Laboratory classes: 12h</td>
</tr>
<tr>
<td>Self study : 24h</td>
</tr>
</tbody>
</table>

**Description:**
Geometrical acoustics, statistical acoustics, wave acoustics.
Environmental acoustics, Noise index, acoustical barriers and diffraction. Noise regulations.
Underwater acoustics, acoustic waves in water, refraction and reflection. Masking by reverberation and noise.
Underwater transducers. Cavitation phenomenon.

Laboratory
Measuring absorption coefficients in reverberant chamber.
Acoustical computer simulations
Acoustical room measurements

### Theme 3. Acoustical isolation

<table>
<thead>
<tr>
<th>Learning time: 13h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>Self study : 9h</td>
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</tbody>
</table>

**Description:**
Airborne and structural noise.
Indirect paths of noise transmission (flanking)
Calculation methods for global acoustical isolation
### 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.
# Theme 7. Loudspeaker systems

<table>
<thead>
<tr>
<th>Learning time: 19h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>Laboratory classes: 6h</td>
</tr>
<tr>
<td>Self study: 9h</td>
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</tbody>
</table>

**Description:**
- Direct radiation systems.
- Horn radiators.
- Laboratory
- Electroacoustical computer simulations
# Planning of activities

<table>
<thead>
<tr>
<th>PROBLEMS WITH SHORT ANSWERS</th>
<th><strong>Hours:</strong> 2h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Exam</td>
<td><strong>Hours:</strong> 4h</td>
</tr>
<tr>
<td><strong>Laboratory practice</strong></td>
<td>Practical classes: 4h</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Theme 1. Basic principles of sound</td>
</tr>
<tr>
<td>Laboratory:</td>
<td>Measuring absorption coefficients in reverberant room</td>
</tr>
<tr>
<td>- Measurements with sound pressure meter</td>
<td><strong>Hours:</strong> 12h</td>
</tr>
<tr>
<td>Practical classes: 12h</td>
<td><strong>Hours:</strong> 4h</td>
</tr>
<tr>
<td><strong>Laboratory practice</strong></td>
<td>Practical classes: 4h</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Theme 2. Architectural and environmental acoustics</td>
</tr>
<tr>
<td>Laboratories:</td>
<td>Measuring absorption coefficients in reverberant room</td>
</tr>
<tr>
<td>- Acoustical computer simulations</td>
<td>Acoustical measurements in rooms</td>
</tr>
<tr>
<td>Laboratory:</td>
<td><strong>Hours:</strong> 6h</td>
</tr>
<tr>
<td>- Recording studio</td>
<td>Practical classes: 6h</td>
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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:**


**Complementary:**