

## Course guide

# 310413 - 310413 - Environmental and Architectural Acoustics

**Last modified:** 15/05/2023

**Unit in charge:** Barcelona School of Building Construction  
**Teaching unit:** 748 - FIS - Department of Physics.

**Degree:** MASTER'S DEGREE IN ADVANCED BUILDING CONSTRUCTION (Syllabus 2014). (Optional subject).

**Academic year:** 2023    **ECTS Credits:** 5.0    **Languages:** Spanish

### LECTURER

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**Coordinating lecturer:** Carlota E. Auguet Sangrà

**Others:** Julián Álvarez Chaia

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

- 6. Use the physic principles in the thermic, luminic and acoustic scope.
- 9. Recognise the materials and construction techniques of each historical period and value its influence in the architecture design.

**Generical:**

- 7. Provide to the student the capacity to apply the knowledge acquired in the resolution of complex problems in any sector of the building construction.
- CG2. Prepare to communicate with efficiency, orally but also in written.

**Transversal:**

- 10. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
- 11. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

**Basic:**

- 2. Possess and understand knowledge which provide a basis or opportunity to be original in the development and/or application of ideas, usually in a context of research.
- 3. The students must be able to apply the acquired knowledges and their ability of resolution of problems in new or little known environments inside more wide environments (or multidisciplinary) related with their study field.
- 4. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsibilities linked to the application of their knowledges and opinions.
- 5. The students must be able to communicate their conclusions and the knowledges and ultimate reasons which support to specialised and non-specialised audiences in a clear mode and without ambiguities.
- 1. The students must possess the learning abilities which allow them to continue studying in a way which should be to a large extent self-directed and autonomous.

### TEACHING METHODOLOGY

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Theory classes and problems by Google Meet.

## LEARNING OBJECTIVES OF THE SUBJECT

The subject will make special emphasis in developing the necessary knowledge to get introduced in the acoustic consultancy work: compliance of law, both in environmental and construction frameworks, and the evaluation of the acoustic performance of a room. Basic physical concepts of acoustical architecture will be explained, which will be used to solve different practical exercises. Moreover, practical skills in design and acoustical evaluation of concert halls, theaters, and conference rooms, among others, will be developed. Finally, techniques and instruments of acoustical in-situ measuring will be presented.

## STUDY LOAD

Type	Hours	Percentage
Self study	90,0	72.00
Hours medium group	5,0	4.00
Guided activities	10,0	8.00
Hours large group	15,0	12.00
Hours small group	5,0	4.00

**Total learning time:** 125 h

## CONTENTS

### INTRODUCTION TO ENVIRONMENTAL NOISE

**Description:**

Environmental noise. Noise propagation in the open spaces. Sources and typology of noise. Evaluation of environmental noise-induced annoyance.

Measuring Instruments sound and vibration. Legislation on environmental noise.

**Specific objectives:**

Acquisition of principles and fundamental concepts of sound and its propagation.

Knowledge of noise discomfort assessment.

**Related activities:**

Environmental noise measurements and analysis

**Related competencies :**

CG1. Provide to the student the capacity to apply the knowledge acquired in the resolution of complex problems in any sector of the building construction.

CE2. Recognise the materials and construction techniques of each historical period and value its influence in the architecture design.

CB7. The students must be able to apply the acquired knowledges and their ability of resolution of problems in new or little known environments inside more wide environments (or multidisciplinary) related with their study field.

CB8. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsibilities linked to the application of their knowledges and opinions.

CB9. The students must be able to communicate their conclusions and the knowledges and ultimate reasons which support to specialised and non-specialised audiences in a clear mode and without ambiguities.

**Full-or-part-time:** 21h

Theory classes: 2h

Practical classes: 2h

Laboratory classes: 1h

Guided activities: 1h

Self study : 15h



## ROOM ACOUSTIC

### Description:

Acoustic quality of interior spaces. Parameters for acoustic evaluation. Reverberation time. Speech intelligibility. Acoustic absorbing materials and systems. Porous materials, resonators, combined systems. Standards for measuring acoustic parameters of rooms. Standards. Reverberation control according to CTE DB-HR. Room acoustic simulation.

### Specific objectives:

Analysis and determination of acoustic comfort of rooms. Solve potential problems

### Related activities:

Measurement of Reverberation time. Study of room acoustic

### Related competencies :

CG1. Provide to the student the capacity to apply the knowledge acquired in the resolution of complex problems in any sector of the building construction.

CE3. Use the physic principles in the thermic, luminic and acoustic scope.

CE2. Recognise the materials and construction techniques of each historical period and value its influence in the architecture design.

CB10. The students must possess the learning abilities which allow them to continue studying in a way which should be to a large extent self-directed and autonomous.

CB7. The students must be able to apply the acquired knowledges and their ability of resolution of problems in new or little known environments inside more wide environments (or multidisciplinary) related with their study field.

CB8. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsibilities linked to the application of their knowledges and opinions.

CB9. The students must be able to communicate their conclusions and the knowledges and ultimate reasons which support to specialised and non-specialised audiences in a clear mode and without ambiguities.

### Full-or-part-time: 42h

Theory classes: 5h

Practical classes: 4h

Laboratory classes: 1h

Guided activities: 2h

Self study : 30h



## ACOUSTIC ISOLATION AND NOISE CONTROL

### Description:

Noise and vibration in buildings. Origin, characteristics and propagation. Airborne noise, impact noise, vibrations. Insulation of construction elements. Propagation of sound in solid media. Simple wall, mass law and the coincidence effect. Double wall and resonance frequency. Indirect transmission. Calculation of the insulation of a building set. Pathologies and solutions. Laboratory measurements and measurements "in-situ". Acoustic insulation measurement index. Legislation. CTE DB-HR. Requirements and limit values. Calculation methodologies.

### Specific objectives:

Acquisition of knowledge and capacity for determination of sound insulation of building elements and correction of potential problems.

### Related activities:

Analysis of sound insulation of building elements

### Related competencies :

CG1. Provide to the student the capacity to apply the knowledge acquired in the resolution of complex problems in any sector of the building construction.  
CE3. Use the physic principles in the thermic, luminic and acoustic scope.  
CE2. Recognise the materials and construction techniques of each historical period and value its influence in the architecture design.  
CB10. The students must possess the learning abilities which allow them to continue studying in a way which should be to a large extent self-directed and autonomous.  
CB7. The students must be able to apply the acquired knowledges and their ability of resolution of problems in new or little known environments inside more wide environments (or multidisciplinary) related with their study field.  
CB8. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsibilities linked to the application of their knowledges and opinions.  
CB9. The students must be able to communicate their conclusions and the knowledges and ultimate reasons which support to specialised and non-specialised audiences in a clear mode and without ambiguities.

### Full-or-part-time: 62h

Theory classes: 7h  
Practical classes: 7h  
Laboratory classes: 1h  
Guided activities: 2h  
Self study : 45h

## GRADING SYSTEM

Delivery of exercises proposed in class.

## EXAMINATION RULES.

Exercises corresponding to environmental acoustics: 20%  
Exercises corresponding to acoustic conditioning: 40%  
Exercises corresponding to acoustic insulation: 40%



## BIBLIOGRAPHY

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### Basic:

- Carrión Isbert, Antoni. Diseño acústico de espacios arquitectónicos [on line]. Barcelona: Edicions UPC, 1998 [Consultation: 15/07/2014]. Available on: <http://ebooks.upc.edu/product/diseo-acstico-de-espacios-arquitectnicos>. ISBN 8483012529.
- Arau, Higiní. ABC de la acústica arquitectónica. Barcelona: CEAC, 1999. ISBN 84-329-2017-7.
- Rodríguez Rodríguez, Francisco Javier; Puente Crespo, Javier de la; Díaz Sanchidrián, César. Guía acústica de la construcción. 2a ed. Madrid: CIE Inversiones Editoriales Dossat 2000, 2008. ISBN 9788496437814.
- Recuero López, Manuel. Ingeniería acústica. Madrid: Paraninfo, 2000. ISBN 8428326398.
- Beranek, Leo L. Acústica. Buenos Aires: Hispano Americana, 1961.