



## Course guide

# 370045 - AUDIOL - Basics of Hearing Aids

Last modified: 28/06/2023

**Unit in charge:** Terrassa School of Optics and Optometry  
**Teaching unit:** 731 - OO - Department of Optics and Optometry.

**Degree:** BACHELOR'S DEGREE IN OPTICS AND OPTOMETRY (Syllabus 2020). (Optional subject).

**Academic year:** 2023    **ECTS Credits:** 3.0    **Languages:** Catalan

### LECTURER

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**Coordinating lecturer:** Cardona Torradeflot, Genís  
<https://futur.upc.edu/GenisCardonaTorradeflot>

**Others:**

### PRIOR SKILLS

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Basic knowledge of Physics and Physiology

### REQUIREMENTS

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Basic knowledge of Physics and Physiology

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Transversal:**

CT4. (ENG) Teamwork. The ability to work as a member of an interdisciplinary team, as just another member or in a leadership role, who can contribute to developing projects pragmatically and with a sense of responsibility and make commitments that take into account the resources that are available.

CT3. Teamwork. To be able to work as a member of a multidisciplinary team, either as a base member or undertaking managerial decisions aiming at developing projects from a practical and responsible standpoint, adopting commitments given the available resources

**Basic:**

CB2-OPT. (ENG) Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y oseen las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio

CB3-OPT. (ENG) Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética

### TEACHING METHODOLOGY

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MD1 - Lecture with student participation including theoretical and clinical aspects.

MD3 - Lab session with students aimed at solving clinical cases and/or problems related with the contents of the course.

MD4 - Lab sessions

MD5 - Reading resources, texts and articles related to the contents of the course.

MD7 - Seminars



## LEARNING OBJECTIVES OF THE SUBJECT

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Nature of sound and its parameters  
Ear anatomy and physiology  
Audiometric techniques  
Interpretation of audiometric graphs  
Hearing loss, causes and typology  
Hearing aids, types and selection  
Programming digital hearing aids  
Fitting hearing aids and follow-up

## STUDY LOAD

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Type	Hours	Percentage
Hours small group	7,5	10.00
Self study	45,0	60.00
Hours medium group	22,5	30.00

**Total learning time:** 75 h

## CONTENTS

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### T1. Sound: definition and properties

#### Description:

In this preliminary section, we will review the main characteristics of the waves, with particular attention to the sound waves, as different from light waves. We will describe the properties and phenomena related to sound.

#### Specific objectives:

- To know the characteristics of sound.
- The understand sound as a longitudinal wave requiring a medium of propagation.
- To know the basic properties of sound propagation (reflection, interference, doppler effect...).
- To know the dynamic range of human hearing (frequency and amplitude).

#### Related activities:

Lab session 1. Use of apps to analyze frequency and amplitude of different sound sources.

#### Full-or-part-time: 9h

Practical classes: 3h

Laboratory classes: 2h

Self study : 4h



## T2.Ear anatomy and physiology

### Description:

In this section we will describe briefly the anatomy of the ear: external ear, middle ear and internal ear. Besides, we will describe how each part functions and the contribution towards the complete hearing process.

### Specific objectives:

- To know the parts of the human ear.
- To understand how each of these parts leads to a complete sense of hearing.
- To follow a sound wave from the outside of the ear to its interpretation at the central nervous system.

### Related activities:

Task 1

### Full-or-part-time: 7h

Practical classes: 3h

Self study : 4h

## T3.Audiometry

### Description:

Description of the classical audiometric test, i.e., audiometry. Introduction to the audiometer and to the methodology related to air and bone audiometry, with or without masking. Approach to the threshold of pain as a supraliminal test. Interpretation of audiometric graphs.

### Specific objectives:

- To know how to operate an audiometer.
- To gain proficiency to perform air and bone audiometries, with or without masking.
- To gain proficiency to perform supraliminal tests.
- To provide a correct interpretation to audiometries.

### Related activities:

Lab session 2: Air and bone tone audiometry

Lab session 3: Masking and supraliminal audiometry

### Full-or-part-time: 15h

Practical classes: 5h 30m

Laboratory classes: 1h 30m

Self study : 8h



#### T4. Hearing loss

**Description:**

The various conditions leading to hearing loss will be described, highlighting age-related hearing loss, followed by the correct interpretation of the results provided by tonal audiometry and by other complementary tests. Classical syndromes (such as Ménière syndrome) will be described, as well as tinnitus.

**Specific objectives:**

- To know the main ear pathologies leading to hearing loss.
- To know the presentation and symptoms of some of the syndromes with highest incidence which cause hearing loss (such as Ménière syndrome).
- To acquire the required skills to correctly interpret the results of audiograms and other complementary tests.
- To know the main etiology, characteristics and treatment of tinnitus.

**Related activities:**

Lab session 2: Air and bone tone audiometry  
Lab session 3: Masking and supraliminal audiometry  
Lab session 4: Logaudiometry and other complementary tests

**Full-or-part-time:** 12h

Practical classes: 4h

Self study : 8h

#### T5. Hearing aids

**Description:**

Description of the different types of hearing aids, highlighting the benefits and pitfalls of each modality. Fitting a hearing aid, and posterior follow-up. Technology and programming of hearing aids. Selection of the available hearing aids according to type and severity of hearing loss.

**Specific objectives:**

- To know the different types of hearing aids.
- To acquire a basic understanding of the technology and programming of hearing aids.
- To determine the best type of hearing aid for each patient according to hearing loss typology and severity.
- To know the different steps required to successfully fit a hearing aid and the posterior follow-up.

**Related activities:**

Tasks 2 and 3

**Full-or-part-time:** 22h

Practical classes: 5h

Self study : 17h



## T6. Complementary audiometry tests

### Description:

Description of several additional tests to better understand the hearing perception and discrimination of the patient (logaudiometry), and to assess the health of the middle ear (impedance measurement), amongst others.

### Specific objectives:

- To know the basis of logaudiometry, and to be able to administer this test and correctly assess the results.
- To know the fundamentals of impedance measurement.
- To have a basic understanding of other objective tests commonly employed to diagnose hearing disorders.

### Related activities:

Lab session 4: Logaudiometry and other complementary tests

### Full-or-part-time: 10h

Practical classes: 3h

Laboratory classes: 3h

Self study : 4h

## ACTIVITIES

### Lab session 1. Sound parameters

### Description:

In this lab session students will explore the parameters of sound waves from different sources. The session shall start with an introduction and practical demonstration in the lab or online, followed by field work in groups of 3 or 4 students.

### Specific objectives:

- To know and to experiment with the different sound parameters.
- To be aware and use phone apps to determine the characteristics of sound.

### Material:

Several phone apps to measure sound frequency and amplitude.

Lab workbook.

### Delivery:

The corresponding section of the lab workbook will be revised

### Full-or-part-time: 2h

Laboratory classes: 2h



### Lab session 2. Air and bone tone audiometry

**Description:**

Introduction to air and bone audiometry. Familiarization with the audiometer as the classical device to determine hearing thresholds. Record and interpretation of audiometries.

**Specific objectives:**

- To understand the operation of an audiometer.
- To gain proficiency in the determination of air and bone hearing thresholds.
- To gain basic knowledge in the interpretation of the most common types of audiometries.

**Material:**

Lab workbook.  
Audiometer and complementary resources.

**Delivery:**

The corresponding section of the lab workbook will be revised

**Full-or-part-time:** 1h 30m

Laboratory classes: 1h 30m

### Lab session 3. Masking and supraliminal audiometry

**Description:**

Introduction to masking in air and bone audiometry. When is masking necessary? Definition and use of supraliminal audiometry in terms of pain threshold which, jointly with the hearing threshold, determines the auditory range of the patient, required to know the operation field of the hearing aid.

**Specific objectives:**

- To understand the need and procedure of masking in audiometry.
- To know how to provide the correct interpretation of an audiometry under masking.
- To gain proficiency in the administration of supraliminal audiometries.

**Material:**

Lab workbook.  
Audiometer and complementary resources.

**Delivery:**

The corresponding section of the lab workbook will be revised

**Full-or-part-time:** 1h 30m

Laboratory classes: 1h 30m



#### Lab session 4. Logoaudiometry and other complementary tests

**Description:**

Description and practice of the logoaudiometry technique as a complementary test of auditory processing and perception. Introduction to other complementary techniques: measurement of acoustic impedance, otoscopy, etc.

**Specific objectives:**

- To gain proficiency in the administration of logoaudiometries.
- To know the basic concepts related to acoustic impedance and to otoscopy.

**Material:**

Lab workbook.  
Audiometer and complementary resources.  
List of words to conduct logoaudiometry.

**Delivery:**

The corresponding section of the lab workbook will be revised

**Full-or-part-time:** 1h 30m

Laboratory classes: 1h 30m

#### Final test

**Description:**

Final test, multiple choice questions

**Specific objectives:**

To show the corresponding successful knowledge and skills acquisition

**Full-or-part-time:** 1h

Practical classes: 1h

#### Task 1. Quiz about anatomy and pathology of the ear

**Description:**

This task consists in a short quiz about ear anatomy and pathology.

**Full-or-part-time:** 2h

Self study: 2h

#### Task 2. Perusal of videos related to hearing aids

**Description:**

In this activity students will view several videos describing aspects related to hearing aids. This may be followed with a short auto-assessment questionnaire or with a task to be delivered online.

**Full-or-part-time:** 2h

Self study: 2h



### Task 3. Review of commercially available hearing aids

**Description:**

In this group activity students will review the different options of hearing aid commercially available. Each group will work on a particular manufacturer and the results will be shared with the class afterwards online or face to face.

**Full-or-part-time:** 2h

Self study: 2h

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## GRADING SYSTEM

Final exam (40%)

Compulsory tasks to be conducted alone or in group (40%)

Attendance and successful performance in lab sessions (20%)

Re-evaluation: global exam (100% of qualification) including theoretical and practical questions.

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## EXAMINATION RULES.

The final exam will consist in multiple choice questions (4 responses, with penalization of the errors, or true/false questions). The examen may contain questions related to the resolution of practical cases, interpretation of graphs, etc.

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## BIBLIOGRAPHY

**Basic:**

- Gil-Carcedo García, Luis María; Vallejo, L. A; Gil-Carcedo, E. Otorología . 3a ed. Madrid : Médica Panamericana, cop. 2011. ISBN 9788498353730.
- Sobotta, Johannes; Paulsen, Friedrich; Waschke, Jens. Atlas de anatomía humana . 23a ed. Ámsterdam ; Barcelona [etc.] : Elsevier, 2012. ISBN 9788480868730.
- Angulo Jerez, Antonia; Blanco López de Lerma, José Luis; Mateos Álvarez, Felipe. Audioprótesis : teoría y práctica . Barcelona [etc.] : Masson, 1997. ISBN 8445805037.

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## RESOURCES

**Hyperlink:**

- Canal youtube sobre audiologia i audiopròtesi. <https://www.youtube.com/@DrCliffAuD>