COURSE DATA

DATA SUBJECT

Code: 35273
Name: Physiology of Language and Hearing Organs
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1203 - Degree in Speech Therapy	Facultat de Psicologia i Logopèdia	1	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1203 - Degree in Speech Therapy	Physiology	BASIC

COORDINATION

GONZALEZ PEÑA ROLANDO DE JESUS

SUMMARY

The course begins with the physical principles of sound to provide the necessary foundation for understanding both the physiology of sound production and its perception. In the second part of the course, the basics of electrophysiology are studied to understand how information is transmitted through the nervous system, and the role of Broca¿s and Wernicke¿s areas in the processes of speech and hearing.
Understanding what sound is and the physical and physiological parameters that define it enables students to grasp the basic elements on which the Speech Therapy degree is based, allowing them to comprehend phonation as the vibration of the vocal cords and hearing as the reception of sound.
The role of the diaphragm and breathing in the proper projection of the voice, as well as the role of the mouth as a resonance system, are commonly addressed in the phoniatrics clinic¿concepts that are developed in this course.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

It is recommended that students have basic knowledge of physics and mathematics.

COMPETENCES / LEARNING OUTCOMES

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Be able to develop skills such as regulating their own learning, solving problems, reasoning critically and adapting to new situations.

Knowledge of the physiology of the organs of speech, hearing and voice.

Manage the technologies of communication and information.

Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.

Use the exploration techniques and instruments typical of the profession and record, synthesize and interpret the data provided by integrating them into the information set.

Work in the school, healthcare and healthcare settings as part of the professional team. Advice on the development, implementation of care and education policies on topics related to speech therapy.

DESCRIPTION OF CONTENTS

1. PHYSICAL BASIS OF SOUND

The physical characteristics of sound energy intensity and frequency depending on the characteristics of the vibration generated it are studied. The importance of the Fourier theorem to the study of sounds is explained.

1 - Simple harmonic vibrations. Energy characteristics of vibration.
2 - Free and forced vibrations: Damping and Resonance.
3 - Complex Vibrations: Fourier theorem.
4 - Equation of propagation of a wave. Wavelength.
5 - Intensity and attenuation of the waves.
6 - Features sound. Loudness and acoustic magnitudes.
7 - Transmission of sound between two media.

2. Bases of the hearing and phonation

The basis of the psychophysical law of hearing and the importance of each of the parts of the ear auditory processing are analyzed. Likewise phonation process is analyzed.

II.1 -. PHYSIOLOGICAL BASIS OF ACOUSTIC
8 - Subjective qualities of sound. Weber-Fechner law. Sensation level. The decibel.
9 - Hearing los in decibels: audiograms - Loudness. The phon.
10 - The role os the ear as a sensory receptor. Biophysics of the outer ear: transmission.
11 - Biophysics of the middle ear: amplification. Consequences.
12 - Biophysics of the inner ear: transduction.
13 - Binaural Hearing: auditory orientation

II.2 - PHYSIOLOGY AND BIOPHYSICS VOICE
14 - Power Source: the lungs.
15 - Oscillator: the vocal cords. Modes of vibration.
16 - Resonator: the larynx-pharynx-oral cavity system.
17 - Analysis of the human voice. Sound storage, reproduction and transmission systems.

3. Electrophysiology basis

The resting conditions of the cell membrane in excitable cells are studied to understand how an action potential can be generated and propagated, allowing information to reach the auditory projection areas as well as Broca¿s and Wernicke¿s areas.

III.1 -. BASICS CONCEPTS
18 -. Basic scheme of sensory organization. Concept of neuron and nerve.
19 -. Properties of the nerve cell. The cell membrane. The transport across the membrane.

III.2 -. BIOELECTRIC PHENOMENA OF CELL REST
20 -. The cell membrane potential. Diffusion flow. Concepts of concentration and permeability.
21 -. Ionic flow in solution. Equilibrium potential of an ion: ccuación Nernst equation. Gibbs-Donnan equilibrium. Resting potential in excitable cells.
22 - Concept of active transport. Sodium pump (Na+/K +ATPase).

III.3 -. BIOELECTRIC PHENOMENA OF CELL EXCITATION
23. Cellular excitability. The action potential: concept and phases. All-or-nothing law. Refractory period. Influence of stimulus intensity.
24. Types of ion channels. Voltage-gated channel proteins. Basis of the action potential properties.
25. Conduction mechanisms. Unmyelinated fibers: local currents. Myelinated fibers: saltatory conduction.
26. General aspects of synaptic transmission: electrical and chemical synapses. Functional basis of electrical synapses.
27. Functional basis of chemical synapses. Presynaptic phenomena. Neurotransmission: concept and characteristics.
28. Synaptic receptors. Neurotransmitter-gated channel proteins. Excitatory and inhibitory synaptic actions. Concept of synaptic integration.
29. Bioelectric potentials. Evoked brain potentials.
30. Neural pathways and centers involved in phonation and hearing. Broca¿s and Wernicke¿s areas.

4. PRACTICES

1. Physical foundations of sound: Exercises on vibrations and waves.
2. Digital sound analysis: Frequency determination.
3. Digital sound analysis: Fourier analysis.
4. Basis of hearing and phonation: Exercises in physiological acoustics.
5. Experimental determination of the limits of the auditory field.
6. Kahoots activities related to topics 1-17.
7. Experimental verification of the Nernst equation.
8. Fundations of electrophysiology: Electrophysiology exercises.
9. Simulation-based study of the refractory period in a neuron.
10. Kahoots activities related to topics 18-30.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	45,00
Laboratory	15,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	40,00
Preparation of lessons	0,00
Preparation for assessment activities	45,00
Resolution of case studies	5,00
Total hours	**90,00**

TEACHING METHODOLOGY

- Theoretical classes: The instructor will present the topic and its bibliography using audio-visual methods, focusing primarily on the most important points and those that may present greater difficulty for student comprehension.
- Practical sessions: Under the guidance of the instructor, students will carry out laboratory experiments specifically designed to enhance the understanding of key concepts and necessary techniques. Additionally, some sessions will include problem-solving exercises to deepen theoretical understanding, while others will use the Kahoot format for content feedback and review.

- Student work: Active participation in both theoretical and practical classes.
- Preparation and completion of the final assessment.
- Use of the virtual classroom for the exchange of course-related information.

EVALUATION

- **Attendance at practical sessions is compulsory**. Students must attend at least 80% of these sessions to pass the course, and any absence beyond this must be duly justified by exceptional circumstances.
- **The course is passed** with a final grade of 5 or higher.
- **Continuous assessment**: Completion of two practical assignments with fixed submission deadlines (evaluation 1 point). This is a non-recoverable assessment activity. In the second examination session, the grade for these assignments will be retained. Independent of the compulsory attendance requirement for practical sessions, active participation in them will be evaluated with a total of 1 point (0.1 point per actively attended session).
- **Written exam** consisting of short-answer and multiple-choice questions. 75% of the questions will cover theoretical content (worth 6 points), and 25% will cover practical content (worth 2 points).

In accordance with RD1125/2003, the distinction of "Matrícula de Honor" (Honors) may be awarded to students who achieve a grade equal to or higher than 9.0, strictly following the ranking of final grades.

REFERENCES

Basic:

- Aurengo, A., & Petitclerc, T. (2008). Biofísica. McGraw-Hill Interamericana. ISBN: 978-8448163921
- Le Huche, F., & Allali, A. (2004). La voz (Tomo 1). Elsevier-Masson. ISBN: 978-84-458-1245-7
- Fox, S. I. (2022). Fisiología humana (15ª ed.). McGraw-Hill Interamericana. ISBN: 978-607-151537-7
- Nájera, A., Arribas, E., Navarro, J. D., & Jiménez, L. (2015). Fundamentos de física para profesionales de la salud. Elsevier España. ISBN: 978-84-9022-859-3 (Disponible en formato electrónico en la Biblioteca UV)

Supplementary:

- Salesa, E., Perelló, E., & Bonavida, A. (2013). Tratado de audiología. Elsevier-Masson. ISBN: 978-84-458-2114-5
- Bernal, J., Bobadilla, J., & Gómez, P. (2000). Reconocimiento de voz y fonética acústica. Ra-Ma. ISBN: 978-84-7897-398-9