COURSE DATA

DATA SUBJECT

Code: 46999
Name: Clinical Visual Psychophysics
Cycle: Master's Degree
ECTS Credits: 4.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2280 - Master's Degree in Advanced Optometry and Vision Sciences	Facultat de Física	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2280 - Master's Degree in Advanced Optometry and Vision Sciences	Psicofísica visual pra clínica	COMPULSORY

COORDINATION

LUQUE COBIJA M JOSEFA

SUMMARY

This course applies knowledge about the structure and function of the neural mechanisms of the visual system to the design of psychophysical tests for evaluating the status of visual mechanisms, both for clinical and laboratory use. The principles behind the design of a set of tests covering various aspects of vision (color vision, spatial vision, and motion perception) will be reviewed with a practical approach, encompassing the generation, use, and evaluation of psychophysical tests. Students will develop skills to select, apply, and interpret these tests in the diagnosis and monitoring of patients with visual disorders.

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 a solid understanding of ocular anatomy and physiology,

including the structure of the eye and the neural mechanisms of the visual system (retina, optic pathways, and visual cortex), as well as basic knowledge of visual neuroscience to understand the transduction and neural transmission of visual information. A minimum competence in linear algebra is also required, and familiarity with basic vision models is considered useful.

COMPETENCES / LEARNING OUTCOMES

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Act autonomously in learning, make informed decisions in different contexts, issue judgements based on experimentation and analysis and transfer knowledge to new situations.

Administer tests to real observers under appropriate conditions, controlling stimuli and minimising the effect of distortion factors linked to adaptation conditions, observation distance, task description and the optical status of the patient.

Analyse the results of a psychophysical test for detecting visual system anomalies.

Apply specialised techniques and new clinical methodologies in optometry: aberrometry and ocular surface, psychophysical diagnostic and support techniques, follow-up and care in refractive surgery, low vision, vision therapy, and advanced contactology.

Apply the knowledge acquired and be able to solve proplems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to the field of study.

Be able to communicate effectively, both orally and in writing, adapting to the characteristics of the situation and audience.

Characterise binocular interactions that occur in spatial vision.

Collaborate effectively in work teams, taking on responsibilities and leadership roles and contributing to collective improvement and development.

Contribute to the design, development and implementation of solutions that respond to social demands, considering the Sustainable Development Goals as a reference.

Critically analyse the diagnostic capabilities of a psychophysical test.

Demonstrate critical and self-critical reasoning in the field of the degree, considering aspects such as professional ethics, moral value and the social implications of the different activities carried out.

Develop psychophysical tests for clinical examination.

Evaluate and compare new psychophysical methods and techniques for visual examination.

Have ethical commitment and social responsibility, both in the care component linked to the optometrist profession and in clinical research.

Identify different models of human vision.

Know and understand, within the area of the degree, inequalities based on sex and gender in society; integrate different needs and preferences based on sex and gender into the design of solutions and problem-solving.

Know how to communicate conclusions and the knowledge and rationale behind them to both specialised and non-specialised audiences clearly and unambiguously.

Plan and apply techniques for generating and controlling computer-based stimuli.

Plan and manage time and resources, and gain experience in decision-making.

Propose creative and innovative solutions to complex situations or problems within the field of knowledge to respond to diverse professional and social needs.

Relate psychophysical behaviour in motion perception to physiological mechanisms.

Understand the concepts of adaptation, stimulus, psychophysical task and measurement method.

Understand the operating principles of standard clinical psychophysics tests.

Understand the structure and function of the visual system in specific populations such as the elderly and patients with neural damage.

Work in multidisciplinary teams in the health sciences.

DESCRIPTION OF CONTENTS

Topic 1. Neural foundations of the visual system
This topic reviews the anatomical and functional bases of the visual pathway, from the retinal photoreceptors to the primary and associative cortical areas. It examines cell types, retino-geniculo-cortical synapses, and receptive field organization, with particular emphasis on the parvocellular and magnocellular pathways.

Topic 2. Basic principles of psychophysical test design for clinical use
The principle of redundancy reduction in psychophysical test design is introduced, strategies to reduce the number of visual mechanisms involved in a test are reviewed (control of adaptation, task, and stimulus parameters), clinical psychophysical methods are introduced (ROC curves).

Topic 3. Color vision evaluation tests
The basic design strategies for color vision tests are analysed (pseudoisochromatic tests, matching tests, and threshold measures), with special emphasis on threshold-based tests (Contrast Cone Test, Cambridge Color Test, Color Assessment and Diagnosis). Results corresponding to various visual anomalies are described.

Topic 4. Spatial achromatic and chromatic contrast sensitivity measurements
Procedures for measuring spatial achromatic and chromatic contrast sensitivity are described, using both narrow-band stimuli (contrast sensitivity function) and broad-band stimuli (Pelli-Robson test). Strategies to favour magno and parvo mechanisms with achromatic stimuli and to avoid achromatic intrusion when evaluating chromatic mechanisms are discussed. Results associated with different visual anomalies are described.

Topic 5. Temporal sensitivity and motion perception tests
Procedures for measuring responses to flickering and moving stimuli are described, from temporal contrast sensitivity and critical flicker fusion frequency to various motion thresholds (displacement, speed, and coherence) used to assess anomalies related to the magnocellular mechanism. Results corresponding to various visual disorders are presented.

Topic 6. Perimetry
Most of the tests described in previous topics evaluate either the foveal region or a fixed extrafoveal location. This topic describes the factors to consider and strategies applied in tests aimed at evaluating wide regions of the visual field, going beyond traditional SAP and covering perimetries designed to target specific visual mechanisms (FDT, HPRP, MAP, SWAP...).

Topic 7. Specific tests for visual agnosias
This topic covers tests for the recognition of shapes, faces, and colors aimed at identifying prosopagnosic, apperceptive, and associative agnosias. Standardised protocols and interpretation criteria are detailed for diagnosing ventral cortical lesions.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	20,00
Seminar	10,00
Laboratory	14,00
Total hours	**44,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	15,00
Independent study and work	25,00
Preparation of lessons	0,00
Preparation for assessment activities	8,50
Resolution of case studies	20,00
Total hours	**68,50**

TEACHING METHODOLOGY

The course combines lectures, seminars, and practical sessions to promote both knowledge acquisition and active student participation.

Lectures and seminars
Short theoretical presentations will be continuously alternated with group tasks where students apply the theoretical knowledge covered.

Practical sessions
There will be computer lab sessions in which students will design vision tests, along with laboratory sessions where they will carry out measurements using standard clinical equipment.

EVALUATION

The final grade in both the first and second exam sessions is obtained by weighting three components according to the percentages indicated in parentheses:

- Final exam (70%) - Theoretical and practical questions.
- Continuous assessment (15%) - Consisting of in-class assignments and the resolution of problem sets (individual student work).
- Laboratory (15%) - Group construction of a vision test.

Continuous assessment and the laboratory component are non-recoverable.

To calculate the weighted average of the three grading items, a minimum score of 4 out of 10 must be obtained in each of them individually.

A grade below 4 in the exam implies a fail.

If the minimum score is not reached in continuous assessment but is reached in the laboratory, the final grade will be calculated as 0.85*Exam + 0.15*Laboratory.

If the minimum score is not reached in the laboratory but is reached in continuous assessment, the final grade will be calculated as 0.85*Exam + 0.15*Continuous assessment.

If the minimum score is not reached in either of the non-recoverable components, the final grade will be calculated as 0.85*Exam.

REFERENCES

Basic references:

- Capilla Perea P., Luque M.J., de Fez D. *Percepción visual: Psicofísica, mecanismos y modelos.* Editorial Médica Panamericana - 2019 - ISBN 978-8491103837
- de Fez Saiz D., Viqueira Pérez V. *Fundamentos de percepción visual.* Publicacions Universitat d'Alacant - 2014 - ISBN 978-84-9717-299-8
- Lu Z.-L., Dosher B. *Visual Psychophysics: From Laboratory to Theory.* MIT Press - 2014 - ISBN 978-0262019089
- Birch J. *Diagnosis of Defective Colour Vision.* Butterworth-Heinemann - 2001 (2a ed.) - ISBN 978-0750621083
- Cronly-Dillon J. *Vision and Visual Dysfunction: Index.* Macmillan Press - 1991 - ISBN 978-0333490393
- Rowe F.J. *Visual Fields via the Visual Pathway.* Blackwell - 2006 - ISBN 978-1405108332

Complementary references:

- Schwartz S.H. *Visual Perception: A Clinical Orientation.* McGraw-Hill Medical - 2017 (5a ed.) - ISBN 978-0071845682