VNIVERSITAT DE VALÈNCIA

Course Guide
46999 Clinical Visual Psychophysics

COURSE DATA

DATA SUBJECT

Code: 46999
Name: Clinical Visual Psychophysics
Cycle: Master's Degree
ECTS Credits: 4.5
Academic year: 2026-27

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 of the structure and function of the neural mechanisms of the visual system to the design of psychophysical tests for evaluating the status of these mechanisms in both clinical and laboratory settings. The principles underlying the design of tests to assess different aspects of vision, including colour vision, spatial vision, and motion perception, will be reviewed through a practical approach encompassing their development, use, and evaluation. Students will develop the skills needed 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

Students are recommended to have a solid foundation in ocular anatomy and physiology, including the

structure of the eye and the neural mechanisms of the visual system, such as the retina, optic pathways, and visual cortex. Basic knowledge of visual neuroscience is also recommended to support understanding of the transduction and neural transmission of visual information, together with basic notions of linear algebra and elementary models of vision.

COMPETENCES / LEARNING OUTCOMES

2280 - Master's Degree in Advanced Optometry and Vision Sciences

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 retinal photoreceptors to primary and associative cortical areas. It examines the main cell types, retinogeniculate-cortical synapses, and the organisation of receptive fields, 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, together with strategies to reduce the number of visual mechanisms involved in a test by controlling adaptation, task requirements, and stimulus parameters. Clinical psychophysical methods are also presented, and the assessment of the diagnostic validity of a given technique through receiver operating characteristic, ROC, curves is addressed.

Topic 3. Colour vision evaluation tests

The main design strategies for colour vision tests are analysed, including pseudoisochromatic tests, matching tests, and threshold measurements. Particular attention is given to threshold-based tests, such

as the Contrast Cone Test, Cambridge Color Test, and Color Assessment and Diagnosis, as well as to the interpretation of results obtained in different visual anomalies.

Topic 4. Measurement of spatial achromatic and chromatic contrast sensitivity

Procedures for measuring spatial achromatic and chromatic contrast sensitivity are described using narrow-band stimuli, such as those employed in the contrast sensitivity function, and broad-band stimuli, such as the Pelli-Robson test. Strategies to favour responses from magnocellular and parvocellular mechanisms with achromatic stimuli, as well as to minimise achromatic contributions when assessing chromatic mechanisms, are analysed. Characteristic results associated with different visual anomalies are also described.

Topic 5. Temporal sensitivity and motion perception tests

Procedures for measuring responses to flickering and moving stimuli are described, ranging from temporal contrast sensitivity and critical flicker fusion frequency to different motion thresholds, including displacement, speed, and coherence thresholds. Their use in the assessment of anomalies related to the magnocellular mechanism is analysed, and characteristic results associated with different visual disorders are presented.

Topic 6. Perimetry

Most tests described in the previous topics assess either the foveal region or a fixed extrafoveal location. This topic addresses the factors to be considered and the strategies applied in tests designed to evaluate wide regions of the visual field, beyond standard automated perimetry, SAP. Perimetric tests designed to assess specific visual mechanisms, such as FDT, HPRP, MAP, and SWAP, are included.

Topic 7. Specific tests for visual agnosias

This topic covers tests for recognising shapes, faces, and colours that are aimed at identifying prosopagnosic, apperceptive, and associative forms of visual agnosia. Standardised protocols and interpretation criteria useful for assessing alterations associated with ventral cortical lesions are reviewed.

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 is delivered through an active and integrated methodology combining lectures, seminars, practical sessions, and independent student work. These activities are designed to connect the neural foundations of vision with the design, application, and interpretation of psychophysical tests of clinical relevance.

Lectures and seminars

Short theoretical presentations will be combined with participatory activities aimed at applying the concepts covered. Students will work through problem-solving activities, practical case analyses, and group discussions involving stimulus design, the selection of psychophysical tasks, the control of examination conditions, and the interpretation of results.

Practical sessions

In computer laboratory sessions, students will design and control visual stimuli and develop simple psychophysical tests for assessing different visual mechanisms. In laboratory sessions, measurements will be carried out using equipment commonly employed in clinical practice. Students will analyse examination procedures, factors that may affect the results, and their interpretation in relation to different visual disorders.

Independent work

Non-contact work will include study of the course content, individual preparation and resolution of problems and practical cases, and the completion of individual or group assignments related to the design, application, or analysis of psychophysical tests.

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 de la 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. 2nd ed. Butterworth-Heinemann, 2001. ISBN: 978-0750621083.

• Rowe, F. J. Visual Fields via the Visual Pathway. Blackwell Publishing, 2006. ISBN: 978-1405108332.

Complementary references

• Cronly-Dillon, J. Vision and Visual Dysfunction: Index. Macmillan Press, 1991. ISBN: 978-0333490393.

• Schwartz, S. H. Visual Perception: A Clinical Orientation. 5th ed. McGraw-Hill Medical, 2017. ISBN: 978-0071845682.