COURSE DATA

Data Subject	
Code	34296
Name	Mechanisms and models of vision
Cycle	Grade
ECTS Credits	6.0
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
1207 - Degree in Optics and Optometry	Faculty of Physics	3	First term

Subject-matter

Degree	Subject-matter	Character
1207 - Degree in Optics and Optometry	11 - Visual perception II	Obligatory

Coordination

Name	Department
CAPILLA PEREA, PASCUAL	280 - Optics and Optometry and Vision Sciences

SUMMARY

The subject of Mechanisms and Models of Vision, part of the matter “Visual Perception”, aims to study the neural mechanisms involved in visual perception and the simpler models quantitatively describing the vision of color, shape and movement. The models that will be studied are only linear models that use low level mechanisms (that is, up to the striate cortex).

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Previous knowledge of Psychophysics of Vision is required, as well as an elementary knowledge of the anatomy and physiology of the visual system.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1207 - Degree in Optics and Optometry

- To have and to understand the fundamentals of Optometry for its correct clinical and healthcare application.
- Knowing how to apply the knowledge acquired to professional activity, knowing how to solve problems and develop and defend arguments.
- Being able to gather and interpret relevant data to make judgments.
- Being able to transmit information, ideas, problems and solutions to both a specialized and non-specialized audience.
- Development of learning skills necessary to undertake further studies with a high degree of autonomy.
- To know the basic models of vision.
- To know the spatial and temporal aspects of vision.
- To know how to correlate psychophysical experiments with the physiology of the visual system.
- To know and to apply Fourier theory to vision models.
- To know the basic models of color, shape and movement vision.
- To know the spatial and temporal chromatic aspects of vision.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

Learning outcomes should be consistent with each and every one of the specific skills listed in the previous section.

DESCRIPTION OF CONTENTS

1. Neural foundations of vision.

Architecture of the visual system. The retina and the visual pathways. The striate cortex.

2. Color vision.

The trichromatic theory. Chromatic and achromatic mechanisms: linear models. On the physiological mechanisms of colour vision.

3. Spatial vision.

Contrast sensitivity on the colour space. The visual system as a filter: the single channel model. The visual system as a discret set of filters: multichannel models. On the physiological mechanisms of the spatial vision.

4. Spacio-temporal properties and motion perception.

Analysis of the motion by the visual system. Contrast sensitivity on the spatio-temporal domain. Models on the spatio-temporal domain. On the physiological mechanisms of the motion perception.

5. Seminars

Mandatory seminars (Advanced colorimetry, spectral decomposition of an image, spectral decomposition of a moving scene)
Especific seminars (At least one seminar for each didactic unit).

6. Laboratory sessions

Changes of triestímulus space, surround effect on the perceived contrast, coherence threshold.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Tutorials	15,00	100
Laboratory practices	15,00	100
Development of group work	10,00	0
Development of individual work	20,00	0
Study and independent work	25,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	10,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The course will consist of 3 different class types with different methodology: (i) Theory, (ii) seminars and supervised work, (iii) laboratory practical classes.

In classes of type (i) the basic theoretical content of the course will be taught and the psychophysical experiments that illustrate such content will be discussed. To increase the presentation / assimilation ratio, a video projector will be used to display graphs, pictures, animations and films, combined with discussions / presentations on the board. Also simple demonstrations will be carried out. It will encourage and guide students to the expansion of content received in each class through the recommended reading, and the possibility of expansion of their knowledge in future courses.

Type (ii) classes include two types of activities: 1) seminars on specific topics additional to the program; to the end of the talk there will be a corresponding space for dialogue, 2) problems will be proposed to be performed at the classroom or at home individually or in pairs, whose results will be partially exposed and discussed in the classes.

Finally, in the type (iii) classes, a set of experimental demonstrations of the different characteristics of vision will be carried out in the laboratory, using the appropriate psychophysical methods in each case. Following the completion of each practical session, it will be necessary to submit a form with the results and conclusions. Students should also write a detailed report of one of the practical sessions.

EVALUATION

Evaluation of the course:

The evaluation of the subject will be done with the following criteria (about 10 points):

A) 6 points: for a written exam, with theoretical-practical questions.

B) 2 points: for the problems proposed and made by the student during the course, as continuous evaluation.

C) 2 points: for the memories of the work done in the laboratory.

The required qualification to pass the subject will be 5 points, with the requirement to obtain a minimum of 40% of the maximum attainable in each of the sections.The deadlines for the delivery of problems will be fixed with sufficient time in advance. Students who have not delivered the problems solved, in the established dates, or have not passed the court note, will be entitled to a problem examination. Seminar attance will be evaluated in a 10% extra qualification.

Attendance at laboratory sessions is mandatory.

The reports of the practices must be delivered on the date established at the beginning of the course. Students who have not delivered the reports, or have not passed the court note, will be entitled to a practice exam in the second call.

REFERENCES

Basic

- Artigas, J.M., Capilla, P., Felipe, A. y Pujol. J. ÓPTICA FISIOLÓGICA. PSICOFÍSICA DE LA VISIÓN. McGraw-Hill InterAmericana (1995).

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Gegenfurtner, K.R. y Sharpe, L.T. COLOR VISION. FROM GENES TO PERCEPTION. Cambridge University Press (1999).

Hubel, D.H. EYE, BRAIN AND VISION. Scientific American Library (1995).

Kulikowski, J.J., Walsh, V y I.J. Murray, Eds. LIMITS OF VISION. En Vision and Visual Dysfunction. Vol. 5. Macmillan Press (1991).

Leventhal, A.G. Ed. THE NEURAL BASIS OF VISUAL FUNCTION. En Vision and Visual Dysfunction. Vol. 4. Macmillan Press (1991).

Norton, T.T., Corliss, D.A. y Bayley, J.E. THE PSYCHOPHYSICAL MEASUREMENT OF VISUAL FUNCTION. Butterworth-Heinemann (2002).

Regan, D. HUMAN PERCEPTION OF OBJECTS. Sinauer Associates (2000).

Rodiek, R.W. THE FIRST STEPS IN SEEING. Sinauer Associates (1998).

Schwartz, S.H. VISUAL PERCEPTION: A CLINICAL ORIENTATION. McGraw-Hill (1999).

Spillman, L y Werner, J.S. VISUAL PERCEPTION: THE -NEUROPHYSIOLOGICAL FOUNDATIONS. Academic Press (1990).

Valverg, A. LIGHT, VISION AND COLOUR. Wiley (2005).

Tovee, M.J. AN INTRODUCTION TO THE VISUAL SYSTEM. Cambridge University Press (1996).

Wandell, B. FOUNDATIONS OF VISION. Sinauer (1995).

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

TEACHING METHODOLOGY

In the event that the health situation requires a hybrid teaching model, the teaching modality approved in the Academic Degree Committee in a session of July 20, 2020 will be adopted, which consists of 100% presence of the students in all activities, but with a classroom capacity of 50% in theory classes.

If a total reduction in attendance is required, then the synchronous videoconference modality would be used, given at the time set by the subject and the group, during the period determined by the Health Authority.