COURSE MODULE – Human Perception and Cognition

COURSE CODE	HPC
COURSE LEVEL	Master
ECTS CREDITS	5
COURSE INSTRUCTOR/S	Juan Luis Nieves; Luis Gomez; Rafael Huertas
EDUCATION PERIOD	SEMESTER 2
EXPECTED PRIOR-KNOWLEDGE	Color Science, Basics skills in Matlab, Basic and Fundamentals on Mathematics for Data analysis, Signal and Image Processing.
LANGUAGE OF INSTRUCTION	English

AIM

The aim of the course is to provide a solid and integrated view of the visual processes with an emphasis on the physical aspects of visual information. This more quantitative approach is complemented with notions of retinal and cortical organization and with the fundamentals on visual psychophysics. Although the course aims at a solid theoretical basis, practical issues and problem solving will be considered wherever appropriate and independent project development and research will be strongly encouraged.

On completion of this course the students will be able to:
•anatomically and functionally identify the main components of the human visual system.
•develop a basic working knowledge of classical psychophysics.
•develop an understanding of the relation between biological systems, neural processing mechanisms, and perception. This will include understanding the how biological factors influence aspects of human visual.
•develop an understanding of the color appearance phenomena and the models for compute them.
•develop an understanding of the study of sensory systems and processes within the historical context of the field, and potential future directions of the field. This includes understanding the tentative nature of knowledge, tolerating ambiguity, and using skeptical inquiry to discover discrepancies and/or gaps in current knowledge.
•develop and refine their ability to critically read and understand scientific literature, understand and use scientific and technical vocabulary, and synthesize information from multiple sources.

TEACHING ACTIVITIES

This course is based on flip-teaching, exchanges and discussions between students and instructors, lectures and practical session activities, as well as homework.

COURSE OUTLINE

(*topic 1*) Introduction to visual perception. Visual perception and the main components of the human visual system. The visual process.

(*topic 2*) Colour perception and colour appearance. Fundamentals of colour perception. Descriptions and Phenomena of Color Appearance Hue cancellation and opponent colours. Acquired and inherited colour vision deficiencies. Colour constancy. Chromatic Adaptation Transforms (CAT). Color Appearance Models (CAM)

(*topic 3*) Perceiving objects. Spatial aspects of visual perception. Perception of objects and shapes.

(*topic 4*) Visual attention and saliency. What determines where we look? Effects of Attention on visual Perception.

(*topic 5* Perceiving depth and size. Cues to depth perception. Binocular vision and depth perception. Stereo acuity. Eye movements.

(*topic 6*) Motion perception. Optic flow. Perception and action.

PRACTICAL ACTIVITIES

Practical works (laboratory sessions and case studies) in order to implement concepts introduced in the lectures, to practice on real applications and to train students.
(Lab session 1) Psychophysical methods.
(Lab session 2) Visual optics simulations.
(Lab session 3) Measurement of the Contrast sensitivity function

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(Lab session 4) Visual attention
(Lab session 5) Working with modern color appearance models

LEARNING OUTCOMES[1]

• *Knowledge* and *Comprehension* of the fundamentals, principles, applications, limits, relationships, of all concepts and topics covered by this course;
• *Application, Analysis, Synthesis* and *Evaluation* skills of the main concepts and topics covered by this course;
• Ability to apply/implement concepts and principles introduced in the lectures on practical tasks and on industrial study cases;
• Ability to self-learn, to understand some problems and to suggest/find solutions to solve these problems.
On completion of this course the students will be able to:
• Demonstrate an understanding of basic multispectral color science.
• Analyze, compare, implement algorithms for spectral estimation from camera responses.
• Describe, analyze and reason about how multispectral acquisition devices work and how can they be optimized for a particular application.
• To know the state of the art of spectral color science and some of its most relevant fields of application.

FORM/S OF ASSESSMENT

Written exam (50%), Practical works (50%)

ASSESSMENT CRITERION

Written exam and Practical works

Excellent - outstanding performance	A
Very Good - above the average standard but with some errors	B
Good - generally sound work with a number of notable errors	C
Satisfactory - fair but with significant shortcomings	D
Sufficient - performance meets the minimum criteria	E
Fail - some more work required before the credit can be awarded	FX
Fail - considerable further work is required	F

Detail of criteria used to assess acquired skills :
• Activities and questionnaires giving evidence of knowing (5%)
• Activities and questionnaires giving evidence of comprehension/understanding (5%)
• Activities and questionnaires giving evidence of analysis (5%)
• Activities and questionnaires giving evidence of synthesis (5%)
• Activities and questionnaires giving evidence of evaluation (5%)

Excellent	A
Very Good - above the average standard	B
Good - generally sound well	C
Satisfactory - but with significant shortcomings	D
Sufficient - performance meets the minimum criteria	E
Fail - some more work required	FX
Fail - considerable further work is required	F

The evaluation of informal learning outcomes will be based on questionnaires and laboratory notebook (self-evaluation, learning diary).

LITERATURE AND STUDY MATERIALS

- Sensation and Perception. E. Bruce Goldstein. 6th edition Wadsworth Publishing. ISBN: 0534639917, 2002
- Foundations of vision, Brian A. Wandell, Sinauer Associates, 1995.
- Introduction to Visual Optics. Alan H. Tunnacliffe. Association of British Dispensing Opticians. ISBN 0-900099-28-1, 1993.
- Vision science: photons to phenomenology, Stephen E. Palmer, The MIT Press, 1999.
- Eye, brain, and vision, David A. Hubel, W. H. Freeman & Co, 1988.

CONTACT DETAILS

Prof. Juan Luis Nieves - Universidad de Granada (SPAIN)
E-mail: jnieves@ugr.es Office: n. 102 (Mecenas building, 1st floor)

Prof. Luis Gomez Robledo - Universidad de Granada (SPAIN)
E-mail: luisgrobledo@ugr.es Office: n.

[1] The meaning of *keywords* in italic used to define Learning Outcomes are detailed in Annex.

Prof. Rafael Huertas - Universidad de Granada (SPAIN)
E-mail: rhuertas@ugr.es Office: n. 114

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