VNIVERSITAT ID VALÈNCIA

COURSE DATA

DATA SUBJECT

Code: 43081
Name: Digital analysis of signals and images in physiology
Cycle: Master's Degree / Doctorate
ECTS Credits: 3
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2141 - Master's Degree in Physiology	Facultat de Medicina i Odontologia	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2141 - Master's Degree in Physiology	Methodology for research in physiology	COMPULSORY

COORDINATION

CIBRIAN ORTIZ DE ANDA ROSA MARIA

SUMMARY

This course introduces students to the study of images, their properties, and methods for image processing, as well as to the various imaging techniques of biomedical interest. It covers both the fundamental principles behind these techniques and the type of information they provide. The theoretical and practical training enables students to understand and extract relevant information from different types of medical images, such as digital radiology, magnetic resonance imaging, thermography, and microscopy, among others.

The general objectives of the course are:

- To understand the techniques for acquisition, storage, and processing of medically relevant images and signals.

- To apply processing, treatment, and analysis techniques to morphological and functional images and signals.

- To use software tools related to the processing of biomedical images and signals.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

There are no prerequisites for taking the subject.

COMPETENCES / LEARNING OUTCOMES

2141 - Master's Degree in Physiology

Assess the need to complete the scientific training, in languages, computer science, ethics, etc., attending conferences or courses and/or carrying out complementary activities, self-evaluating the contribution that the performance of these activities implies for their comprehensive training.

Be able to access to information tools in other areas of knowledge and use them properly.

Be able to integrate new technologies in their professional and/or research work.

Handle the different techniques for processing digital images to obtain information of scientific interest in the image in question.

Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.

Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.

Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.

Students should demonstrate self-directed learning skills for continued academic growth.

Students should possess and understand foundational knowledge that enables original thinking and research in the field.

To acquire a critical attitude that allows you to make reasoned judgments and defend them with rigor and tolerance.

DESCRIPTION OF CONTENTS

1. General concepts of Imaging
-Human vision.
-Image formation: object, lens, and sensor.
-Sampling and quantification.
-Monochrome and color images.
-Image storage. Formats.

2. Digital Image Processing
-Motivation.
-Phases of digital image processing.
-Image preprocessing techniques (I): histogram.

3. Practical applications of Digital Medical Image Processing
-Motivation.
-Visualization of medical images: level and window.
-Practical examples of filtering applied to medicl images.
-Image corregistration.
-Medical image segmentation.

4. Morphological Imaging Systems
-Introduction.
-Visible maging: Photography.
-Optical fiber: Endoscopy.
-Microscopy: optical, confocal, and scanning.
-Radiographic imaging: X-rays and CT.
-Ultrasound imaging.

5. Functional Imaging Systems
-Introduction.
-Thermography.
-Magnetic Resonance Imaging.
-Nuclear Medicina Inaging: Scintigraphy, SPECT, PET.

6. Practice: Medical Imaging Treatment I
Color, color depth and RGB channels.
-Level and window in a digital medical image.
-Image resolution.

7. Practice: Medical Imaging Treatment II
-Measurement of distances and angles.
-Improvement of the image by manipulation of the histogram.
-Subtraction of images. Its application in medical images.

8. Practice: Acquisition and treatment of Bioelectric Signals
-Electromyography.
-Electrocardiography.

9. Practice: Thermographic Images
-Basis.
-Applicability.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	2,00
Theory	10,00
Laboratory	8,00
Total hours	**20,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	2,00
Individual or group project	12,00
Independent study and work	15,00
Preparation of lessons	5,00
Preparation for assessment activities	11,00
Resolution of case studies	10,00
Total hours	**55,00**

TEACHING METHODOLOGY

- Theoretical classes with active alumni participation.

- Practical laboratory classes, including introductory seminars, conducting internships with the teacher follow-up and support, and redaction of a written memory or written test.

- Conferences of experts in the different subjects.

- Face-to-face and electronic tutoring with teachers.

EVALUATION

Evaluation system:

- Written exam consisting of 6 short answer questions: evaluation up to 6 points.

- Memory of the practice of Thermography: evaluation up to 4 points.

Attendance at 80% of the practices is compulsory.

Minimum passing grade: 5 points.

REFERENCES

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- MOREIRA R. Atlas de ultrasonografía. Ed. Amolca (2010). ISBN: 9789588473468.

- MAIER A, STEIDL S, CHRISTLEIN V, HORNEGGER J. (Eds.). Medical Imaging Systems: An Introductory Guide. Ed. Springer. (2018). ISBN: 9783319965192.

- BAILEY DL, TOWNSEND DW, VALK PE, MAISEY MN. (Eds.). Positron Emission Tomography: Basic Sciences (2nd ed.). Ed. Springer. (2014). ISBN: 9781852337988

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