

69725 - Medical imaging capture techniques

Syllabus Information

Academic Year: 2022/23

Subject: 69725 - Medical imaging capture techniques

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 633 - Master's Degree in Biomedical Engineering

ECTS: 3.0

Year: 1

Semester: Second semester

Subject Type: Optional

Module:

1. General information

1.1. Aims of the course

The main aim of this course is to gain knowledge on the physical and chemical principles on which current medical imaging technologies are based. These techniques aim at characterizing the composition and properties of biological tissues with spatial information. The ultimate goal is assisting diagnostic work and the treatment and investigation of disease mechanisms.

The mechanisms of interaction of electromagnetic and acoustic waves with biological matter and the procedures by which spatial data can be obtained will be covered.

The most interesting clinical techniques corresponding to different bands of the frequency spectrum will be described, in particular ultrasound (Echography), radiofrequency (Magnetic Resonance), X-rays (projection and Computerized Tomography) and gamma rays (PET, SPECT)

The contents of this course are fully aligned with Goal 3 (Good health and well-being) of the 2030 Agenda for Sustainable Development: Ensure healthy lives and promote well-being for all at all ages.

1.2. Context and importance of this course in the degree

Solving problems in the biomedical field requires advanced techniques for characterizing biological tissues in general, and the human body in particular. In this context, the use of medical images is essential.

At present, there are multiple imaging techniques offering diverse information (structural, compositional, functional or biochemical information) and using either ionizing or non-ionizing radiation.

This course aims at covering the need to know what data is actually provided by those different imaging techniques (based on their physical and chemical principles) in order to critically understand the information handled by radiologist, radiophysicist and nuclear medicine services at hospitals.

2. Learning goals

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

E1: Final exam (30%): written test consisting of theoretical and practical questions. To pass the subject, a minimum total score of 3 points out of 10 must be obtained in this final exam.

E2: Intermediate objective tests (20%).

Throughout the bimester, written tests will be carried out during regular class hours.

E3: Tutored practical work (50%).

Individual work will be carried out on a topic related to the content of the subject which has to be previously agreed with the teacher. A report (maximum 15 pages) and an oral presentation (10-15 minutes plus 5 minutes for questions) on this work will be evaluated.

Those who do not attend to the lectures, as well as anyone asking for it, will be evaluated only through tests E1 and E3. In this case, the contribution to the final grade will be 50% for E1 and 50% for E3.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives and it is based on:

- Lectures
- Problems solving
- Laboratory practice sessions
- Assignments
- Tutorials
- Assessment

4.2. Learning tasks

The course includes the following learning tasks:

A01 Lectures. Class presentation by the instructor of the main contents.

A02 Problems and case solving. Students will work on quizzes and small exercises. Then, a complete discussion will be carried out in class to solve those cases and problems in a collaborative way.

A03 Laboratory practice sessions. One practice session will take place in the laboratory. The learning outcome of this session will also be evaluated in the final exam. This activity may be replaced or completed by a visit to the Physics and Radiological Protection Service of a hospital.

A05 Assignments. The student will work on a specific topic previously agreed with the teacher. This assignment will result in a written document of no more than approximately 15 pages and an oral presentation.

A06 Tutorials. Students can ask doubts about unclear contents seen in class or supervision of their assignments.

A08 Assessment. Written theory-practical exams, assignment and oral presentation.

4.3. Syllabus

The course will address the following topics:

Topic 1. Ultrasound Imaging

1.1. Physics of ultrasound

1.2. Image modes

Topic 2. Magnetic Resonance Imaging (MRI)

2.1. MRI basics

2.2. Measurement of relaxation times

2.3. Image formation

2.4. Contrast

2.5. MRI spectroscopy and contrast agents

Topic 3. Medical image with ionizing radiation. General aspects

Topic 4. X-ray Imaging

4.1. Projection Radiography

4.2. Computed Tomography (CT)

Topic 5. Nuclear Medicine Imaging

5.1. Planar Scintigraphy (PS)

5.2. Emission Computed Tomography (SPECT, PET)

4.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website.

4.5. Bibliography and recommended resources

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=69725>