Imaging and Wave Therapies

ECTS credits
5 credits

Semester
Spring

In brief

Course langage: English

Presentation

Prerequisites

First year Common Core courses and first semester of the second year at École Centrale Méditerranée

Learning objectives

At the end of this Teaching Unit, students will have a good knowledge of the foundations and possibilities offered by medical imaging (from wave-matter interaction to data processing). In-depth understanding of the physiological properties and metabolisms targeted by the different modalities, as well as of the digital techniques implemented, specific to each modality. This foundation of skills will enable the student to respond effectively to diagnostic and therapeutic needs, with an appreciation of medical constraints.

Description of the programme

Medical imaging is the subject of multiple issues. In the field of health, non-invasive observation of the body provides morphological, metabolic and functional information, leading to significant progress in terms of care and public health (screening). From an industrial point of view, the development of new modalities has resulted in the manufacture of increasingly sophisticated and more specific equipment. Covering a wide dynamic range (from the cellular to the macroscopic scale), we describe the wave-tissue interaction models and their use in imaging and therapy. The different imaging modalities, from the most conventional to the most advanced, and the associated therapies are put in perspective. Digital image processing is a key step for diagnostic assistance and therapeutic control. In particular, image quality, data analysis, object tracking in sequences and decision support are addressed. The objective is to train students in the most advanced imaging methods, taking into account the physical foundations, in order to be able to offer the best potential for innovation for medical purposes. This teaching unit is divided into three parts:
"Cellular and subcellular microscopy;
"Medical Imaging and Therapy"; and

"Image processing".
Detailed content of the courses in the online documentation on the school's website (in French and English).

Generic central skills and knowledge targeted in the discipline

This course allows students to broaden the basic concepts of physics, mechanics and image processing to imaging and wave therapy (applied to living organisms). These techniques involve the analysis of information resulting from the interaction between waves and matter in order to obtain an image and/or an effect on matter useful for therapy, and then the processing of information useful for diagnosis, reconstruction or follow-up. Students will be able to analyze the socio-economic context related to medical imaging and therapy through the presentation of the issues related to each technique and thus measure the potential for innovation. Practical work will also help to concretize these different notions.

How knowledge is tested

CC in each part, contributing 30%, 35% and 35% respectively

Bibliography

1. Locquin, M. Langeron, Handbook of Microscopy, Butterworth-Heinemann, 1983.
V. Tuchin, Tissue optics: Light scattering methods and instruments for medical diagnosis, SPIE Press, 2015.
J. Beutel, R Van Metter, H. Kundel, Handbook of Medical Imaging: Physics and Psychophysics, SPIE Press, 2000.
I.N. Bankman, Handbook of Medical Image Processing and Analysis, Academic Press, 2009.

Teaching team

- Hervé RIGNEAULT
- Anabela DASILVA
- Carine GUIVIER-CURIEN
- Philippe LASAYGUES
- Serge MENSAH
- Salah BOURENNANE
- Caroline FOSSATTI
- Thierry GAIDON

Sustainable Development Goal

Access to health

Quality education

Life below water

Life on land

Total des heures		**70h**
CM	Master class	53h
TP	Practical work	17h

Useful info

Name responsible for EU

Lead Instructor

Julien Fade

julien.fade@centrale-med.fr