

## COURSE SYLLABUS

### Image Diagnostics

2324-2-H4102D014

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#### Aims

Acquisition of knowledge related to:

- X-ray based, US-based, Magnetic Resonance, Nuclear Medicine and hybrid diagnostic imaging instrumentation
- Radiotherapy instrumentation
- Pharmacological aspects of diagnostics medicinal products, including fundamental of pharmacokinetics, pharmacodynamics and regulatory aspects related to the use of contrast media and radiopharmaceuticals in Diagnostic imaging and radionuclide therapy

Basic comprehension of the key anatomic reference structures, as an introduction to clinical interpretation of radiological images.

#### Contents

- Diagnostic imaging modalities: US, CT, MRI, scintigraphy, PET/CT and Pet/MR
- Principle of radiobiology
- Radionuclide therapy
- Radiotherapy systems
- Role of integrated imaging modality for image-guide therapy
- Legislation of Diagnostic Medicinal Products, classification and methods of production
- Pharmacology of Diagnostic Medicinal Products
- Normal biodistribution and pathological pattern of the most commonly used radiopharmaceuticals
- Normal anatomy as documented by means of conventional radiology, CT, ultrasound, and Magnetic Resonance Imaging.

## Detailed program

### \*\*Instrumentation for Diagnostic Imaging and Radiotherapy \*\*

- Diagnostic Imaging Instrumentation:
- X-ray imaging: revision of physical principles and image formation; multislice CT, cone beam CT, mammography, angiography
- Magnetic Resonance Imaging: revision of physical principles and T1/T2 image formation; diffusion weighted and perfusion weighted MRI, fMRI, spectroscopy
- Echography: physical principles and image formation; echographic probes
- Nuclear Medicine Imaging: revision of physical principles and image formation; PET/CT and PET/RM hybrid instrumentation
- Role of integrated imaging modality for image-guide therapy

### Radiotherapy instrumentation:

- Linear accelerator and components
- Intensity Modulated Radiotherapy (IMRT), Image Guided Radiotherapy (IGRT), tomotherapy
- Cyber knife, gamma knife
- Proton therapy,
- Flash therapy
- Dosimetric planning
- Clinical indication and protocols

### Pharmacology of Diagnostic Medicinal Products

- Radiological contrast media: mechanism of action, pharmacokinetics and safety
- Radiopharmaceuticals: mechanism of action, kinetics of biodistribution and safety.
- Normal biodistribution and pathological pattern of the most commonly used radiopharmaceuticals
- Optical imaging probes: mechanism of action, kinetics behavior and safety
- Regulatory affairs relative to their classification and reimbursement

### Radionuclide therapy

- Principle of radiobiology
- Radiopharmaceuticals for radionuclide therapy
- Legislation and facilities requirements, supply and waste management
- Dosimetric estimates and side effects
- Clinical indication and protocols

### Radiological anatomy

- Normal anatomy on the basis of the following scheme:
- Thorax: lung, and mediastinum; vascular structures, along with the heart.
- Abdomen: upper abdomen: liver, pancreas, kidney, and adrenal glands.
- Lower abdomen: pelvic organs. Male and female genital tract.

## Prerequisites

Basic knowledge on chemistry, physics, human anatomy, physiology and pharmacology.

## Teaching form

Lectures including videos of real facilities. Case examples and case studies. Small group activities. As to radiological anatomy, students will participate to conventional lessons; ample interactive discussion on radiological findings, as particularly shown in CT and MR images; practical demonstrations on clinical reporting workstations.

## Textbook and teaching resource

Slides illustrated and commented on during lessons.  
General reviews from international literature.

Radiology Fundamentals. Introduction to Imaging & Technology. Editors: Jennifer Kissane, Janet A. Neutze, Harjit Singh. Springer 2020

Nuclear medicine textbook, Methodology and Clinical Applications. Editors: Duccio Volterrani, Paola Anna Erba, Ignasi Carrió, H. William Strauss, Giuliano Mariani. Springer 2019. Chapters 1-11

Basic Radiotherapy Physics and Biology. Editors: David S. Chang , Foster D. Lasley , Indra J. Das , Marc S. Mendonca , Joseph R. Dynlacht. Springer 2021

## Semester

Second semester of second year

## Assessment method

Self evaluation with written or oral self-assessment test (closed questions or multiple choice); specific scientific question, problem solving activities on specific issues during the course.

Final test:

The course exam consists of a written exam with multiple-choice questions or open questions. Oral exam consisting of ample discussion on the basis of radiological images digitally provided with the aim of recognizing the key anatomical features and the autonomous reflection capacity on critical points of the program is also possible. The questions aim at verifying the student's knowledge. Each multiple-choice question is given a score between 0 and 1; each open question is given a score between 0 and 2. Laude is assigned in case of particularly deserving tests.

Evaluation criteria: theoretical knowledge, synthesis skills, ability in the application of diagnostic methods to a specific clinical or experimental context.

## Office hours

By appointment fixed by e-mail

## **Sustainable Development Goals**

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | GENDER EQUALITY

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