

SYLLABUS DEL CORSO

Instrumentation for Diagnostic Imaging and Radiotherapy

2627-2-H4104D014-H4104D01401

Aims

The course is design to provide Knowledge on X-ray based, US-based, Magnetic Resonance, Nuclear Medicine and hybrid diagnostic imaging instrumentation and Radiotherapy and Radionuclide therapy techniques, including instrumentation

Contents

1. Diagnostic Imaging Equipment:
 - a. Overview of X-Ray systems, mammography, CT scanners, Magnetic Resonance Imaging (MRI).
 - b. Understanding gamma cameras and hybrid imaging systems including PET/CT, SPECT/CT, and PET/MR.*Knowledge and Understanding – acquire detailed knowledge of imaging technologies and their principles.*
2. Facilities for Radionuclide Therapy:
 - a. Description of the infrastructure and safety requirements for radionuclide therapies.
 - b. Legislative and facility requirements, including procurement and waste management*Knowledge and Understanding – understand the purpose and operational basics of radionuclide therapy facilities.*
3. External-Beam Radiotherapy Equipment:

Introduction to the technologies used in radiotherapy: Linear accelerators and components, Intensity Modulated Radiotherapy (IMRT), Image Guided Radiotherapy (IGRT), CyberKnife, Gamma Knife, Proton Therapy, Flash Therapy.

Knowledge and Understanding – detailed understanding of radiotherapy modalities.
Applying Knowledge and Understanding – recognize appropriate use scenarios for equipment.
4. Dosimetric Planning:

Principles and application of dosimetric planning to optimize treatment effectiveness and safety.

Applying Knowledge and Understanding – apply dosimetric concepts to treatment planning.
Making Judgments – analyze and decide optimal dosage plans.

5. Clinical Indications and Protocols:

- a. Overview of clinical indications guiding the use of imaging
 - b. Study of standard protocols to ensure appropriate and effective patient care.
- Knowledge and Understanding – comprehend clinical rationale behind equipment usage.*
Applying Knowledge and Understanding – implement protocols correctly.
Making Judgments – evaluate appropriateness of clinical indications.

6. EBRT and Radionuclide-radioligand therapies

- a. Principles of radiobiology
 - b. Examples of clinical indications and treatment protocols
- Knowledge and Understanding – Understand the fundamental radiobiological principles underlying radionuclide therapy, as well as the legal and infrastructural framework governing its safe implementation.*
Applying Knowledge and Understanding – Apply knowledge of clinical indications and protocols to ensure appropriate and effective treatment planning.
Making Judgments – Critically evaluate the suitability of radionuclide therapy for individual patients and manage logistical aspects such as waste handling responsibly.

Detailed program

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
- 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

Radionuclide therapy

- Principle of radiobiology
- Legislation and facilities requirements, supply and waste management
- Clinical indication and protocols

Prerequisites

Physics basic knowledge

Teaching form

Lectures. Active and interactive discussion on critical issues presented during the course. Case presentation and

case discussion.

Textbook and teaching resource

Slides presented during the course; guide line and auto evaluation question to be discussed during lessons
Nuclear medicine textbook, Methodology and Clinical Applications. Editors: Duccio Volterrani, Paola Anna Erba, Ignasi Carrió, H. William Strauss, Giuliano Mariani. Springer 2019. Selected Chapters

Semester

Second semester of the 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 questions 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 contest.

Office hours

By appointment fixed by e-mail

Sustainable Development Goals

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