PHYS-455 **Introduction to medical radiation physics**

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Cursus	Sem.	Type
Nuclear engineering	MA1	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	**3 weekly**
Lecture	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This course covers the physical principles underlying medical diagnostic imaging (radiography, fluoroscopy, CT, SPECT, PET, MRI), radiation therapy and radiopharmacy. The focus is not only on risk and dose to the patient and staff, but also on an objective description of the image quality.

Content

Physics of radiography x-ray device, x-ray spectra, main image receptors
Image quality main challenge, signal theory, decision theory
Physics of radiation therapy epidemiological data about cancer, general workflow, beam production and characterization, dose calculation, dose distribution, high-level treatment techniques
Risk and radiation effects, acute and chronic risks, psychological aspects, communication about radiation risk
Radiopharmaceutical products types of radiopharmaceuticals in nuclear medicine, lab infrastructure, labeling approaches, thin layer chromatography
Physics of radioscopy radiography and fluoroscopy units, challenges of radiation protection, dose indicators
Physics of computer tomography (CT) principle of CT image acquisition, image quality, DECT
Physics of resonance magnetic imaging (MRI) MRI acquisition, proton density, localization of the signal
Physics of single-photon emission computed tomography (SPECT) gamma camera imaging, resolution and sensitivity, quantitative imaging
Physics of positron emission tomography (PET) coincidence detection, time-of-flight systems, resolution and sensitivity, quantitative imaging
Dose to the patient general method, dose estimation in radiodiagnostic, dose estimation in internal contamination
Receiver operating characteristics (ROC) meaning of a ROC curve, detection experiment, performance communication
Model observers in medical imaging and human vision objective image quality, ideal and anthropomorphic observers, visual pathway, perception of a signal

Keywords

medical imaging, medical radiation

Learning Prerequisites

Recommended courses

This course has many synergies with the Radiation biology, protection and applications course where the basics of radiation physics and some aspects of radiation protection are very useful to follow the present course.

Teaching methods

Ex-cathedra with integrated individual exercises

Assessment methods

Written exam

Resources

Bibliography

Course in general
- William R. Hendee and E. Russell Ritenour, "Medical Imaging Physics", Wiley-Liss, 4th edition, 2002
- The Essential Physics of Medical Imaging, Third Edition, Jerrold T. Bushberg

Références suggérées par la bibliothèque

- The Essential Physics of Medical Imaging, Third Edition, Jerrold T. Bushberg
- William R. Hendee and E. Russell Ritenour, "Medical Imaging Physics"

Moodle Link

- https://go.epfl.ch/PHYS-455