

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	Oral
Workload	120h
Weeks	14
<b>Hours</b>	<b>3 weekly</b>
Courses	2 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**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**

oral 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**

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