GHENT UNIVERSITY

# Course Specifications

Valid as from the academic year 2024-2025

## Medical Radiation Physics and Dosimetry (C004450)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 6.0** **Study time 180 h**

**Course offerings and teaching methods in academic year 2024-2025**

| | | | |
|---|---|---|---|
| A (semester 2) | English | Gent | lecture |
| | | | seminar |

**Lecturers in academic year 2024-2025**

| | | |
|---|---|---|
| Bacher, Klaus | GE38 | lecturer-in-charge |

| Offered in the following programmes in 2024-2025 | crdts | offering |
|---|---|---|
| Master of Science in Teaching in Science and Technology(main subject Physics and Astronomy) | 6 | A |
| Master of Science in Physics and Astronomy | 6 | A |
| Master of Science in Physics and Astronomy | 6 | A |
| Exchange Programme in Physics and Astronomy (Master's Level) | 6 | A |

**Teaching languages**

English

**Keywords**

medical physics, medical imaging, radiation dosimetry, nuclear medicine, radiotherapy

**Position of the course**

The student learns how a variety of physical principles and laws are applied in medical diagnostics and therapy. Special attention is paid to physics of medical imaging, nuclear medicine and radiotherapy. The student gets in contact with this research field of sciences in medicine.

**Contents**

Interaction of non-ionizing electromagnetic waves with matter and tissues
- physical models
- relaxation processes
- effects of low-frequent (< 100 kHz) and high-frequent (>100 kHz) radiowaves.
- interactions with ultraviolet radiation.

Interaction of ionizing electromagnetic waves with matter and tissues
- fundamental interactions at the atomic level: photoelectric effect, compton scattering, pair formation
- attenuation and absorption of X-rays
- effects at cellular level
- dosimetry of ionizing radiation: exposure, kerma, absorbed dose, equivalent dose, effective dose

Conventional imaging in radiology
- screen-film technology for conventional radiography and mammography
- digital radiology: computed radiography and direct read-out radiography
- analysis of image quality, CAD
- patient dosimetry

Computed Tomography
- CT-technology: spiral CT, multi-slice CT
- 3D-applications, CAD
- image quality analysis
- patient dosimetry

Interventional radiology and cardiology
- physical principles of fluoroscopy and cinegraphy with image intensifiers
- flat-panel systems in interventional radiology/cardiology
- cone-beam CT
- CT-angiography
- patient dosimetry

Ultrasound
- physical models of interaction of sound waves with matter and tissues
- acoustic impedance
- ultrasound: principles and image formation chain

Magnetic resonance imaging
- MR models
- MR relaxation in tissues
- MR signals and diffusion
- field gradients for location in space

Nuclear medicine
- overview of radioactive decay modes
- production of radionuclides for medical purposes: cyclotron, reactor
- nuclear medical imaging: gammacamera, SPECT, PET
- therapeutis applications of radionuclides
- patient dosimetry in nuclear medicine

Radiotherapy
- Medical linear accelerator
- Absolute dose determination
- Patient dosimetry: treatment planning

**Initial competences**

basic physics

**Final competences**

1 Understand the physical concepts used in medicine.
2 Describe the physical operation of medical imaging instruments.
3 Evaluate the advantages and disadvantages of medical imaging techniques.
4 Apply the principles of radiation dosimetry in different clinical disciplines.
5 Be aware of the need of a medical physicist in a hospital environment.

**Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

**Conditions for exam contract**

This course unit cannot be taken via an exam contract

**Teaching methods**

Group work, Seminar, Lecture, Independent work

**Study material**

Type: Syllabus

Name: Syllabus'
Indicative price: € 10
Optional: no

**References**


- Intermediate Physics for Medicine and Biology-R.K.Hobbie (2001)
- Medical Physics and Biomedical Engineering- B.H. Brown, R.H. Smallwood, D.C. Barber, P.V. Lawford and D.R. Hose (1999)
- The essential Physics of Medical Imaging - J.T. Bushberg, J.A. Seibert, E.M. Leidholdt, J.M. Boone (2002)


**Course content-related study coaching**

after appointment with the lecturer (klaus.bacher@ugent.be)

**Assessment moments**

end-of-term and continuous assessment

**Examination methods in case of periodic assessment during the first examination period**

Oral assessment

**Examination methods in case of periodic assessment during the second examination period**

Oral assessment

**Examination methods in case of permanent assessment**

Assignment

**Possibilities of retake in case of permanent assessment**

not applicable

**Extra information on the examination methods**

- Periodic evaluation: Oral examination with written preparation, closed book
- Permanent evaluation: report and oral presentation

**Calculation of the examination mark**

Exam determines 100% of the final mark.