GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2025-2026

Medical Imaging (E010371)

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 2025-2026

A (semester 1)	English	Gent	lecture seminar
B (semester 1)	Dutch	Gent	

Lecturers in academic year 2025-2026

Vandenberghe, Stefaan	TWO6	lecturer-in-charge
Vandemeulebroucke, Jef	VUB	co-lecturer

Offered in the following programmes in 2025-2026	crdts	offering
Master of Science in Electrical Engineering (main subject Communication and Information Technology)	6	A
Master of Science in Electromechanical Engineering(main subject Control Engineering and Automation)	6	A
Master of Science in Electromechanical Engineering(main subject Electrical Power Engineering)	6	A
Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)	6	A
Master of Science in Electromechanical Engineering(main subject Maritime Engineering)	6	A
Master of Science in Electromechanical Engineering(main subject Mechanical Construction)	6	A
Master of Science in Electromechanical Engineering(main subject Mechanical Energy Engineering)	6	A
Master of Science in Biomedical Engineering	6	B
Master of Science in Biomedical Engineering	6	A
Master of Science in Computer Science Engineering	6	A
Master of Science in Photonics Engineering	6	A

Teaching languages

English, Dutch

Keywords

MRI, CT, SPECT, PET, Ultrasound, image processing

Position of the course

The goal of this course is to make the students familiar with medical imaging and image processing techniques. An overview will be given of the working mechanisms of the most important medical imaging techniques, their advantages and disadadvantages , their applications and recent technical developments. In addition, an introduction is given to the most commonly used techniques in medical image processing and analysis.

Contents

1 Introduction to images and image processing: sampling, filters convolution theorem
2 X-rays radiography and principle of computed tomography and analytical reconstruction
3 SPECT imaging: collimation, detection and image degrading effects
4 PET imaging: principle, image degrading effects and iterative reconstruction
5 Ultrasonic imaging

6 MRI: basic principles of magnetic resonance and image formation
7 Image enhancement and filtering: histogram-based methods, linear and nonlinear filters for noise reduction, edge enhancement and detection.
8 Image registration and visualization
9 Segmentation: thresholding, region growing, level sets, classification, mathematical morphology

Initial competences

Basic knowledge of physics and signal processing

Final competences

1 Understand physical principles of different medical imaging techniques
2 Be capable of defining components of medical imaging systems
3 Have insight in advantages and disadvantages of existing image reconstruction techniques
4 Be able to judge the advantages and disadvantages of different medical imaging techniques.
5 Be able to explain the basic principles of the most important techniques in image enhancement, image segmentation and image registration.
6 Understand relationship between different image processing techniques

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

Seminar, Lecture

Study material

None

References

Course content-related study coaching

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

The use of GenAI as a supporting tool is allowed as long as the "Guidelines for students for responsible use of generative AI" are strictly adhered to. The student must report appropriately on the AI use. Specific instructions are communicated via the learning platform.

Calculation of the examination mark

Periodical evaluation (75%) + non-periodical evaluation (25%)
Second exam: only periodical evaluation