

# Medical Imaging

Programme course

6 credits

Bildgenererande teknik inom medicinen

TBMT02

Valid from: 2017 Spring semester

**Determined by**

Board of Studies for Electrical  
Engineering, Physics and Mathematics

**Date determined**

2017-01-25

**Offered for the last time**

Spring semester 2024

**Replaced by**

TBMT59

## Main field of study

Electrical Engineering, Biomedical Engineering

## Course level

Second cycle

## Advancement level

A1F

## Course offered for

- Computer Science and Engineering, M Sc in Engineering
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- Applied Physics and Electrical Engineering, M Sc in Engineering
- Biomedical Engineering, Master's programme
- Information Technology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering

## Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

## Prerequisites

Modern Physics, Signal Theory, Anatomy and Physiology, Biomedical Signal Processing.

## Intended learning outcomes

The course should provide a possibility for the student to acquire knowledge in biomedical imaging technologies and diagnostics and their impact on biological tissue. The student should be able to describe and use between the most common imaging modalities and reconstruction algorithms. The student should also be able to describe and compare the different components in the image generation process and how it has impact on image quality specifying physiological processes. After passing the course the student should be able to:

- explain the basis for radiation prescriptions based on knowledge in radiation impact on living systems and how transferred radiation energy can be measured with dosimetry.
- describe how medical images are generated using x-ray radiation through application of knowledge involving tissue ionization processes.
- describe and value how different components and processes in the image generation chain influence the final image.
- describe and value different radiological image detection systems.
- describe and explain reconstruction principles for computed tomography images.
- derive and model principles for nuclear magnetic resonance imaging.
- describe the development of contrast in MR images.
- apply knowledge about MRI contrast to select the most appropriate pulse sequences to a chosen application.
- describe and value the principles of a normal MRI-image reconstruction process.
- summarize and explain the basic physical principles being necessary for using ultrasound in medicine.
- describe, model and value ultrasound systems with possibilities to record spatial localization in 3D.
- explain and derive the reconstruction process of ultrasound images.
- optimize and choose methods to achieve a better ultrasound image and contrast.
- summarize the impact of ultrasound on biological tissue.

## Course content

Radio biology and radio physics.

Image generation technology using X-ray, CT, MRI, PET/SPECT and ultrasound.

Imaging diagnostics and enhancement.

Laboratory work: Digital medical imaging systems and image quality in medical imaging.

Hand in task for all imaging modalities.

## Teaching and working methods

The course has a strong student-centered focus with PBL as a keystone. This includes tutorial sessions, seminars, lectures, workshops and laboratory work. Tutorial sessions, laboratory work and seminars are mandatory.

## Examination

BAS1	Work in PBL-group	1 credits	U, G
LAB1	Laboratory Work	1.5 credits	U, G
TEN2	Written examination	3.5 credits	U, 3, 4, 5

## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Other information

Supplementary courses: Neural networks and learning systems, Medical Image Analysis, Biomedical Optics.

## Department

Institutionen för medicinsk teknik

## Director of Studies or equivalent

Linda Rattfält

## Examiner

Linda Rattfält

## Course website and other links

<https://www.imt.liu.se/en/edu/courses/TBMT02/index.html>

## Education components

Preliminary scheduled hours: 62 h

Recommended self-study hours: 98 h

## Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at [http://stydokument.liu.se/Regelsamling/Innehall/Utbildning\\_pa\\_grund-\\_och\\_avancerad\\_niva](http://stydokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva).