Medical Imaging

Programme course

6 credits

Bildgenererande teknik inom medicinen

TBMT02

Valid from: 2020 Spring semester

Determined by
Board of Studies for Electrical Engineering,
Physics and Mathematics

Date determined
2019-09-23
Main field of study

Electrical Engineering, Biomedical Engineering

Course level

Second cycle

Advancement level

A1X

Course offered for

- Master's Programme in Biomedical Engineering
- Computer Science and Engineering, M Sc in Engineering
- Information Technology, M Sc in Engineering
- Biomedical Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Applied Physics and Electrical Engineering, 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. After passing the course the student should be able to:

- explain effects of ionizing radiation on biological tissue and the human body.
- describe methods to measure ionizing radiation, to do dosimetry calculations and
their relation to safety regulations.
- describe how medical images are generated using x-ray radiation.
- describe how different components and processes in the image generation chain influence the final image.
- describe and explain reconstruction principles for computed tomography images.
- describe 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 the principles of MRI-image reconstruction.
- summarise and explain the basic physical principles exploited for generating ultrasound images in medicine.
- describe and model how ultrasound systems can achieve spatial localisation.
- explain the reconstruction process of ultrasound images.
- optimise and choose methods to improve ultrasound image quality.
- summarise the impact of ultrasound on biological tissue.

Course content

- Image generation technology using X-ray, CT, MRI and ultrasound.
- Imaging diagnostics and enhancement.
- Radiation biology and safety.
- Laboratory work: Image quality in medical imaging.
- Workshop with hand-in assignments where various aspects of CT, MRI and ultrasound imaging are simulated.

Teaching and working methods

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

Examination

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
<th>Grade</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPG1</td>
<td>Home assignment</td>
<td>U, 3, 4, 5</td>
<td>3.5 credits</td>
</tr>
<tr>
<td>LAB1</td>
<td>Laboratory Work</td>
<td>U, G</td>
<td>1.5 credits</td>
</tr>
<tr>
<td>BAS1</td>
<td>Work in PBL-group</td>
<td>U, G</td>
<td>1 credits</td>
</tr>
</tbody>
</table>

An oral examination is included in the work in PBL-groups.
Grades

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

Other information

Supplementary courses

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

About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is Swedish, the course as a whole or in large parts, is taught in Swedish. Please note that although teaching language is Swedish, parts of the course could be given in English. Examination language is Swedish.
- If teaching language is Swedish/English, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English (depending on teaching language).
- If teaching language is English, the course as a whole is taught in English. Examination language is English.

Other

The course is conducted in a manner where both men's and women's experience and knowledge are made visible and developed.

The planning and implementation of a course should correspond to the course syllabus. The course evaluation should therefore be conducted with the course syllabus as a starting point.

Department

Institutionen för medicinsk teknik

Director of Studies or equivalent

Marcus Larsson

Examiner
Evren Özarslan

Education components

Preliminary scheduled hours: 62 h
Recommended self-study hours: 98 h

Course literature

Books

ISBN: 9780521190657