



HL2019 Ionising Radiation Imaging 6.0 credits

Medicinsk avbildning med joniserande strålning

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for HL2019 valid from Spring 2019

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Medical Engineering

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The two major medical imaging modalities, transmission and emission, are both based on ionising electromagnetic radiation as information carrier from the organ to be depicted to the imaging detector system. The course treats the theory of the physical processes involved, presents detectors and instruments for medical imaging and gives a perspective on the advances in this field. Consequences of ionising radiation on living tissues are presented.

Transmission imaging where the anatomy of the organ is shown is the most widely used technique and is performed both in 2D (i.e. radiography, uroscopy) and in 3D mode (Computed Tomography). In emission imaging the physiology of the organ is studied in vivo with high sensitivity in systems that can produce images in 2D (Gamma Camera) or in 3D (SPECT and PET). All these imaging systems will be discussed thoroughly. The laboratory exercises of the course are devoted to the presentation of medical imaging systems with working demonstrators.

Image reconstruction is an indissoluble part of modern 3D medical imaging, the most common reconstruction techniques will be presented and hands-on reconstruction session will be part of the course.

The effect of quantum noise on image quality and reliability will be discussed. During the course the basic theory of radiation therapy will be also treated.

Different models for dose calculation will be treated and international dose protection regulation will be presented.

Following this course, you will gain a deeper knowledge and understanding:

About how ionising radiation interacts with matter

About nuclear structure, natural and artificial radioactivity, and nuclear reactions

How ionising radiation like X-ray or radioactive substances for medical imaging are produced

How detectors for ionising radiation are constructed and their signals are treated

How imaging systems for ionising radiation are functioning, data collected, and images are reconstructed

and you will learn:

How dose is measured and calculated

About the rules for radiation exposure and protection

Course contents

You will explicitly learn about the different imaging systems, their function and application. These systems are:

2D X-ray radiography with different imaging techniques

Fluoroscopy and image intensifiers

3D Computer Tomography

Gamma Camera and scintigraphy

Single Photon Computed Tomography

Positron Emission Tomography

Dose calculation through computer simulations

Quantum noise effect on imaging

Regulations about radiation exposure

You will also get an insight into the development of new detection and imaging techniques and organ dedicated imaging systems.

Specific prerequisites

Bachelor's degree in Engineering Physics, Electrical Engineering, Computer Science or equivalent.

Basic knowledge of anatomy. (SH1011, HL1007, HL1201, HL1202 or equivalent.)

Course literature

Presently suggested reading:

The Essential Physics of Medical Imaging (2nd Edition),

J. T. Bushberg, J. A. Seibert, E. M. Leidholdt Jr. , J. M. Boone

Lippincott Williams & Wilkins; 2.00 edition (December 15, 2001) ISBN-10: 0683301187

ISBN-13: 978-0683301182

Examination

- LAB1 - Laboratory Work, 2.0 credits, grading scale: P, F
- PRO1 - Project, 2.0 credits, grading scale: P, F
- TEN1 - Examination, 2.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Passed written exam (TEN1; 2 cr.) grading A-F.

Passed lab work (LAB1; 2 cr.) grading P/F.

Passed project (PRO1; 2 cr.) grading P/F.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.