Medical Radiation Physics

Programme course

8 credits

Medicinsk strålningsfysik

TVFA02

Valid from: 2017 Spring semester

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

Date determined
2017-01-25

Main field of study
Biomedical Engineering

Course level
First cycle

Advancement level
G2X

Course offered for
- Biomedical 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
Wave motion, Electromagnetism - Theory and Application, Modern physic.

Intended learning outcomes

The course will provide the student with basic knowledge of how ionizing and non-ionizing radiation interacts with matter, the basics of dosimetry of ionizing radiation with emphasis on diagnostic and therapeutic applications in health care. The course also introduces radiation biology and radiological protection of patient and staff so that the student are made aware of the radiation hazards for humans and how to protect him/herself and patient from unnecessary irradiation. The course gives an overview of regulations that are formed around the use of ionizing radiation in health care and how different staff (i.e. physicist, engineers, nurses and doctors) collaborates on quality assurance on equipments that produce radiation.
After the course the student should be able to:

- Describe how the human body is affected by ionizing radiation (Solo2)
- Describe quantities used for radiation dosimetry, report on how these are measured or computed and to do simple dose estimations (Solo2)
- Describe fundamental knowledge of radiological protection so that the student can protect him/herself and assist others to manage their own safety (Solo2)
- Explain how ionizing radiation interact with matter and use this knowledge to select a suitable method to measure radiation (Solo3)
- Explain radioactive decay, give example of how it is used in the hospital and reflect on how radiological waste is managed from an environmental perspective (Solo3)
- Describe how different radiation detectors operate and make an argument why some radiation detectors are suitable for measuring a particular type of ionizing radiation (Solo3)
- Apply different radiation detectors working principles and use this knowledge in different radiation environments to assess the reasonableness in the measured data (Solo4)
- To briefly describe the regulations and requirement from government and authorities (i.e. Swedish Radiation Protection Agency) that surrounds the use of ionizing radiation in society, specifically in the health care system with focus on the responsibility of the medical engineer (Solo2)
- Describe and give examples of systematic quality assurance in the health care system with emphasis on radiological equipment (Solo2)
- Describe the basic physics of nuclear magnetic resonance as a basis for the course TBMT02 (Solo2)
- Describe the basic physics of ultra sound as a basis for the course TBMT02 (Solo2)

Course content

The course focuses on the basic physics of ionizing radiation behind the many diagnostic and therapeutic applications in health care and, as a central part, include interaction of ionizing radiation and matter In radiation dosimetry we study how ionizing radiations impart energy to for example human tissue and how the energy-impartation per unit mass (absorbed dose) is quantified by measurements or calculations. Radiation detectors are used for patient and staff dosimetry, for creating diagnostic images, for surveillance and for quality assurance of the environment in health care and industry. The subject of radiation biology describes how radiation affects living organisms and what risk are associated with ionizing and non-ionizing radiation, in the short and long run. Radiological protection is a subject that includes how to protect staff and patients from unnecessary irradiation or damages due to radiation. The course includes the basic physics of nuclear magnetic resonance and ultra sound – techniques that are used in health care for imaging and for quantitative analysis.

Teaching and working methods

The course is divided into lectures, seminars, study group sessions, tutorials, laboratory work and a field study exercises. The course is scheduled for student-centred learning with sessions of problem-based learning that are compulsory (1 ECTS). The course is to a large extent based on laboratory work and all lab sessions are compulsory and are completed by submitting a written lab report (3 ECTS).

Examination

MOM1	Laboratory work and field study exercise	1 credits	U, G
LAB1	Laboratory work and field study exercise	3 credits	U, G
TEN1	Written examination	4 credits	U, 3, 4, 5

Grades

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

Other information

Supplementary courses: Medical Imaging

Department

Institutionen för medicin och hälsa

Examiner

Alexander Malusek

Course website and other links

http://www.imh.liu.se/utbildning_vid_IMH/medicinsk-stralningsfysik?l=sv

Education components

Preliminary scheduled hours: 64 h
Recommended self-study hours: 149 h

Course literature

Grundläggande strålningsfysik av Mats Isaksson (Studentlitteratur) Ytterligare kursmaterial finns på kursens webbsida, se nedan.

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://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.