SH2310 Strålningsdetektorer och medicinska bildgivande system 7,5 hp

Radiation Detectors and Medical Imaging Systems

När kurs inte längre ges har student möjlighet att examineras under ytterligare två läsår.

Fastställande

Kursplan för SH2310 gäller från och med VT10

Betygsskala

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

Utbildningsnivå

Avancerad nivå

Huvudområden

Fysik

Särskild behörighet

Rekommenderade förkunskaper: Subatomär fysik (SH2101) eller motsvarande.

Undervisningsspråk

Undervisningsspråk anges i kurstillfällesinformationen i kurs- och programkatalogen.

Lärandemål

After completion of the course, the student should be able to:

- Explain the physical and technological principles behind various types of radiation detectors and imaging modalities.
- List the various components that build up imaging systems of different types and describe their respective functions.
- Give examples of radionuclides and radiopharmaceuticals used for nuclear imaging, explain how they are produced, as well as motivate their use in their respective applications in terms of their physical, chemical and biological properties.
- Describe the various contrast mechanisms employed by the different medical imaging modalities.
- Categorize imaging modalities with respect to parameters such as emission/transmission imaging; anatomical/functional imaging; ionizing/non-ionizing radiation imaging, projection/tomographic imaging, etc.
- Solve basic numerical problems involving e.g. count rate and image acquisition time, radiation dosimetry, administration of activity and radiographic contrast, Rose model.

To qualify for the highest grades, the student should also demonstrate the ability to:

- Evaluate detectors and medical imaging systems in terms of quantitative parameters such as contrast, signal-to-noise ratio, modulation transfer function, etc.
- Identify physical and current technological limitations of medical imaging systems.

Kursinnehåll

The course treats the physical, mathematical and technological aspects of medical imaging systems. Modalities (imaging types) covered include x-ray imaging, computed tomography (CT), gamma camera imaging and single photon emission computed tomography (SPECT), positron emission tomography (PET), ultrasound imaging and magnetic resonance imaging (MRI). Other topics include radiation biology, dosimetry and production of radioisotopes.

Special emphasis is given to the principles of radiation detection and the associated instrumentation, which in many cases were developed within sub-atomic physics. Recently introduced digital detectors, current development and technology trends are an important part of the course.

Numerical methods to quantify the performance of medical imaging systems are presented. The design of medical imaging systems usually involves a number of tradeoffs involving parameters such as contrast, spatial resolution, noise, image acquisition time, size and cost. It is a major goal of the course to provide an understanding of these relations.

Kurslitteratur

J. Bushberg (Editor), “The essential physics of medical imaging”, 2nd edition, 2001.

Examination

- LAB1 - Laborationer, studiebesök, 3,0 hp, betygsskala: P, F
- TEN1 - Tentamen, 4,5 hp, betygsskala: A, B, C, D, E, FX, F

Examinator beslutar, baserat på rekommendation från KTH:s handläggare av stöd till studenter med funktionsnedsättning, om eventuell anpassad examination för studenter med dokumenterad, varaktig funktionsnedsättning.

Examinator får medge annan examinationsform vid omexamination av enstaka studenter.

Övriga krav för slutbetyg

One written exam (or project work) (TEN1; 4,5 university credits) and laboratory work including compulsory participation in visits (LAB1; 3 university credits).

Etiskt förhållningssätt

- Vid grupparbete har alla i gruppen ansvar för gruppens arbete.
- Vid examination ska varje student ärligt redovisa hjälp som erhållits och källor som använts.
- Vid muntlig examination ska varje student kunna redogöra för hela uppgiften och hela lösningen.