HL2010 Ultrasound 6.0 credits

Ultraljud

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 HL2010 valid from Spring 2014

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Bachelor's degree in Applied or Theoretical Physics, Electrical Engineering or equivalent. Knowledge of anatomy and physiology is recommended.

Language of instruction

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

Intended learning outcomes

After the course is successfully completed, student will acquire the theoretical and practical knowledge and will be able to:

1. Discuss and perform calculations related to propagation of the acoustical waves in homogeneous media, i.e. gasses, liquids or solids; and in complex media, i.e. biological tissue.
2. Based on the medical requirements design and optimize characteristics of the ultrasound transducer and emitted acoustic wave.
3. Discuss the fundamental physical principles, biological effects and safety issues related to the application of ultrasound in connection with harmonic imaging, acoustic streaming, cavitation and sonoporation; and exemplify different practical applications of each process.
4. Discuss clinically approved and routinely used ultrasound techniques such as Doppler, speckle tracking and more recent advanced modalities such as 4D ultrasound, shear wave elastography and contrast enhanced ultrasound.
5. Identify strengths and weaknesses of the modalities for evaluation of various tissue types such as cardiac, vascular and fetus.

Course contents

- Lecture sessions in the course are dedicated to cover following topics: 1. Propagation of the acoustic waves through different media: gas, liquids, solids; at normal and oblique incident. Specific characteristic parameters and governing equations. 2. Design of ultrasound transducers and their key elements. 3. Biological effects of ultrasound: harmonic imaging, acoustic streaming, cavitation, sonoporation. 4. Application of ultrasound in clinical practice. Visualization and quantification of the diagnostic data by Doppler, speckle tracking, 3D-4D ultrasound and shear wave elastography. 5. Basic principles and resent advancements in ultrasound contrast agents: from manufacturing, through testing to visualization. 6. Ultrasound safety 7. Standards for digital image acquisition, archiving and communication. Clinical practice and risk management.Laboratory works in a course are dedicated to provide hands on experience on: 1. Basic principles of ultrasound physics and discussion on propagation of the acoustical waves in different mediums and accompanied effects. 2. Calibration and performance testing of the clinical ultrasound. 3. Clinical protocol in handling patients.Demonstrationin a course is designed to appreciate and assess the biological effect of ultrasound on living cells on an example of cavitation.One written assignment complements the laboratory works and allows correlating experimental finding with theoretical calculations.

Course literature

1. Hand-out material
2. Hoskins PR, Martin K, Thrush A, "Diagnostic Ultrasound: Physics and Equipment" Cambridge Medicine, Second edition, 2010

Examination

- LAB1 - Laboratory Work, 1.5 credits, grading scale: P, F

- TEN1 - Examination, 4.5 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.

Other requirements for final grade

Passed written exam (TEN1; 4.5 cr.) grading A-F.
Passed lab work (LAB1; 1.5 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.