HL1203 Medical Instrumentation 9.0 credits

Medicinsk mätteknik

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 HL1203 valid from Spring 2011

Grading scale

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

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Basic knowledge of medicine and medical technology equivalent to course HL1201
Basic knowledge of electricity and measuring techniques equivalent to course HE1200

Language of instruction

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

Intended learning outcomes

The overall goal of this course is to provide a deeper understanding of the of measurable physical signals in the human body, to increase understanding of the function and application of modern medical sensors and measurement principles, processing and presentation of results, and the ability to construct the measuring system for measuring physiological parameters.

After successful completion of the course the student should be able to:
• explain the bioelectric signals about the origin and significance
• understand the characteristics of different sensors, the advantages and disadvantages, and choosing appropriate sensors for measuring temperature, pressure, flow, volume and concentration of blood and respiratory gases.
• specify the requirements for gain, bandwidth, and CMRR of medical devices
• evaluate the possibilities, limitations and sources of error in various methods of signal processing applied on Biosignals.
• explain the meaning of the concepts of sensitivity and specificity in clinical environment.
• use a few sensors, such as termoresistorer, thermistors, thermocouples, piezoelectric, optical and magnetic to measure physiological signals.

Course contents

The teaching consists of lectures and five compulsory laborative experiments.

• Physiological sensors
• Biosignals, its origins and significance
• Characteristics of different sensors
• Instrumentation in physiological measurements
• Methods for measuring temperature, pressure, flow and volume of blood and respiratory gases
• Signal processing applied to biosignals
• Possibilities, limitations and sources of error in different methods
Laborative experiments:

Design of a measurement system using thermocouple and thermodiodes to measure temperature.

Design of a measurement system using piezoelectric transducer for measurement of pulse rate and blood pressure.

Study the application of accelerometers in a Pacemaker.

Design of a measurement system using optical transducers to measure concentration

Design of ECG bioamplifier to record the ECG signals and study the different sources of errors while recoding the biosignals.

Laborations where thermistors, thermocouples, piezoelectric, optical and magnetic sensors used for measuring and processing of physiological signals.

Course literature

Selected materials, edited by Mannan Mridha

Reference literature:

Biomedical Transducers and Instrumentation by Togawa, Tamura and Öberg 1998

Microsensors by Julian W. Gardner 1996

Medical Instrumentation: Application and Design, John Webster
Bioinstrumentation, John Webster
Outlines & Highlights for Medical Instrumentation Application and Design by John G. Webster, John W. Clark (Contribution by), Michael R. Neuman, ISBN: 9780471676003

Examination

- LAB1 - Lab Works, 5.0 credits, grading scale: P, F
- TEN1 - Examination, 4.0 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.

Other requirements for final grade

- LAB - Laboratory, 5.0 credits, grades: P, F
- TEN- Written exam, 4.0 credits, grading scale: A, B, C, D, E, FX, 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.