



CM2013 Signal Processing and Data Analytics in Biomedical Engineering 7.5 credits

Signalbehandling och dataanalys för medicintekniska tillämpningar

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

Establishment

Course syllabus for CM2013 valid from Spring 2022

Grading scale

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

Education cycle

Second cycle

Main field of study

Medical Engineering, Technology and Health

Specific prerequisites

Completed a 15 credit thesis in engineering, social sciences, medicine, biomedical engineering, applied physics, industrial economics, or entrepreneurship. Alternatively, one year of work experience in medical technology, technical physics, computer science, electrical engineering, or entrepreneurship. English B/6.

Language of instruction

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

Intended learning outcomes

After the course, students should be able to:

- L1. Describe and discuss the principles of biomedical signal acquisition, sampling, and processing
- L2. Characterize biosignals origin and noise features
- L3. Design and implement fundamental biosignal analysis, modelling, and visualization tools
- L4. Select and apply appropriate methods for pattern recognition and classification of biosignals for solving a given problem in biomedical engineering
- L5. Design, motivate, implement, and evaluate a signal processing method for solving a specific problem in biomedical engineering
- L6. Effectively work as part of a project team

Course contents

The course is an introduction to the field of signal processing and data analytics in biomedical engineering. The focus is on providing a comprehensive introduction to the concepts of methods and techniques popular for the analysis of biosignals for medical, health, and sports applications. The course will at least cover the following topics:

Origin and characteristics of biosignals and medical images

Discretization of signals

- Analogue-to-digital conversion processes
- Sampling theorem and random sampling

Applications and implementation of transform theory in biomedical applications

- Signal decomposition using Fourier series
- Fourier Transform and Fast Fourier transform
- Time and Frequency Analysis
- Other relevant transforms methods

Digital filters and their applications in biomedical engineering

- Introduction to digital filters design

- Application of filters and transform methods to 1-D (signals and time series) and 2-D signals (images)

Stochastic processes and biosignal Modelling

- Spectrum estimation

Types of noise and methods for noise reduction in biosignals

Machine learning techniques and pattern recognition in biomedical applications

- Feature extraction and selection
- Supervised learning
- Unsupervised learning

Methods and applications of multivariable data analysis in biomedical applications

And other new developments in the field

Examination

- RED1 - Assignments, 2.0 credits, grading scale: P, F
- PRO1 - Project work, 2.0 credits, grading scale: P, F
- TEN1 - Written exam, 3.5 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.

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

Final grade, grade scale A-F

The exam (A-F) determines the final grade for the course when all course parts have been passed. The examination form and grading criteria will be specified in a course-PM.

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.