CM2014 Simulation Methods in Medical Engineering 7.5 credits

Simuleringsmetoder i medicinsk teknik

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

On 2020-10-09, the Head of School of XXX has decided to establish this official course syllabus to apply from the spring semester 2022 (registration number C-2020-1810).

Grading scale

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

Education cycle

Second cycle

Main field of study

Medical Engineering

Specific prerequisites

Bachelor's degree in Engineering Physics, Electrical Engineering, Computer Science or equivalent.

English 6.

Language of instruction

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

Intended learning outcomes

After passing the course, the student should be able to

☐Understand the rationale behind medical simulations and what societal challenges could be solved with medical simulations

☐Describe the key concepts and theoretical background in medical simulations

☐Derive and explain some fundamental mathematical models in medical simulations

☐Solve basic differential equations (analytically and numerically) of relevance in medical simulations

☐Critically analyze and discuss the plausibility of the simulation results

Course contents

Modeling and simulation play an important role and have developed into indispensable disciplines in many fields, including Medical Engineering. This course aims at providing a comprehensive introduction to the methods and theory of medical simulations, covering the following topics:

☐Finite element methods (FEM) for biomechanics simulations

☐Medical imaging simulation methods (ultrasound and ionizing radiation imaging)

☐Methods that have applications in mechanistic modeling of disease, treatment, epidemiology, healthcare systems and processes, logistics etc., including

oSystems dynamic modeling and simulation

oDiscrete event simulations

oAgent-based modeling

☐Molecular simulations

☐CFD (Computational fluid dynamics) for fluid and climate technology

☐Surgical and haptic simulations

Despite different simulation methods, all have mathematics behind, and an understanding of differential equations is warranted

Examination

- LAB1 - Laboratory work, 4.5 credits, grading scale: P, F
- TEN1 - Written exam, 3.0 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.

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.