Biomedical Modeling and Simulation

Programme course

6 credits

Biomedicinsk modellering och simulering

TBME08

Valid from: 2017 Spring semester

Determined by
Board of Studies for Electrical Engineering, Physics and Mathematics

Date determined
2017-01-25

Main field of study
Biomedical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Computer Science and Engineering, M Sc in Engineering
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- Engineering Biology, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Biomedical Engineering, Master's programme
- Information Technology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Computer Science and Software Engineering, M Sc in Engineering

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Anatomy and physiology. Signal processing. Some programing experience is assumed.

Intended learning outcomes

The objective of the course is to introduce and apply general theories for modelling and simulation of systems relevant within biomedical engineering. This includes both physical and physiological models. After passing the course the student should be able to:

- identify and describe general principles for modeling and simulating a system.
- apply these principles when designing mathematical models for a number of realistic systems.
- implement and use computer based modeling and simulation for studying research relevant problems within the field of biomedical engineering. This includes diagnostic and therapeutic methods, as well as physiological processes.
- evaluate the applicability and usablity for different modells and simulation techniques.

Course content

Introduction to concepts of system modeling, model formalism and it's relationship to different simulation strategies. Application of general and specific methods to analyze and model systems. Implementation and simulation of models in a computing environment. Discrete-time and stochastic simulation methods. Evaluation of model applicability, accuracy and robustness. Laboratory activities comprising:

- blood flow and blood pressure simulation.
- simulation of airflow in the lungs.
- 3D simulation with FEM technology of heat transfer in human tissue.
- Stochastic simulation of light transport in human tissue.
- Simulation of how bio-potentials are generated across the cell membrane.

Teaching and working methods

The course has a student-centered focus with seminars, lectures and laboratory work as keystones.

Examination

LAB1	Laboratory Work	3 credits	U, G
TEN1	Written Examination	3 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5

Department
Institutionen för medicinsk teknik

Director of Studies or equivalent
Linda Rattfält

Examiner
Marcus Larsson

Course website and other links
http://www.imt.liu.se/edu/courses/TBME08/

Education components
Preliminary scheduled hours: 38 h
Recommended self-study hours: 122 h

Course literature
Valda delar av: L. Ljung och T. Glad, Modellbygge och Simulering, Studentlitteratur 2003. Artiklar och kompletterande material, IMT 2015.

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.