SE2121 Introduction to Biomechanics 9.0 credits

Biomekanik

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

Establishment

The course syllabus is valid from Spring 2022 according to the school principal's decision: S-2022-0529 Decision date: 2022-02-24

Grading scale

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

Education cycle

Second cycle

Main field of study

Engineering Physics

Specific prerequisites

English B / English 6

Basic course in solid mechanics (for instance SE1010, SE1020 or SE1055) and a Finite Element (FE) course (for instance SE1025).

Language of instruction

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

Intended learning outcomes

Biomechanics applies engineering/mechanical principles and methods to biological systems and aims at understanding their normal (physiological) and abnormal (pathological) responses. Biomechanics is a rapidly growing field of engineering and plays a dominant role in the development of medical devices, for example. The course provides the foundation of cardiovascular biomechanics from the organ to the tissue level. Specifically, a quantitative approach to human physiology from the biomedical engineering perspective is presented, where both structural and hemodynamic aspects are addressed. In-vitro experimental and analytic tools are developed and used to solve problems in cardiovascular biomedical engineering.

After the course, the participants should be able to

- Understand the basics of vascular physiology
- Model a particular bioengineering problems by selecting appropriate modeling assumptions
- Understand the purpose, function, implication and limitation of biomechanical modeling
- Achieve a theoretical understanding of non-linear continuum mechanics
- Solve a particular problem by using either analytical approaches or the FE method
- Combine and integrate different solution strategies to address more challenging problems
- Achieve a practical understanding in applying the FE method as demonstrated by solving typical problems of bioengineering interest
- Present, analyze and explain derived results in a clear and causal way

Course contents

The course provides the foundation of cardiovascular biomechanics from the organ to the tissue level. A quantitative approach to human physiology from the biomedical engineering perspective is presented, where structural and hemodynamic aspects are addressed. In-vitro experimental and analytic tools are developed and used to solve problems in cardiovascular biomedical engineering. Techniques include Finite Element (FE) modeling, model parameter identification, non-linear continuum mechanics, constitutive descriptions of passive and active properties of blood vessels, Newtonian and non-Newtonian descriptions of blood.

Examination

- HEMA - Home Assignment, 3.0 credits, grading scale: P, F
- TENA - Examination, 4.0 credits, grading scale: A, B, C, D, E, FX, F
- LABA - Laboratory Work, 2.0 credits, grading scale: P, 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.

Other requirements for final grade

Laboratory work (LAB1, 2.0 credits), Home assignments (HEM1, 3.0 credits) and Examination (TEN1, 4.0 credits)

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.