SD2450 Biomechanics and Neuronics 6.0 credits

Biomekanik och neuronik

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 SD2450 valid from Autumn 2008

Grading scale

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

Education cycle

Second cycle

Main field of study

Biotechnology,Mechanical Engineering

Language of instruction

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

Intended learning outcomes

To integrate medical and technical knowledge by providing the students insight into anatomy, biological materials, implant materials and their properties. To give knowledge of injury mechanics and injury criteria for biological tissues, in particular the central nervous system. Further to give knowledge of how numerical modelling of soft and hard biological tissue can be used to calculate deformations, strains and stresses in the tissue in effort to predict injury/instability of the tissue.

During this course you are expected to acquire the following skills:

- Describe the human anatomy and the function of the nervous system.
- Describe the basic constituents of human tissues and their mechanical properties.
- Explain the mechanical properties of human tissues based on their design, purpose, and structure of the basic constituents.
- Derive the simple viscoelastic material models and describe how the more complex viscoelastic relations can be modeled.
- Discuss and compare biomaterials of polymers, metals and ceramics based on their properties and suggest suitable applications.
- Suggest a design and material choice for a load bearing implant, based on an analysis of the function and loading of the part.
- Explain the fundamental theories and the equations of motion for static and dynamic FEA.
- Perform a dynamic FEA and evaluate the reliability of the results.
- Analyze an accident, predict the injury outcome and suggest preventive strategies.
- Describe the energy absorption of foam materials and discuss how this can be used to protect the human, for example in helmet design.

Course contents

Basic anatomy and physiology. Mechanical properties of biological material. Implants. Numerical modelling of biological tissue. In particular the brain and cervical spine. Injury criteria.

Specific prerequisites

Base programme BD, M, P, T or equivalent. Fundamental knowledge in solid mechanics (e.g. SE1010, SE1020, or SE1055) is necessary and basic knowledge in FEM (e.g. SD2411, SE1025, SG2850, or DN2260) is recommended.

Course literature

Course folder and selected chapters from: Nahum,, A. M. and Melvin, J. W. 1993. Accidental Injury – Biomechanics and Prevention. Springer Verlag, New York Inc.

Examination

- LABA - Laboratory Work, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- TENA - Examination, 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.

Other requirements for final grade

Experimental lab and home work problem (LABA; 3 university credits), and written exam (TENA; 3 university 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.