T-828-BIOM **ADVANCED BIOMECHANICS** **8 ECTS**

Year of study:	4th year (1st year MSc).
Semester:	Fall.
Level of course:	5. Graduate (Second cycle), intermediate.
Type of course:	Elective. *Recommended elective for MSc Biomedical Engineering.*
Prerequisites:	Biomechanics (T-561-LIFF). Knowledge of structural mechanics is recommended.
Schedule:	Runs for 12 weeks – 6 teaching hours a week.
Supervising teacher:	Magnús Kjartan Gíslason.
Lecturer:	Magnús Kjartan Gíslason.

Learning outcomes: At the end of the course, the student will have a basic understanding of the material composition of various tissues in the body and their properties. The students will also know about the various types of materials used in orthopaedic surgery and how those materials are going to interact with the body. Understanding of prostheses for amputees, orthoses, and their design

***Knowledge*:** At the end of the course, the student will have knowledge on
- Material properties of bones, ligaments, tendons, and cartilage
- Basic calculations on tissue properties based on measurements
- Time dependent properties of biological materials
- How metals interact with bone and long-term effect on the bone.
- Carry out measurements on biological tissue and assess uncertainties
- Total joint arthroplasty and joint prosthesis design
- Prostheses for amputees and orthoses
- Medical device regulatory aspects

***Skills*:** At the end of the course, the student will have skills in:
- Quantifying parameters of biological tissue
- to design measurements involving biological tissue and interpret the results
- to be able to identify the clinical aspect of materials used in surgery
- to be able to identify design features of prosthesis and orthoses design
- to be able to understand the procedures in placing a medical device on the market.

***Competence*:** At the end of the course, the student will gain competence on:
- Evaluating measurements on biological tissue, what results are to be expected and limitations.
- Assessing which materials are appropriate for various types of surgical procedures
- Assessing design features in various different types of prostheses, orthoses and how to put them on the market.

Description: The fundamentals of biomaterials are introduced and how the mechanical properties of tissue can be evaluated. Post-processing of bending tests on animal bone, tensile testing on human tendons and measurements on orthopaedic implants will be carried out as well as discussing the limitations of such measurements. Difference between in-vivo and in-vitro will be discussed. The loading conditions on various joints of the body will be discussed and how they will dictate the design criteria for an orthopaedic implant. Visit to surgeons will be made and the students will get a clinical perspective on the application of biomaterials. Visits to Össur prosthetics where the design principles of prostheses and orthoses will be introduced.

Reading material: Selected papers in biomechancis and other in-depth material distributed by teacher. Suggested reading: Ayyana M. Chakravartula and Lisa Pruitt. Mechanics of Biomaterials: Fundamental Principles for Implant Design.
Teaching and learning activities: Lectures, lab work, discussions.
Assessment methods: Coursework (50%), Presentation on a selected topic in biomechanics/biomaterials (20%) and final exam (30%)
Language of instruction: English.