

ME-482

Biomechanics of the musculoskeletal system

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Cursus	Sem.	Type
Bioengineering	MA1, MA3	Opt.
Biomedical technologies minor	H	Opt.
Life Sciences Engineering	MA1	Opt.
Mechanical engineering	MA1, MA3	Opt.

Language of teaching	English
Credits	5
Withdrawal Session	Unauthorized Winter
Semester Exam	Fall Written
Workload	150h
Weeks	14
Hours	3 weekly
Courses	2 weekly
Exercises	1 weekly
Number of positions	80

It is not allowed to withdraw from this subject after the registration deadline.

Summary

The basis for a mechanical description of the musculoskeletal system are presented. This description is based on the concepts of solid mechanics, physiology and anatomy of the musculoskeletal system. Concrete examples of the development of implants are also covered.

Content

Biomechanics at the body level (functional anatomy; joint kinematics; forces in the joints). Biomechanics at the tissue level (large deformations; passive and active constitutive laws; identification; laws of evolution). Biomechanics in clinical applications (orthopaedics biomechanics; traumatology, implant development). Mini-project in group.

Keywords

Constitutive laws, Identification, Orthopedics

Learning Prerequisites**Recommended courses**

- Elementary knowledge in physiology
- Master the concepts of conservation laws

Learning Outcomes

By the end of the course, the student must be able to:

- Explain the link between the physiology and the mechanical properties of a tissue, B2
- Compute the kinematics and the forces in articulations, B3
- Identify the mechanical behaviour of tissues and fluids from experimental data, B5
- Propose or develop specific constitutive laws, B7
- Describe the feedback loop that, starting from a mechanical signal translated into a chemical signal, allows for the adaptation of the mechanical properties of tissues, B9
- Describe the procedure to identify a constitutive law, B14

Transversal skills

- Communicate effectively with professionals from other disciplines.
- Access and evaluate appropriate sources of information.
- Write a scientific or technical report.
- Make an oral presentation.

Teaching methods

The course is organised as theoretical sessions and includes the resolution of exercises and the realization of a mini-project within a group.

Expected student activities

Exercises to do. Realization of a mini-project in groups of 4, oral presentation of the project and a report of maximum 15 pages.

Assessment methods

The mini-project will be evaluated through an oral presentation and a written report (group presentation). The mini-project counts for 1/3 of the final mark. There will be a written exam on the presented lectures.

Supervision

Office hours	Yes
Assistants	Yes
Forum	No

Resources

Bibliography

The course material can be downloaded from the moodle website (<http://moodle.epfl.ch/course/view.php?id=1201>).

1. Skeletal Tissue Mechanics, B. Martin, et al., Springer, 1998 (ISBN 0-387-98474-7)
2. Continuum mechanics, Spencer, Longman, 1992 (ISBN 0-582-44282-6)

Ressources en bibliothèque

- [Continuum mechanics / Spencer](#)
- [Skeletal Tissue Mechanics / Martin](#)

Moodle Link

- <http://moodle.epfl.ch/course/view.php?id=1201>