Module Description, available in: EN

Biomedical Engineering

General Information

Number of ECTS Credits

3

Module code

TSM_BioMedEng

Valid for academic year

2026-27

Last modification

2024-10-18

Coordinator of the module

Marcel Egli (HSLU, marcel.egli@hslu.ch)

Explanations regarding the language definitions for each location:

- Instruction is given in the language specified for each location and module execution.
- Documentation is available in the language(s) listed for each location and module execution. If the documentation is in multiple languages, the percentage distributed is indicated (100% = all documentation provided).
- The examination, including both questions and answers, is provided entirely (100%) in the language(s) specified for each location and module execution. The exams are on-site.

	Lausanne			Lugano	Zurich		
Instruction					**X** E 100%		
Documentation					**X** E 100%		
Examination					**X** E 100%		

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

Basic knowledge in cell biology, anatomy, functional anatomy, and pathology (fracture, neuro, orthopedics, osteosynthesis) is beneficial. Potentially missing knowledge can be acquired individually as an autodidact effort.

Brief course description of module objectives and content

The lecture encompasses a comprehensive exposition of Biomedical Engineering. It commences with a historical overview, followed by an examination of contemporary methodologies and tools. Physiological principles will be discussed before focusing on subjects like biosignals and sensors. An array of topics will be dissected, including but not limited to bioimaging, biomolecular engineering, tissue engineering, and the intricacies of precision and personalized medicine. Attendees will attain discernment concerning foundational prerequisites such as biology and physiology and the variety of materials used for implants, prostheses, and available biomaterials. Current clinical paradigms will be scrutinized, notably osteoporosis,

fracture fixation, and osteoarthritis. Furthermore, orthopedic treatment modalities and osteosynthesis techniques will be meticulously analyzed, encompassing fracture fixation and the primary stability of implants and joint replacements. A deeper comprehension will be given to measurement technologies catering to human physiological performance encompassing kinematics and kinetics. This includes evaluating movement analysis, muscular dynamics, and cerebral activity. (7) The course will also discuss (robot-assistive) rehabilitation technologies in the case of neuropathology, such as stroke, MS, and paraplegia, with a specific focus on innovations in virtual/augmented reality.

Aims, content, methods

Learning objectives and competencies to be acquired

The first half of each afternoon session will focus on biomedical engineering and prosthetics. During the second half, the students will be tasked to work as a group on describing a medical device product of their choice (an existing device or a medical aid they would like to build).

Module content with weighting of different components

Biomedical engineering

- Physiological systems
- Biotechnology and tissue engineering
- Bioelectric and neuro-engineering
- Human sensory systems
- Bioreactors and tissue engineering in regenerative medicine

Prosthetics

- Pathologies of the Musculoskeletal System

- Human movement analysis, orthopedics, (clinical) biomechanics, biomaterials

- Biomechanical testing of implants/test development & lab accreditation
- Diagnosis & assessment based on AI-based algorithms

Robot assistive rehabilitation

- Clinical assessment of neurodegenerative diseases/human performance analysis
- Rehabilitation devices and procedures
- Therapeutic procedures based on virtual/augmented reality

Teaching and learning methods

Various teaching methods, like classical or group work, will be applied.

Literature

Slides and lecture notes will be made available to the students. Furthermore, a list will be provided with books and articles relevant to the topics taught.

Assessment

Additional performance assessment during the semester

The module contains additional performance assessment(s) during the semester. The achieved mark of the additional performance assessment(s) applies to both the regular and the resit exam.

Description of additional performance assessment during the semester

Throughout the semester, students will give group presentations on selected medical devices. The lecturer will provide feedback on the presentation immediately afterward, and the grade received will account for the final mark but is weighted only for 10%.

Basic principle for exams

As a rule, all standard final exams are conducted in written form. For resit exams, lecturers will communicate the exam format (written/oral) together with the exam schedule.

Standard final exam for a module and written resit exam

Kind of exam

Written exam

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

No electronic aids permitted

Other permissible aids

Students can use physical cheat sheets of up to two DIN A4 pages. These sheets must be handwritten on paper or a tablet PC / iPad and then printed. The use of electronic devices during the exam is strictly prohibited.

Exception: In case of an electronic Moodle exam, adjustments to the permissible aids may occur. Lecturers will announce the final permissible aids prior to the exam session.

Special case: Resit exam as oral exam

Kind of exam

Oral exam

Duration of exam

30 minutes

Permissible aids

No aids permitted