Joint Degree Master Program in Biomedical Engineering

Joint Course Catalogue

Status: December 18, 2025
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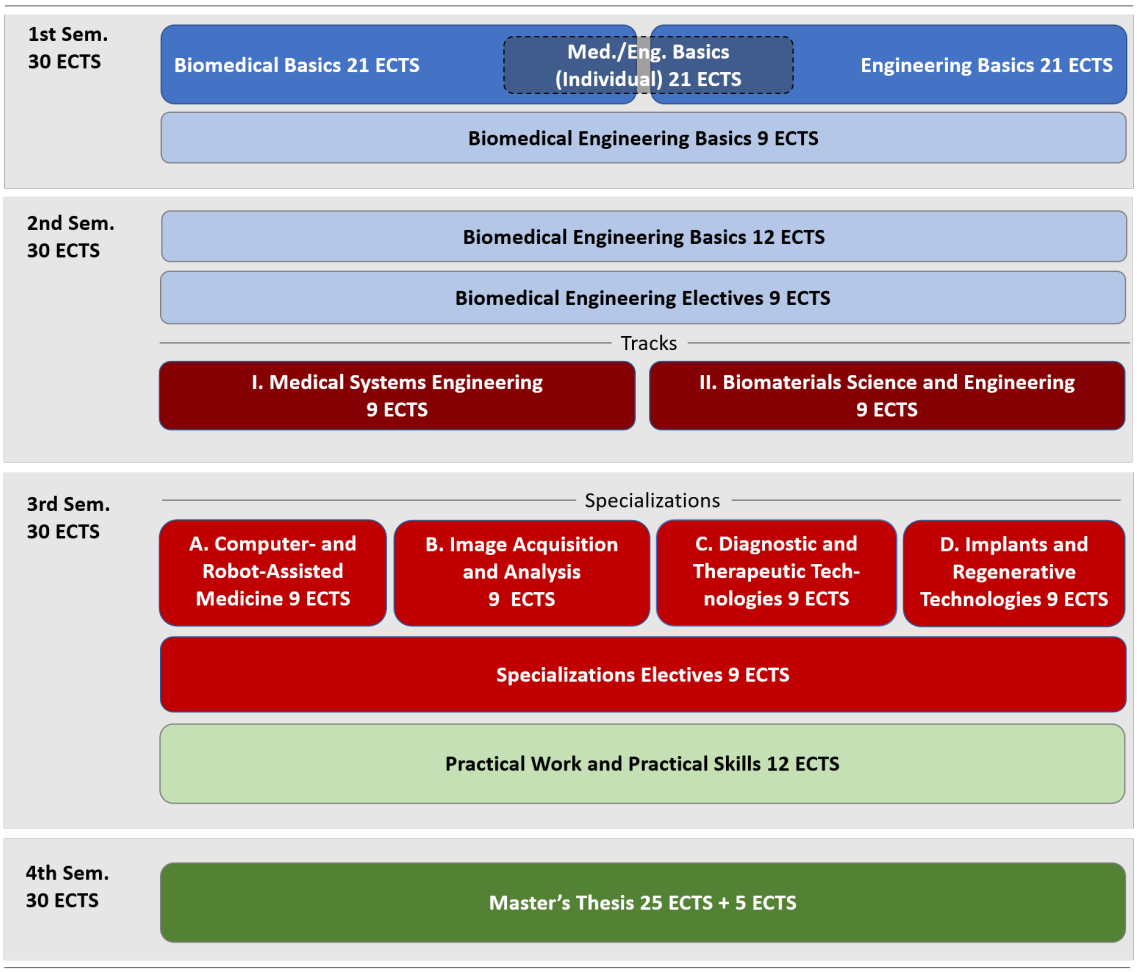
Official course catalogue of the joint degree master program in biomedical engineering. For more details and course registration see https://biomedicalengineering.ch/.

Program Structure



* Not all combinations of modules can be guaranteed

Table of Contents

C06 / M-SBME-MSc C06

Hardware Programming of Medical Sensors

Module	Biomedical Basics
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	Graded exercises, project or group works (50%), written exams during the semester (50%)
Workload	3 ECTS
Lecturer(s)	Reto Wildhaber <reto.wildhaber@fhnw.ch> (Coordinator) Nico Grütter Simon Lemoigne Frédéric Waldmann

Course contents	- Theory (ca. 20 contact lessons)
	- Microcontroller structures and peripherals
	  - Introduction to C programming
	  - Sensors with analoge and digital sensor interfaces
	- Sensor calibration
	  - Analog to digital conversion and technologies
	- Sensor interfacing to microcontrollers (incl. interrupts)
	  - Memory management on microcontrollers
	  - Digital data flow on microcontrollers
	  - Data containers and data structures
	  - Basic signal processing algorithms
	  - Outlook: Alternative hardware structures and low power technologies
	- Exercises (ca. 22 contact or online lessons)
	  - Exercise/Project/Programming sessions

Bibliography (Mandatory / Optional)	t.b.d.
Entry Requirements	Basics in programming and electronics
Learning Outcome and Competences	After completing the module, students will be able to… • evaluate a hardware platform for given application • connect a sensor to a microcontroller system • implement digital data acquisition using microcontrollers • perform optimal analog-to-digital conversion
Comments	
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	June 04, 2025

C07 / 69465-01

Physiology & Anatomy: Digestive, Endocrine and Urinary System

Module	Biomedical Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture with internship
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	Assessment format: exam Examen Multiple Choice Exam
Workload	3 ECTS
Lecturer(s)	Emanuel Burri <e.burri@unibas.ch> (Assessor) Patrizia Amico Matthias Betz Michael Brauchle Felix Burkhalter Magdalena Filipowicz Sinnreich Frank-Martin Häcker Patricia Hirt-Minkowski Stylianos Kouvaros Gwendolin Marie Manegold-Brauer Matthias Matter Robert Mechera Svetozar Subotic
Course contents	Endocrine System Pathophysiology of the Endocrine System Gastroenterology (Eat and grow) Kidney and Urinary System Pathophysiology of the Kidney and Urinary System Gastrointestinal System
Bibliography (Mandatory / Optional)	SILVERTHORN, D. U. (2019). Human physiology: an integrated approach. Atlas of Human Anatomy (Netter Basic Science), Seventh Edition, Elsevier Publishers
Entry Requirements	
Learning Outcome and Competences	To understand the anatomy, physiology and pathophysiology of the digestive, endocrine and genitourinary Systems. To understand basic human topographic anatomy and histology of the digestive, endocrine and genitourinary Systems, as well as anatomy of common pathologies. To receive insight into the status of latest research in each field.
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294563
Last Updated	August 06, 2025

C08 / 69466-01

Physiology & Anatomy: Locomotor System and Skin

Module	Biomedical Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture with internship
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	Assessment format: exam Examen, Multiple Choice Prüfung
Workload	3 ECTS
Lecturer(s)	Andrej Nowakowski <andrej.nowakowski@unibas.ch> (Assessor) Michael Brauchle Emmanuel Contassot Beat Göpfert Simon Herger Michael Hirschmann Florian Imhoff Markus Knupp Annegret Mündermann Cordula Maria Netzer Claudio Rosso
Course contents	Physiology and Anatomy of the Musculoskeletal System Pathophysiology of the Musculoskeletal System Dermatology (Skin – barrier between inside and outside)
Bibliography *(Mandatory / Optional)*	SILVERTHORN, D. U. (2019). Human physiology: an integrated approach Atlas of Human Anatomy (Netter Basic Science), Seventh Edition, Elsevier Publishers
Entry Requirements	
Learning Outcome and Competences	To understand basic human topographic anatomy and histology, physiology and pathophysiology of the locomotor apparatus, as well as anatomy of common pathologies. To receive insight into the status of latest research in each field.
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294562
Last Updated	August 06, 2025

C09 / 69462-01

Physiology & Anatomy: Head and Spinal Cord

Module	Biomedical Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture with internship
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	Assessment format: exam Examen, Multiple Choice Exam:
Workload	3 ECTS
Lecturer(s)	Cristina Granziera <cristina.granziera@unibas.ch> (Assessor) Michael Brauchle Alessandro Cagol Markus Knupp Stylianos Kouvaros Laurent Muller Katrin Parmar Regina Maria Marga Schläger Tim Sinnecker Markus Weber
Course contents	- Neurology (Central command) - Anatomy and Cell Physiology and Neural System - Pathophysiology of the Neural System - Anatomy and Physiology of the Sense Organ (visual, auditory system and smell/taste) - Pathophysiology of the Sense Organs
Bibliography (Mandatory / Optional)	Atlas of Human Anatomy (Netter Basic Science), Seventh Edition, Elsevier Publishers SILVERTHORN, D. U. (2019). Human physiology: an integrated approach
Entry Requirements	
Learning Outcome and Competences	
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294561
Last Updated	August 06, 2025

C10 / 69464-01

Physiology & Anatomy: Cardiovascular and Respiratory System

Module	Biomedical Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture with internship
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	Assessment format: exam Examen Multiple Choice Exam
Workload	3 ECTS
Lecturer(s)	Anna Marsano <anna.marsano@unibas.ch> (Assessor) Petya Apostolova Patrick Badertscher Florent Baty Christoph Berger Lucas Boeck Michael Brauchle Elisabeth Eppler Beat Kaufmann Giulia Milan Michael Zellweger
Course contents	Anatomy of and physiology of the respiratory system (Breathing is everything) Anatomy and physiology of the cardiovascular system (Circulation) Anatomy of and physiology of hematology/ immunology (Blood – more than red) Pathophysiology of the cardiovascular system, the respiratory system, the immune system
Bibliography (Mandatory / Optional)	SILVERTHORN, D. U. (2019). Human physiology: an integrated approach Atlas of Human Anatomy (Netter Basic Science), Seventh Edition, Elsevier Publishers
Entry Requirements	
Learning Outcome and Competences	
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294564
Last Updated	August 06, 2025

C11 / 52054-01

Biology of Tissue Regeneration

Module	Biomedical Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Attendance of 10/14 lectures minimum is mandatory Presentation of each student about a topic related to "Tissue Regeneration" Multiple Choice Exam
Workload	3 ECTS
Lecturer(s)	Karoliina Pelttari-Göritz <karoliina.pelttari@unibas.ch> (Assessor) Andrea Banfi Andrea Barbero Nunzia Di Maggio Roberto Gianni' Barrera Elisabeth Artemis Kappos Olga Krupkova Anna Marsano Ivan Martin Adrien Moya Arnaud Scherberich
Course contents	1. Structure and organization of a cell: the fundamental unit of life (Olga Krupkova) 2. Cell division and protein synthesis (Adrien Moya) 3. Cell-cell- and cell-matrix interactions (Arnaud Scherberich) 4. Tissue organization and morphogenesis (Karoliina Pelttari) 5. Stem cells (Nunzia di Maggio) 6. Endogenous tissue regeneration: wound healing (Roberto Gianni Barrera) 7. Angiogenesis and vasculogenesis for tissue regeneration (Andrea Banfi) 8. Cartilage tissue (Andrea Barbero) & Bone tissue/organ (Arnaud Scherberich) 9. Nerve tissue (Elisabeth Kappos) 10. Cardiac tissue (Anna Marsano) 11. Principles of regenerative medicine and their applications (Ivan Martin) 12. Series presentation by students (I) 13. Series presentation by students (II) 14. Series presentation by students (III)
Bibliography (Mandatory / Optional)	
Entry Requirements	
Learning Outcome and Competences	Students will gain fundamental knowledge on cell biology and on the molecular and cellular mechanisms responsible for the development and regeneration of different types of tissues/organs. Additionally, students will receive information on selected rapidly emerging multidisciplinary fields of regenerative medicine
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294551

Last Updated August 06, 2025

C12 / 69467-01

Bioengineering Basics I

Module	Biomedical Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Student’s presentation & Multiple choice exam (50/50 weight)
Workload	3 ECTS
Lecturer(s)	Pablo Sinues <pablo.sinues@unibas.ch> (Assessor) Valentina Basoli Olivier Braissant Urs Duthaler Vanessa Hofmann David Schürmann Simon Schwarz
Course contents	1. Biochemistry Refresher: Water, Acids, Bases, and Buffers ¦ Cell building blocks 2. Microbiology basics I: Bacteria, Fungi and Viruses 3. Microbiology basics II: Sterility and decontamination ¦ Antimicrobial substances and targets 4. Basic genetics: DNA structure and function 5. Advanced genetics: Principles of genetic mutation, and associated human diseases ¦ Gene technology 6. Metabolism I: Basics thermodynamic ¦ G and energy metabolism 7. Metabolism II: Anabolism & catabolism 8. -OMICS I: Genomics (GWAS) ¦ Epigenomics (EWAS) ¦ Transciptomics (RNAseq) 9. -OMICS II: Proteomics ¦ Metabolomics 10. Biofluids 11. Biomarkers 12. Method validation ¦ Quality control ¦ Reference intervals
Bibliography (Mandatory / Optional)	Alberts, B., Hopkin, K., Johnson, A., Morgan, D., Raff, M., Roberts, K., & Walter, P. (2019). Essential cell biology (Fifth edition, international students edition ed.). W. W. Norton & Company Ha, C.-E., & Bhagavan, N. V. (2011). Essentials of Medical Biochemistry: With Clinical Cases. Elsevier Science.
Entry Requirements	
Learning Outcome and Competences	After completing the module, students will be able to: • Comprehend essential notions necessary for a training in biology-related engineering fields. • Describe the basic components and functions found in cells • Translate information from genetic code • Describe essential metabolic pathways • Verify statements about specific cellular mechanisms
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294560
Last Updated	August 06, 2025

C01 / M-SBME-MSc C01

Atomic View to Materials

Module	Engineering Basics
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	- Individual oral examination, 30 min.
Workload	3 ECTS
Lecturer(s)	Michael de Wild <michael.dewild@fhnw.ch> (Coordinator) Klaus Mayer Bert Müller
Course contents	Periodic table of elements; Bravais lattices (Müller, 2) - Tutorial 01 (Question 1: Chemical elements within the human body; Question 2: Description of crystalline lattices) Chemical and physical bonds in condensed matter (Müller, 2) - Tutorial 02 (Question 1: Ionic crystal with covalent character—magnesium oxide; Question 2: Explaining properties of metals, semiconductors, and insulators) Polymeric solid states (Müller, 2) - Tutorial 03 (Question 1: Properties of polyether ether ketone (PEEK) and polyethylene (PE); Question 2: Crystalline structures in polymers) Microstructure, surfaces and interfaces (de Wild, 2) - Tutorial 04 (Question 1: Photoelectric effect; Question 2: Calculation of grain size) Preparation of surfaces for implants (de Wild, 2) - Tutorial 05 (Question 1: Surface roughness measurements; Question 2: Hydrophobicity of surfaces) Crystal defects in medically relevant materials (Müller, 2) - Tutorial 06 (Question 1: Zero-dimensional defects; Question 2: One-dimensional defects) Simple crystal structures of elements and compounds (Müller, 2) - Tutorial 07 (Question 1: Titania structures; Question 2: Optical and electron microscopy) Electrical and optical properties; Optical and electron microscopy (de Wild, 2) - Tutorial 08 (Question 1: Monte Carlo Simulation Energy Dispersive Spectroscopy (EDX); Question 2: calculation of absorption coefficient) Computed tomography for tissue and implant characterization (Müller, 2) - Tutorial 09 (Question 1: Conventional X-ray sources; Question 2: Interactions of X-rays with matter) Crystal and thin-film growth including online monitoring (Müller, 2) - Tutorial 10 (Question 1: Hierarchy of activated processes; Question 2: Molecular beam deposition) Materials in dentistry, microstructures, phases, biodegradation (de Wild, 2) - Tutorial 11 (Question 1: De- and re-mineralization of enamel; Question 2: XRD phase identification) Small-angle X-ray scattering for materials and tissue characterization (Müller, 2) - Tutorial 12 (Question 1: Tooth structure in health and disease; Question 2: Lipid bilayer thickness measurement) Experiments, error estimation/Statistics: Spectrometer, Pohl oscillator (Mayer, 2) - Tutorial 13 (Question 1: Resonances; Question 2: Error analysis) Labtour and Q&A session: Demonstrations of surface and bulk characterization methods and systems for additive manufacturing (de Wild, 2) - Tutorial 14 (Question 1: Measuring crystal shape; Question 2: Ostwald ripening)
Bibliography (Mandatory / Optional)	- W.D. Callister, D.G. Rethwisch, Materials Science and Engineering: SI Version (English), Wiley-VCH Verlag GmbH & Co KgaA, 2016. - G. Carter, D. Paul, Materials Science and Engineering, ASM International, Materials Park, OH, 2010. ISBN 978-0-87170-399-6. - Interactive simulations (https://phet.colorado.edu/en/simulations/category/new)

Entry Requirements	Defined entry level - Bachelor degree with medical or engineering background
Learning Outcome and Competences	The students will understand the atomic and molecular structure of solid states and soft materials. Based on this knowledge, the students will be able to draw conclusions about material properties on the macroscopic scale to select and tailor their characteristics for medical applications including the broad variety of medical implants made from metals, ceramics, polymers, composites, etc. The microscopic, crystallographic and spectroscopic characterization of materials down to the atomic level will be discussed, as this is the main prerequisite for innovations and improvements. Finally, the biocompatibility of implant materials will be explored. After completing the module, students will be able to… • understand the arrangement of element within the periodic table • explain potential arrangements of atoms in crystal lattices • describe bonding of atoms in molecules and condensed matter • understand microscopy of materials and tissues • present the importance of the microstructure for quality control. • explicit reciprocal-space techniques for materials characterization • understand structure-function relationship of materials • engineer materials for medical applications.
Comments	• Lectures • Power-point presentations as pdf-files • Parts of textbooks • Relevant journal articles • Interactive simulations • Lab tour and Q&A session • Group work, experiment evaluation and interpretation • Tutorial questions and example solutions 2 lectures per week à 45 Min, whole semester 14 weeks (1st and last event 2 lecturers: intro/overview/requirements, resp. summary/important points for exam/Q&A-session)
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	June 04, 2025

C02 / M-SBME-MSc C02

Programming Basics with MATLAB

Module	Engineering Basics
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	• Final e-assessment, individual (100%)
Workload	3 ECTS
Lecturer(s)	Oliver Mülken <oliver.muelken@fhnw.ch> (Coordinator) Thomas Quirin Pablo Sinues
Course contents	Basics of the MATLAB interface. Definition of different objects such as vectors and matrices. Simple computations with defined objects. Import and manipulation of data sets into MATLAB. Plotting of imported data sets and fitting functions to the data. Data analysis using filters such as moving averages. Simple MATLAB functions. Loop structures in MATLAB. Writing simple MATLAB scripts. Application of MATLAB to problems in Biomedical Engineering.
Bibliography (Mandatory / Optional)	• https://ch.mathworks.com/help/matlab/index.html?s_tid=hc_panel • MATLAB for biomedical engineers and scientists; A. P. King and P. Aljabar, Elsevier Science, 2022
Entry Requirements	Technical: • Own laptop • Latest MATLAB version installed. The FHNW provides MATLAB including licence. Download the supported version form https://www.fhnw.ch/plattformen/ict/softwaredownload/ Intellectual: • Basic understanding of Algebra, https://www.khanacademy.org/math/get-ready-for-algebra-i https://www.khanacademy.org/math/algebra • Basic understanding of Analysis, https://www.khanacademy.org/math/get-ready-for-precalculus • Basic knowledge of dealing with computer applications
Learning Outcome and Competences	After completing the module, students will be able to… • operate the basics of the MATLAB interface. • recognize and define different objects such as vectors and matrices. • explain and perform simple computations with defined objects. • import data sets into MATLAB. • manipulate imported data sets. • Implement plotting of imported data sets and fitting functions to the data. • analyse data using filters such as moving averages. • write code for simple MATLAB functions. • understand how different loops structures are used in MATLAB. • write code for simple MATLAB scripts. • apply MATLAB to applications in Biomedical Engineering.

Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	July 09, 2025

C03 / M-SBME-MSc C03

Electrical Engineering and Electronics Basics

Module	Engineering Basics
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	Written exam at course end (100%)
Workload	3 ECTS
Lecturer(s)	Reto Wildhaber <reto.wildhaber@fhnw.ch> (Coordinator)
Course contents	Theory (28 contact lessons) - Resistive Network Analysis - AC Network Analysis - Transient Analysis - Frequency Response and System Concept - Semiconductors and Diodes - Transistor Fundamentals - Operational Amplifiers Exercises (14 contact or online lessons) - weekly or biweekly exercise or Q&A sessions
Bibliography (Mandatory / Optional)	Course book: Giorgio Rizzoni, James A. Kearns, "Principles and applications of electrical engineering", 978-00-7352-9592
Entry Requirements	Basics in physics, mathematics
Learning Outcome and Competences	After completing the module, students will be able to… - analyze linear RLC-networks - draw a passive linear filter - understand the concepts of semiconductors such as diodes - analize a basic circuit including transistors - analize a basic circuit including operational amplifiers
Comments	
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	March 13, 2025

C04 / 52055-01

Mathematics for Biomedical Engineering I

Module	Engineering Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	Assessment format: exam - Examen - 50% of homework exercises points. - Written exam;
Workload	6 ECTS
Lecturer(s)	Edgar Delgado-Eckert <edgar.delgado-eckert@unibas.ch> (Assessor) Oumeymah Cherkaoui Nair Nan von Mühlenen
Course contents	Ordinary differential equations and linear algebra.
Bibliography (Mandatory / Optional)	James Stewart "Calculus", International Metric Edition, 8th Edition. David Poole "Linear Algebra : A Modern Introduction", 4th Edition.
Entry Requirements	
Learning Outcome and Competences	- Solve first order and second order ordinary differential equations. - Learn the basic concepts of linear algebra and vector spaces. - Apply the theory of vector spaces to analyzing data, e.g., principal component analysis (PCA).
Comments	Digital media via "Cengage's WebAssign" (https://www.webassign.net/wa-auth/login)
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294553
Last Updated	August 06, 2025

C16 / 69471-01

Mechanics I: Statics

Module	Engineering Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	Assessment format: exam The exam will be held in written form (2.5h). The students will not need any digital tool for problem solving. Accordingly, the allowed tools to bring to the exam is a sheet of hand-written formulas. Otherwise only tools for writing on paper are needed. For convenience, previous exams are provided in the lecture materials for the students to get an idea of the format, content, and complexity of exams. Exam date:tbd
Workload	3 ECTS
Lecturer(s)	Ferda Canbaz <ferda.canbaz@unibas.ch> (Assessor) Leya Pauly Vinamrata Vinamrata
Course contents	In this lecture, the students will be introduced into the field of statics, which is a subfield of mechanics. Statics summarizes the most fundamental principles of static objects and their possible interaction forces/torques with the environment. Also internal forces of these objects will be analyzed without taking into account deformations. The following topics are planned to be covered: • Vector calculus • basics of statics • equilibrium • degrees of freedom/statical determindness • general approach for solving equilibrium problems • girders • rope statics (infinitesimal calculus, concepts for optimization) • distributed forces • center of mass/gravity/volume • statics of beams • friction • principle of virtual work Matlab will be introduced as a basic calculation and plotting tool. Therefore, please bring an electronic device that allows you to install and perform calculations in Matlab. On Tuesdays (8:15-10:00), theoretical content of mechanics 1, statics will be explained supported by small examples. On the following Monday, exercises will be held by the lecture assistant to solidify the gained knowledge in examples.
Bibliography (Mandatory / Optional)	Literature on Statics Karl Wohlhart, Statik Grundlagen und Beispiele, Springer Russ C. Hibbeler, Engineering Mechanics, Statics, Paerson Introduction to Matlab David Houcque, Introduction to MATLAB for engineering students, Northwestern University https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf https://matlabacademy.mathworks.com/details/matlab-onramp/gettingstarted
Entry Requirements	
Learning Outcome and Competences	The goal of this lecture is that the students should be able to identify if a problem is statically determined and thus can be solved by the means of this course. They will learn how to cut free objects and analyse the interaction forces/torques of static objects, i.e. objects at rest) with the environment. Also, they will learn to analyze the flow of forces/torques within objects. Finally, also basic principles such as friction and

	deriving static equations from energy laws will be introduced. The students should finally obtain a good feeling for the plausibility of their results. The lecture will employ Matlab as a state of the art engineering tool throughout the lecture to get students familiarized to one of the possible tools that are used in engineering, and medical robotics in particular. Matlab is often used to plot, calculate numeric solutions, or show how fast it is to solve equations, which are impossible to solve by hand or at least take a long time to solve by hand.
Comments	Basics that are relevant for the master studies in Biomedical Engineering: https://dbe.unibas.ch/en/education/master-of-science/master-program-starting-in-hs-2023/
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294566
Last Updated	August 06, 2025

C17 / 69472-01

Programming Basics with Python

Module	Engineering Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: no repeat examination (Re-)registration: as often as necessary
Assessment Details	Assessment format: continuous assessment continous assessment 200 of 240 points in weekly exercises quiz
Workload	3 ECTS
Lecturer(s)	Philippe Claude Cattin <philippe.cattin@unibas.ch> (Assessor) Carlo Seppi
Course contents	The goal of the lecture is to prepare students to work with Python and various other tools. We will provide an overview of different useful tools, including Visual Studio, GitHub, and working with the console. Additionally, we will offer a crash course on important features and libraries of Python, such as classes, modules, numpy, pandas, and scikit-learn. We will also explore faster computation using PyTorch on the GPU and briefly discuss AI-assisted programming
Bibliography (Mandatory / Optional)	
Entry Requirements	• Some programming experience is recommended • A laptop is required for this course
Learning Outcome and Competences	1. Understand Python fundamentals and gain proficiency in the language. 2. Learn essential tools for Python development, e.g., Visual Studio, GitHub, and consoles. 3. Explore important Python features and libraries, e.g., classes, modules, numpy, pandas, and scikit-learn. 4. Utilize PyTorch on the GPU for faster computations. 5. Discuss AI-assisted programming and its applications. 6. Apply Python and relevant tools in real-world scenarios. 7. Foster a foundation for further learning in Python and related technologies
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294567
Last Updated	August 06, 2025

C13 / M-SBME-MSc C13

Materials Science and Biomaterials

Module	Biomedical Engineering Basics
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	Written exam, 90 minutes
Workload	3 ECTS
Lecturer(s)	Michael de Wild <michael.dewild@fhnw.ch> (Coordinator) Bert Müller
Course contents	Introduction into biomaterials science and engineering: Hierarchy of structures: Human-organ-tissue-cells-biomolecules-atoms; Titanium-based dental implant as example for tissue-materials interface (Müller/de Wild, 2) - Tutorial 01 (Question 1: Estimating the number of atoms within a human tooth; Question 2: Contact-angle measurements) Atomic/molecular structure of condensed matter (Müller, 2) - Tutorial 02 (Question 1: Physical description of crystalline lattices; Question 2: Explaining materials properties by atomic interactions) Polymeric solid states including their binding (Müller, 2) - Tutorial 03 (Question 1: Prerequisites for the formation of polymer crystals; Question 2: Bond-property relations) Polymers for medical implants including hydrogels (Madduri, 2) - Tutorial 04 (Question 1: Procedure, a medical doctor carries out applying PMMA as bone cement; Question 2: Determination of glass transition temperature) Materials-tissue interface; Standards in biocompatibility testing (de Wild, 2) - Tutorial 05 (Question 1: Definition of biocompatibility and other relevant terms; Question 2: Interactions between implant and surrounding tissues) Description of crystal defects (Müller, 2) - Tutorial 06 (Question 1: Role of entropy in crystal defect formation (vacancies); Question 2: Interactions of dislocations using Burgers vectors) Characterization of materials – bulk and surfaces (de Wild, 2) - Tutorial 07 (Question 1: Debye-Scherrer method (powder diffraction); Question 2: Electron spectroscopy for chemical analysis (ESCA)) Natural and synthetic ceramics for implants and regenerative medicine; mechanical properties (de Wild, 2) - Tutorial 08 (Question 1: Calcium phosphate phases; Question 2: Preparation steps of ceramic products) Metal-based implants with focus on NiTi (de Wild, 2) - Tutorial 09 (Question 1: Stress shielding; Question 2: Shape memory-based medical implants) Formation of solid-state materials (Müller, 2) - Tutorial 10 (Question 1: Liquid-solid transition; Question 2: Concept of critical nucleus -surface and bulk)

Materials and technologies in oral health (Müller/Sigron, 2)
- Tutorial 11 (Question 1: Oral scanners and their accuracy; Question 2: Spatially resolved small-angle X-ray scattering to characterize nano-anatomy)

Artificial sphincters, Stimuli-responsive liposomes (Müller, 2)
- Tutorial 12 (Question 1: Mechanical properties of human soft tissues; Question 2: The Fahraeus-Lindqvist effect and the human blood vessel system)

Sterilization methods, Mechanical testing of implants, fractography (de Wild, 2)
- Tutorial 13 (Question 1: Sterilization methods; Question 2: Stress-strain correlation to Vickers measurements)

Materials selection in implant design; Employing materials science for improving human health: Example brain-computer interface; Q&A session (Müller/de Wild, 2)
- Tutorial 14 (Question 1: Materials and component selection for a hip joint; Question 2: Challenges in brain imaging)

Bibliography (Mandatory / Optional)

- Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen and Jack E. Lemons: "Biomaterials Science: An Introduction to Materials in Medicine", 2nd edition, Elsevier Academic Press.
- W.D. Callister, D.G. Rethwisch, Materials Science and Engineering: SI Version (English), Wiley-VCH Verlag GmbH & Co KgaA, 2016.
- G. Carter, D. Paul, Materials Science and Engineering, ASM International, Materials Park, OH, 2010. ISBN 978-0-87170-399-6.
- Interactive simulations (https://phet.colorado.edu/en/simulations/category/new)

Entry Requirements

Defined entry level
- Scientific background in medicine, chemistry, physics or analytical chemistry.
- Basic lectures on chemistry and physics are a prerequisite to follow this course.

Learning Outcome and Competences

The students will understand the atomic and molecular structure of solid states and soft materials. Based on this knowledge, the students will be able to draw conclusions about material properties on the macroscopic scale to select and tailor their characteristics for biomedical applications including the broad variety of medical implants made from metals, ceramics, polymers, composites, etc. The biological, mechanical, chemical, spectroscopic and tribologic characterization of materials down to the atomic level will be discussed, as this is the main prerequisite for innovations and improvements. State-of-the-art technologies and methodologies for the analysis of materials will be discussed. This lecture series also covers selected fabrication procedures for a variety of implants, including a discussion of phase transformations and thermally activated processes. The biocompatibility of implant materials will be explored. Biocompatibility does not only depend on the chemical composition but also on the surface morphology and critically on the specific host tissue.

After completing the module, students will be able to…
- give an overview of the broad spectra of metallic, polymeric and ceramic biomaterials from the perspective of materials science from the macroscopic to the nanoscopic scale
- explain uses and selection criteria for biomaterials
- express how to exploit the structure-function relationship of materials
- explain different state-of-the-art technologies and methodologies for the analysis of materials
- understand fabrication of biomaterials for medical implants
- understand the concept of biocompatibility
- classify biomaterials according to the response of the biological system.
- justify the importance of physical-chemical analyses for determining biocompatibility.

Comments

-

Course Enrolment

Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published)
Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch

Further Details

FHNW Auxilium -> "Mein Studium"

Last Updated April 04, 2025

C14 / 69469-01

Introduction to LTI-Systems and Control

Module	Biomedical Engineering Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	Assessment format: exam The exam will be held in written form (2.5h). The students will not need any digital tool for problem solving. Accordingly, the allowed tools to bring to the exam is a sheet of hand-written formulas. Otherwise only tools for writing on paper are needed. For convenience, previous exams are provided in the lecture materials for the students to get an idea of the format, content, and complexity of exams.
Workload	3 ECTS
Lecturer(s)	Georg Rauter <georg.rauter@unibas.ch> (Assessor) Nicolas Gerig Cédric Schicklin Carina Schmidt
Course contents	The lecture will be held in inverted classroom format. The lectures for the following week, will be online in form of videos on Tuesday night before the next lecture the Tuesday after. The students are required to watch the lecture and prepare questions until the next lecture in case they need further explanations of the course content. After answering questions, the lecture assistants will perform exercises together with the participants of the course to train and solidify the knowledge from the last lecture. In total, the participants of this course will learn to calculate the time response of a system purely by hand in order to understand the underlying principles of the calculations. The exercises and lectures will be accompanied by exercises also in Matlab to show state of the art tools to the participants in order to appreciate existing solution methods over manual solution. But the basic understanding of linear time-invariant crontrol systems is in the focus so that students get a feeling how control systems work in principle and if results are plausible. Lecture content: Introduction to control systems: open- vs. closed Control schemes LTI-Systems Solution of LTI-Systems Laplace transform State space models: 1st-, 2nd-, and higher order Transfer function Step response Cascaded systems Stability: Asymptotic- and BIBO-stability Back transform Linearization of LTI-Systems BODE diagram Polar plots Root-Locus plots Nyquist stability criterium PID-control (and tuning)
Bibliography (Mandatory / Optional)	Katsuhiko Ogata, Modern Control Engineering, Prentice Hall, 2010 https://www.academia.edu/43692259/Modern_Control_Engineering_Fifth_Edition or http://docs.znu.ac.ir/members/pirmohamadi_ali/Control/Katsuhiko Ogata _ Modern Control Engineering 5th Edition.pdf Chen C. T.: Analog and Digital Control System Design: Transfer-Function, State-Space, and Algebraic

Methods, Saunders College Publishing, 1993
Chen C. T.: Linear System Theory and Design, Saunders College Publishing, 1984
Föllinger O.: Regelungstechnik, 6. Auflage, Oldenbourg Verlag, 1990
Horn M.: Dourdoumas N.: Regelungstechnik, Pearson Verlag, 2004
Kailath T.: Linear Systems, Prentics Hall, 1980
Trentelman, H., Stoorvogel, A. A., Hautus, M.: Control Theory for Linear Systems, Springer, 2001
https://www.tugraz.at/institute/irt/teaching/additional-material
https://matlabacademy.mathworks.com/details/matlab-onramp/gettingstarted

Entry Requirements

Learning Outcome and Competences

The students should become able to analyze simple physical systems and embed them in closed-loop controllers. They should be able to calculate the system's response based on input to the system in the time domain.

In detail, the students should become able to set up Ordinary Differential Equations (ODE) that describe the behaviour of the system that is to be analyzed. In case the ODE is not of linear form, the system will be linearized. Instead of solving the system in time domain, we will use Laplace Transform. Since the system will be embedded in a control circuit, also the control circuit will be set up in Laplace space to obtain the transfer function of the entire system. When input is applied to the system, the system's response in time domain can be calculated. This response in time domain will be obtained using Partial Fraction Decomposition to obtain primitives of transfer functions that can be transformed back to time domain using Laplace Tables.

Also system stability will be analyzed, and cascaded control circuits should be set up to form a solid basis for the next course in the summer semester Applied Control.

Comments

Basics that are relevant for the master studies in Biomedical Engineering:
https://dbe.unibas.ch/en/education/master-of-science/master-program-starting-in-hs-2023/

Course Enrolment

Reg.: course registration, dereg: cancel course registration

Further Details

https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294565

Last Updated

August 13, 2025

C15 / M-SBME-MSc C15

Medical Imaging and Medical Image Processing

Module	Biomedical Engineering Basics
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: no repetition
Assessment Details	• Student presentations, groups of 2-3 (20 %) • Closed book examination at the end of the semester (80 %)
Workload	3 ECTS
Lecturer(s)	Frédéric Bourgeois <frederic.bourgeois@fhnw.ch> (Coordinator)
Course contents	1. Image Formation (Overview imaging modalities, Overview image reconstruction) 2. Basics 3. Image Processing in the Clinic (Image Processing Chain, Data Formats) 4. Image Enhancement in the spatial domain I (Noise, Smoothing) 5. Image Enhancement in the spatial domain II (Template matching, Edges) 6. Image Enhancement in the frequency domain 7. Morphological image processing 8. Image Segmentation 9. Feature extraction (4D images, Optical Flow, Visualization, Surface rendering, Volume rendering, Introduction Image Processing with AI) 10. 4D images 11. Visualization Volume rendering
Bibliography (Mandatory / Optional)	Dougherty, G. (2009). Digital Image Processing for Medical Applications. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511609657
Entry Requirements	Bachelor level of analysis, linear algebra, statistics, basic Matlab and/or Python programming skills
Learning Outcome and Competences	After completing the course, students will be able to • apply image processing methods to basics image analysis problems • understand the typical image processing chains on clinical applications • knowing some advanced image processing methods
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	April 04, 2025

C20 / M-SBME-MSc C20

Sensors and Signal Processing

Module	Biomedical Engineering Basics
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Spring semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment of the group work throughout the semester & report in form of a short scientific paper (100%), groups of 2 to 4. Group work with individual assessment (the own contribution to the group results is evaluated)
Workload	3 ECTS
Lecturer(s)	Joris Pascal <joris.pascal@fhnw.ch> (Coordinator)
Course contents	- System requirements specifications for the development of a sensor system for biomedical applications - Definition of the system requirements specifications - Integrated sensors technologies - Introduction to electromagnetism - State of the art in high precision miniaturized magnetic sensors technologies - Performance assessment of different sensors for their application in biomedical engineering - Signal processing techniques - Analog signal processing techniques for sensors offset and noise reduction - Digital signal processing (digital filters, FFT analysis) - Real time localization algorithm of embedded magnetic sensors - Workshops in laboratory - Design and test of hardware and software with a prototype
Bibliography (Mandatory / Optional)	Relevant scientific papers will be provided to illustrate the state of the art
Entry Requirements	Bachelor level in analysis, linear algebra, electronics and signal processing. Preferably but not mandatory, students have attended to the following lectures during the first semester: C04 Mathematics for Biomedical Engineering C02 Programming Basics with MATLAB C03 Electrical Engineering and Electronics Basics C06 Hardware Programming of Medical Sensors
Learning Outcome and Competences	After completing the module, students will be able to: • understand the requirements for the development of embedded sensors and signal processing for medical devices (e.g. accuracy, long term stability, MRI compatibility) • develop a concept design (a high level description) for the implementation of sensor systems and signal processing for medical devices • select electronic components (e.g. integrated sensors, electronic front end, digital signal processing unit) • define and implement signal processing algorithm on embedded systems
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	December 16, 2025

C21 / 70402-01

Mechanics II: Dynamics

Module	Biomedical Engineering Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Written Exam on the lecture content at the end of the semester (2.5h): 10 points out of 20 possible points Date will be communicated You are allowed to bring one hand-written A4 sheet of formulas for the exam(front and back) No technical aids
Workload	3 ECTS
Lecturer(s)	Georg Rauter <georg.rauter@unibas.ch> (Assessor) Nicolas Gerig Aysegül Kilic Michael Sommerhalder
Course contents	Point kinematics Kinematics of rigid bodies Basics of kinetics Kinetics of rigid bodies Kinetics of the center of mass Energy laws Oscillations The lecture is set up as an inverted class room: The theoretical content of the lectur
Bibliography (Mandatory / Optional)	Karl Wohlhart, Dynamik Grundlagen und Beispiele, Springer Russ C. Hibbeler, Engineering Mechanics, Dynamics, Paerson M. Hiller, Mechanische Systeme: Einführung in die analytische Mechanik u. Systemdynamik, Springer
Entry Requirements	Basics in Mechanics - Statics, C16
Learning Outcome and Competences	Understanding the theory and being able to solve simple problems on the following topics: Point kinematics Kinematics of rigid bodies Basics of kinetics Kinetics of rigid bodies Kinetics of the center of mass Energy laws Oscillations[
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=290093
Last Updated	January 24, 2025

C26 / M-SBME-MSc C26

Medical Device Development

Module	Biomedical Engineering Basics
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Spring semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Case study: written report (75%) and presentation (video recording) (25%)
Workload	3 ECTS
Lecturer(s)	David Hradetzky <david.hradetzky@fhnw.ch> (Coordinator) Thorsten Göttsche Simone Hemm
Course contents	- Identification of stakeholders - Coding / De-coding diagnosis, procedures and reimbursement - Development process for medical devices in compliance with medical standards e.g. EN ISO 13485 - Application of European regulation (MDR) and national laws (MeDO) for medical devices - Conformity assessment procedure, identification and role of involved parties (Notified Bodies) - Application of risk management procedure for medical devices according EN ISO 14971 - Fundamentals in clinical evaluation according EN ISO 14155 - Harmonized standards - Guidance documents (as MEDDEV, NB-MED, MDCG, NBOG, CS) - Post market activities
Bibliography (Mandatory / Optional)	Regulation (EU) 2017/745 on medical devices (MDR) EN ISO 13485 EN ISO 14971 EN ISO 14155 (all documents will be available throughout the course)
Entry Requirements	-
Learning Outcome and Competences	After completing the module, students .. ... will be familiar with the regulations applied for medical device throughout Europe ... will be able to plan, design and run a project for medical device development according to European standards and complying with the Medical Device Regulation ... will be familiar with applying selected risk management procedure according DIN ISO 14971
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	April 05, 2024

C56 / 70411-01

Statistics for Biomedical Engineering

Module	Biomedical Engineering Basics
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement • Presentation at the end of the course of a relevant paper covering statistical methods learned during the lectures (30%) • Exam (70%)
Workload	3 ECTS
Lecturer(s)	Pablo Sinues <pablo.sinues@unibas.ch> (Assessor) Klaus Mayer
Course contents	The course will involve practical statistics and data-analysis techniques relevant in the biomedical engineering field, with a focus on solving biomedical problems. The course will introduce or repeat basic concepts of statistics but will emphasize on the
Bibliography (Mandatory / Optional)	
Entry Requirements	Programming in MATLAB at the level of course “Programming Basics with MATLAB” Programming in Python at the level of course “Programming Basics with Python”/ 69472
Learning Outcome and Competences	After completing the module, students will be able to… • Visualize data using MATLAB and Python. • Summarize data via descriptive statistics. • Use Inferential Statistics. • Perform power and sample size calculations. • Use linear regressio
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=290096
Last Updated	January 24, 2025

C05 / 53772-01

Mathematics for Biomedical Engineering II

Module	Biomedical Engineering Electives
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement - 50% of homework exercises points. - Written exam. - Exam date: July 2024,
Workload	3 ECTS
Lecturer(s)	Edgar Delgado-Eckert <edgar.delgado-eckert@unibas.ch> (Assessor) Georg Schulz
Course contents	Fourier Series, Fourier Transforms, and Laplace transforms and their applications to solving differential equations and image analysis. Systems of coupled linear first-order differential equations. Numerical methods for solving ordinary differential equat
Bibliography (Mandatory / Optional)	Zill - Differential Equations with Boundary-Value Problems, International Metric Edition, 9th edition.
Entry Requirements	Ordinary differential equations and linear algebra (syllabus content of Mathematics for Biomedical Engineering I course, 52055-01).
Learning Outcome and Competences	- Representing functions as weighted infinite sums or integrals of suitable basic functions, such as trigonometric functions (Fourier series and Fourier transforms). - Laplace transforms: Learn how the operations of differentiation and integration can
Comments	Digital media via "Cengage's WebAssign" (https://www.webassign.net/wa-auth/login)
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=290089
Last Updated	January 24, 2025

C22 / M-SBME-MSc C22

Optimization Methods

Module	Biomedical Engineering Electives
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Spring semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	project work
Workload	3 ECTS
Lecturer(s)	Erik Schkommodau <erik.schkommodau@fhnw.ch> (Coordinator) Clément Javerzac
Course contents	The major topics covered in the module are: - identification of problems solvable with optimization methods - abstraction and modelling of task description - coding of optimization tasks - getting overview about linear, non-linear, deterministic and stochastic optimization methods including necessary mathematical methods - implementation of examples from various fields with Matlab
Bibliography (Mandatory / Optional)	- Practical Methods of Optimization Paperback, by R. Fletcher, 2009 - Applied Dynamic Programming (Princeton Legacy Library), by Richard E. Bellman (Author), Stuart E Dreyfus, 2015 - Numerical Recipes: The Art of Scientific Computing, by William H. Press, Saul A. Teukolsky, William T. Vetterling, Brian P. Flannery, 3rd Edition
Entry Requirements	Bachelor level of analysis, linear algebra, statistics; Matlab programming skills There is an online tutorial available for students without Matlab skills
Learning Outcome and Competences	After completing the module, students will be able to: • explain and validate different optimization methods • apply them appropriately to problems in their field (e.g. medical measurement data).
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	December 18, 2025

C24 / 28420-01

Principles in Medical Imaging

Module	Biomedical Engineering Electives
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Multiple Choice Exam
Workload	3 ECTS
Lecturer(s)	Philippe Claude Cattin <philippe.cattin@unibas.ch> (Assessor) Oliver Bieri
Course contents	This course presents the fundamental principles of medical imaging techniques such as magnetic resonance imaging (MRI), X-ray, computed tomography (CT), ultrasound (US), positron emission tomography (PET), and single photon emission computed tomography (S
Bibliography (Mandatory / Optional)	"The Physics of Diagnostic Imaging". David J. Dowsett, Peter A. Kenny, R. Eugene Johnston, Chapman & Hall Medical. "The Essential Physics of Medical Imaging". Jerrold T. Bushberg, J.Anthony Seibert, Edwin M. Leidholdt Jr., John M. Boone, Williams & Wil
Entry Requirements	(C15) Medical Imaging and Medical Image Processing
Learning Outcome and Competences	The objective of this lecture is to introduce the basic physical principles of the imaging systems used in the medical field. The necessary background to understand the imaging devices will be taught.
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=290085
Last Updated	January 24, 2025

C25 / tbd

Angewandte Nano-Wissenschaftssethik

Module	Biomedical Engineering Electives
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: (Re-)registration:
Assessment Details	
Workload	3 ECTS
Lecturer(s)	Roberto Andorno <roberto.andorno@unibas.ch> (Coordinator)
Course contents	
Bibliography (Mandatory / Optional)	
Entry Requirements	
Learning Outcome and Competences	
Comments	-
Course Enrolment	
Further Details	
Last Updated	July 10, 2023

C27 / 70404-01

Bioengineering Basics II

Module	Biomedical Engineering Electives
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Student's presentation & Multiple choice exam (50/50 weight)
Workload	3 ECTS
Lecturer(s)	Pablo Sinues <pablo.sinues@unibas.ch> (Assessor) Valentina Basoli Olivier Braissant Dominik Meinel Götz Schlotterbeck Claudia Weidensteiner
Course contents	Overview to the analytical techniques and instrumentation used clinical chemistry laboratories in hospitals
Bibliography (Mandatory / Optional)	
Entry Requirements	Bioengineering I or a bachelor with a background with content of Bioengineering I
Learning Outcome and Competences	After completing the module, students will be able to understand the basic principles of: • Spectrophotometry • Chromatography and electrophoresis • Electrochemistry • Mass spectrometry • Nuclear magnetic resonance technology and clinical a
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=290094
Last Updated	April 04, 2025

C28 / 54876-01

Applied Engineering in the Hospital and Current Trends

Module	Biomedical Engineering Electives
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Presence: 75% (10/ 14 sessions) to be admitted to the exam. MCP- exam:
Workload	3 ECTS
Lecturer(s)	Philipp Honigmann <philipp.honigmann@unibas.ch> (Assessor) Grzegorz Baumann Alexandre Datta Niklaus F. Friederich Alvaro Gonzalez Jimenez Cristina Granziera Martin T.R. Grapow Raphael Guzman Sven Knecht Lester Melie Garcia Alexander Navarini Marios-Nikos Psychogios Neha Sharma Pablo Sinues Danie
Course contents	3 D Print Breath Analysis Neuro-angiological interventions Thoracic Imaging Cardiac Electrophysiology Application of percutaneous, intravascular techniques in cardiology Bone Workshop DaVinci Neurosurgery- Navigation Technologie
Bibliography (Mandatory / Optional)	
Entry Requirements	Basics of human Anatomy, C60 Limited number of students only, priority will be given to students the Master in Biomedical Engineering.
Learning Outcome and Competences	
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=290092
Last Updated	January 24, 2025

C29 / 48186-01

Laser and Optics in Medicine

Module	Biomedical Engineering Electives
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Practical Work (mandatory) 30%, Quiz 10% and Final oral Exam 60%
Workload	3 ECTS
Lecturer(s)	Ferda Canbaz <ferda.canbaz@unibas.ch> (Assessor) Arsham Hamidi
Course contents	Introduction: Nature of light, fundamentals of light-matter interactions, photobiology, photophysics, photochemistry, laser and light sources. Light-Tissue Interactions: Photochemical interaction, biostimulation, photo-thermal effects, photoa
Bibliography (Mandatory / Optional)	Recommended Reading: Prasad, P.N., “Introduction to Biophotonics”, (Wiley-VCH), 2003 Boudoux, C., "Fundamentals of Biomedical Optics, Niemz, H. M., "Laser-Tissue Interactions" Splinter, R., Hooper, B. A., "An introduction to Biomedical Optics"
Entry Requirements	Physics: electromagnetic theory and quantum mechanics basics, optics, electricity, and mechanics knowledge; Math: Fourier transform Limited student numbers (24), priority given to student in Biomedical Engineering
Learning Outcome and Competences	Students will learn the characteristics of light and lasers, laser-tissue interaction mechanisms, imaging conditions, and basics of 2D and 3D imaging modalities. With practical exercises, students will operate lasers and collect OCT images.
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=290087
Last Updated	January 24, 2025

C30 / M-SBME-MSc C30

Drug Delivery and Combination Products

Module	Biomedical Engineering Electives
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Spring semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	written examination (63%), group work (37%)
Workload	3 ECTS
Lecturer(s)	David Hradetzky <david.hradetzky@fhnw.ch> (Coordinator) Reza Abedian Stephan Affolter Jutta Hotz
Course contents	Introduction (Hradetzky, 1 lesson) Drug delivery basics (Abedian, 4) - Basics in drug delivery, uptake of drugs, mode of action, side effects - Biologics, nano medicine, oligonucleotide, gene therapy Drug development (Abedian, 4) - Clinical development - Roadmap for drugs vs. medical devices Regulations (Affolter, 4) - Lifecycle of healthcare products in EU - Combination products regulation in EU Examples from the industry (if possible, a visit to a manufacturer will be arranged): Coated and impregnated devices (Hotz, 10) - VI and associated devices: history, requirements, kinetics, verification & validation, lab and bench testing , pre-clinical and clinical studies, challenges and pitfalls Devices for self-administration (Affolter, 2, Abedian, 3) - Kinetics, diagnostics, verification & validation, lab and clinical testing, human factor / usability studies, pre-clinical and clinical studies, challenges and pitfalls - Drug delivery history, device technologies, device requirements, trends in drug delivery technology - Software as a medical device, Artificial Intelligence AI in drug delivery
Bibliography (Mandatory / Optional)	
Entry Requirements	Anatomy and Physiology
Learning Outcome and Competences	After completing the module, students will be able to… … understand drug development process, stages and timelines … understand specific requirements of certain molecule types in interactions with delivery devices … develop a sound judgment on the most suitable delivery devices, considering design requirements, needs of certain drug substance and therapeutic areas as well as the target patient groups.
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	December 16, 2025

C31 / 53822-01

Advanced Methods in Medical Image Analysis

Module	Biomedical Engineering Electives
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement written exam
Workload	3 ECTS
Lecturer(s)	Philippe Claude Cattin <philippe.cattin@unibas.ch> (Assessor) Florentin Bieder
Course contents	This course provides an introduction to deep learning and how this cutting-edge technology can be applied to medical image analysis. The course covers the following topics • Fundamentals of deep learning • Numerical optimization (for training machin
Bibliography (Mandatory / Optional)	
Entry Requirements	(C15) Medical Imaging and Medical Image Processing; Python Knowledge similar to course 69472 Limited student numbers, priority given to student in Biomedical Engineering
Learning Outcome and Competences	• Understand the basics of deep learning and how it can be applied to medical image analysis • Understand numerical optimization algorithms used to train deep learning models • Understand the architecture and training of multilayer perceptrons and C
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=290090
Last Updated	January 24, 2025

C32 / M-SBME-MSc C32

Project Management and Intellectual Property

Module	Biomedical Engineering Electives
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Spring semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	project work (2/3 project management 1/2 intellectual property)
Workload	3 ECTS
Lecturer(s)	David Hradetzky <david.hradetzky@fhnw.ch> (Coordinator) Olga Matvienko Markus Renz
Course contents	Project Management (21 lessons) - Introduction - Planning - Execution - Closure - PM in BME: Medical Device Development, Healthcare IT, Research (case studies)Advanced PM topics: Project Portfolio Management, Agile Project Management, Leadership in Project Management, Strategic Project Management, International Project Management, Capstone Project - Professional Development and Ethics: Ethics in Project Management, Professional Development for Project Managers, Project Management Certification Intellectual Property (7) - Overview - Legislation: Copyright, Patent, Trademark, Traded Secret
Bibliography (Mandatory / Optional)	
Entry Requirements	
Learning Outcome and Competences	Learning outcomes • Project Planning: Develop proficiency in creating comprehensive project plans, including defining scope, schedules, budgets, and risk assessments. • Team Leadership: Acquire leadership skills to effectively manage and lead multidisciplinary teams • Risk Management: Demonstrate the ability to identify, assess, and manage risks associated with complex projects. • Communication Skills: Enhance communication skills for project stakeholders, including effective reporting, presentation, and documentation practices. • Understand IP Basics: Develop a foundational understanding of intellectual property laws, including patents, trademarks, and copyrights. • IP Strategy: Gain insights into formulating effective intellectual property strategies for protecting and managing innovations throughout their life cycle. • Patent Analysis: Acquire skills in conducting patent analyses, including searching, reading, and interpreting patents. Competences • Effective Collaboration: Collaborate efficiently with diverse stakeholders, integrating engineering expertise with project management principles to achieve project goals. • Resource Optimization: Optimize resources, both human and material, to ensure the successful completion of projects within time and budget constraints. • Adaptability: Develop adaptability and flexibility in responding to challenges and changes, applying agile project management principles when appropriate.

	• Strategic Decision-Making: Make informed decisions regarding the protection and commercialization of intellectual property. • IP Portfolio Management: Effectively manage and strategize intellectual property portfolios, considering business goals and market dynamics. • Ethical Considerations: Demonstrate an understanding of ethical considerations related to project decision-making and intellectual property.
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	June 25, 2025

C34 / M-SBME-MSc C34

Model-Based Signal Processing and Medical Diagnostics

Module	I. Medical Systems Engineering
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Spring semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Exercises or group works during the semester (20%) and written exam at semester end (80%).
Workload	3 ECTS
Lecturer(s)	Reto Wildhaber <reto.wildhaber@fhnw.ch> (Coordinator)
Course contents	- Bioelectrical Signals and Physical Measurements in Diagnostics: - Pathophysiology of selected cardiovascular, respiratory, and neuromuscular diseases. - Diagnostic methods based on bioelectrical signals such as: ECG (Electrocardiography), icECG (Intracoronary Electrocardiography), esoECG (Esophageal Electrocardiography), and others. - Diagnostic methods based on physical measurements such as: blood pressure, blood flow, blood gas, and air flow signals. - Fundamentals on Model-Based Signal Analysis: - Introduction to linear filters - Introduction to model-based signal analysis - Working in a least-squares framework - From sample to feature spaces - Feature space manipulations - Pattern detection, localization, and discrimination; recursive pattern matching - Parameter estimation in feature space - Distance measures and signal clustering/classification in feature space - Exercises and Practical Applications: - Analysis of physiologic and pathologic ECG signals (examples): - Extraction of heart rate and heart rate variability - P-, T-, and QRS-wave detection and discrimination - Identification of wave onsets and durations - Detection of arrhythmia, clustering of heart beat morphologies - Analysis of invasive blood pressure signal recordings: - Robust extraction of features in noisy signals such as minimum and maximum, notches, slopes, etc.
Bibliography *(Mandatory / Optional)*	Course material: - Lecture script & (some) slides, selected book chapters. Course references (optional): - R. A. Wildhaber et al., Signal Detection and Discrimination for Medical Devices Using Windowed State Space Filters, Biomedical Engineering (BioMed 2017), DOI: 10.2316IP.20J7.852-020 - M. Vetter et al., Foundations of Signal Processing, Cambridge University Press(selected chapters) - Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006 (selected chapters) - J. Enderle, J. Bronzino, Biomedical Engineering, 3rd Edition, Elsevier, 2012 (Only selected chapters) - R. A. Wildhaber et al., Windowed State-Space Filters for Signal Detection and Separation, IEEE Transactions on Signal Processing (Volume: 66, Issue: 14, July 15, 2018)
Entry Requirements	- Basic background in linear algebra and probability theory. - Basic programming skills in Python (or Matlab). - A background in human physiology.

Learning Outcome and Competences	After completing the module, students will be able to… - understand bioelectric signals and how they are induced. - know some example diseases of the cardiovascular and pulmonary system and the purposes of diagnostic measurements and devices. - understand diagnostic tools that rely on bio(electrical) signals or dynamic pressure or flow measurements. - assess the quality of observed signals and is aware of most relevant signal artefacts. - understands the concepts of linear and non-linear filters. - understanding the concepts of time-domain and frequency-domain filtering - understands the concepts of model-based signal processing in a least-squares error framework. - understands complex model designs. - knows methods to detect known signal templates, such as ECG waves of particular shape, in a noisy and interfered signal. - knows methods to deal with superimposed signals (e.g., bioelectrical signals superimposed by some baseline artefacts). - knows methods to extract features from a biological signal. - knows how to take advantage of multi-channel signals.
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	March 13, 2025

C35 / 48882-01

Applied Control

Module	I. Medical Systems Engineering
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement At the end of the semester, there will be a written exam (1h), where the students need to reach at least 10 out of 20 points to pass. The exam will focus on demonstrating the understanding basic the concepts of control that were covered in the lecture.[NS
Workload	3 ECTS
Lecturer(s)	Georg Rauter <georg.rauter@unibas.ch> (Assessor) Nicolas Gerig Murali Krishna Karnam Cédric Schicklin Carina Schmidt
Course contents	The lecture is split into a lecture part, where students learn theoretical aspects on control, use them in exercises, and a practical part where they apply their knowledge on a real robotic system in group projects. The lectures are taught in an inverted
Bibliography (Mandatory / Optional)	Control Systems 1 (IRT at TU-Graz, Austria) https://www.tugraz.at/institute/irt/lehre/ergaenzende-informationen/control-systems-1/ Control Systems 2 (IRT at TU-Graz, Austria) https://www.tugraz.at/institute/irt/lehre/ergaenzende-informationen
Entry Requirements	Students should have prior knowledge on basic control theory: required course (or equivalents): 69469 - Introduction to LTI-Systems and Control 55664-01 - Blockkurs: Hands-on Introduction to Medical Robotics Hardware (is highly recommended)
Learning Outcome and Competences	The goal is to make students aware of a variety of different control principles for linear time-invariant systems (LTI-systems), their advantages and disadvantages. The knowledge is supported by practical examples tested in Matlab/Simulink and TwinCAT3 on
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=290088
Last Updated	January 24, 2025

C36 / M-SBME-MSc C36

Modelling and Simulation

Module	I. Medical Systems Engineering
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Spring semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	- Case studies - Presentation
Workload	3 ECTS
Lecturer(s)	Daniel Seiler <daniel.seiler@fhnw.ch> (Coordinator) Norbert Hofmann nn Nn Simon Zimmermann
Course contents	Approach: Simulation in product development, simulation tools. Finite element modelling: Abstraction, element properties, meshing, boundary conditions, loads and material models. Calculation: solution algorithms, convergence. Result evaluation: interpretation, verification and validation. Application areas: structural mechanics, fluid flow, heat transfer, chemical reactions, electrodynamics, acoustics.
Bibliography (Mandatory / Optional)	tbd
Entry Requirements	Basic in physics, mathematics
Learning Outcome and Competences	- know the mathematical basics of the finite element method (FEM) - understand the relevant sub-steps such as abstraction of reality - know the technical limitations of FE programmes - can create FE models, carry out the calculation and evaluate them - can interpret and verify the FEM results
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	April 14, 2025

C37 / M-SBME-MSc C37

Biofabrication and Biohybrid Systems

Module	II. Biomaterials Science and Engineering
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Spring semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Project work delivered by the end of the module: written report (60%) oral presentation (40%)
Workload	3 ECTS
Lecturer(s)	Maurizio Gullo <maurizio.gullo@fhnw.ch> (Coordinator)
Course contents	- Theory (26 lessons in presence) - Water as a biomaterial, Hydrogels, Cell material interaction, Cell injury. ECM andbiomimicry, Engineering with biological material, - Fabrication methods – Macro/Bioprinting, Inks, Biological building blocks, Vascularstructures, Complex multicellular tissues - Fabrication methods – Micro/Single cell, Polymer microfabrication methods, Sigle cell manipulationmethods, Engineering with single cells - Applications: Cochlea implants, Retina implants, Deep brain stimulation implants, Prostaticreplacement tissue, Cardiac supporting tissue, Skin tissue, tooth implants, biohybrid micro robots,biohybrid limbs - Exercises (6 lessons in presence) - Weekly or by weekly sessions to repeat and assess the knowledge transfer - Project work (10 lessons online) - Group work on a specific topic with report and presentation as output
Bibliography (Mandatory / Optional)	tbd
Entry Requirements	Basic physics and chemistry
Learning Outcome and Competences	After competition of the module the students will … Understand the different biological building blocks in bio fabrication Understand cell material interaction Understand hydrogel chemistry and ECM mimicry Understand cell/tissue repair processes at the micro scale Choose material and processes involved in biohybrid systems Know about sate of the art bio fabrication methods
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	March 13, 2025

C38 / 70410-01

Characterizing Materials in Medicine: Nanoscience

Module	II. Biomaterials Science and Engineering
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Answers to tutorial questions, reports on experiments and PSI visit, rapid-fire presentation plus discussion
Workload	3 ECTS
Lecturer(s)	Bert Müller <bert.mueller@unibas.ch> (Assessor) Hans Deyhle Mattia Humbel Iwan Jerjen Zarah Korb Bekim Osmani
Course contents	Introduction to the nano-structural characterization of human tissues and medically relevant materials, contact-angel measurements and small-angle X-ray scattering experiments Introduction to electron microscopy and energy dispersive X-ray spectroscopy
Bibliography (Mandatory / Optional)	
Entry Requirements	Mandatory: (C13) Materials in Medicine and Biomaterials, Basics in Mathematics similar knowledge to 52055-01 (C04), Recommanded to register to: C05/53772-01 and C21/70402-01, Nice to have: C16/ 69471 Basics in Mechanics: Statics und C56/70411-01 Bas
Learning Outcome and Competences	The students will become familiar with state-of-the art instrumentation for the characterization of medically relevant materials down to the molecular scale. Under supervision, they will carry out selected experiments and analyze their results. The relate
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=290095
Last Updated	January 24, 2025

C39 / 54000-01

Materials in Medicine: Tissue Regeneration

Module	II. Biomaterials Science and Engineering
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement continuous assessment Presentation on a selected topic, laboratory performance, laboratory report
Workload	3 ECTS
Lecturer(s)	Srinivas Madduri <srinivas.madduri@unibas.ch> (Assessor) Bert Müller Guido Sigron
Course contents	Introduction to bioengineering and tissue characterization Tailoring biomaterials and their tissue interface for regenerative medicine, Polymeric and cellular drug delivery for tissue regeneration, Bioengineering of tissues and entire organs,
Bibliography (Mandatory / Optional)	
Entry Requirements	Basics in materials science (C13)
Learning Outcome and Competences	The students will learn how to scientifically discuss the interdisciplinary subject of tissue regeneration exploiting state-of-the art literature. Based on a sound introduction and supervision, - within a workshop style - the students will treat with pre-
Comments	Limited number of students only Priorities: Students of the Master in Biomedical Engineering Strong recommendation to combine this course with Characterizing Materials in Medicine: Nanoscience, 70410-01
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=290091
Last Updated	January 24, 2025

C44 / 53826-01

Computer-Assisted Surgery

Module	A. Computer- and Robot-Assisted Medicine
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement 30 min oral exam individual exam slot will be communicated via email
Workload	3 ECTS
Lecturer(s)	Philippe Claude Cattin <philippe.cattin@unibas.ch> (Assessor) Sidaty El Hadramy
Course contents	In this course, students will learn about the most recent advances in the use of computers to aid in planning and executing surgeries. Focus will be on the general concepts of Computer-Assisted Surgery (CAS) systems.
Bibliography (Mandatory / Optional)	
Entry Requirements	
Learning Outcome and Competences	
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294559
Last Updated	August 06, 2025

C45 / M-SBME-MSc C45

Fundamentals in Robotics

Module	A. Computer- and Robot-Assisted Medicine
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	written examination
Workload	3 ECTS
Lecturer(s)	Erik Schkommodau <erik.schkommodau@fhnw.ch> (Coordinator)
Course contents	Mathematical tools describing mechanical systems (coordinate transformations, Jacobi Matrix, Bezier splines, quaternion) forward and backward transformation of serial robotic system - Denavit-Hartenberg notation - path generation - dynamic descriptions Practical exercise (6 lessons) - safety considerations - introduction to Stäubli programming language (offline and online programming of Stäubli TX60)
Bibliography (Mandatory / Optional)	Books - Craig, J.: Introduction to Robotics. Mechanics and Control. Reading (Mass.): AddisonWesley, 2005 - Canudasde Wit, C.; Siciliano, B.; Bastin, G. (Eds.): Theory of Robot Control. London: Springer-Verlag, 1996 - Sciavicco, L.; Siciliano, B.: Modelingand Control of Robot Manipulators. New York: McGraw Hill, 1996 - Spong; M.W.; Vidyasagar, M.: Robot Dynamicsand Control. New York: John Wiley, 1989 Journals: • The International Journal of Robotics Research • IEEE Journal of Robotics and Automation • IEEE Transactionson Mechatronics
Entry Requirements	• bachelor level of engineering/informatics • basic programming skills in MATLAB
Learning Outcome and Competences	After completing the module, students will be able to… • understand kinematics of robots • apply mathematical tools to describe behaviour of mechanical systems using matlab • program an industrial robot • understand limits of robotical systems • know standard procedures of robots
Comments	The date of the practical exercise will be announced at the beginning of the lecture.
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	May 28, 2025

C47 / 70409-01

Medical Robotics

Module	A. Computer- and Robot-Assisted Medicine
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Closed book examination at the end of the semester (50 %): Exam date: tbd Exam Location: tbd Lab group project presentation 20 minutes and report hand-in (50%)
Workload	3 ECTS
Lecturer(s)	Nicolas Gerig <nicolas.gerig@unibas.ch> (Assessor) Murali Krishna Karnam Ruben Martin Rodriguez Georg Rauter
Course contents	Course contents Lecture (Nicolas Gerig, 26 (13x2) lessons) • presentation/discussion of a medical robot example from the market or research each week. • classifications of different devices fields of medical robots • actuation and control principles • digital and cascaded control • control paradigms • multi-objective control realizations • principles and application of sensory fusion • haptic rendering • continuum and soft robotics Practical exercise in form of semester accompanying group projects (supervised by Nicolas Gerig and/or assistants, ~13 update meetings) • practical group work (2-3 students) on a related challenging topic (e.g. multi-objective control, sensory fusion) with robotic demonstrator or haptic user interfaces at the BIROMED-Lab.
Bibliography (Mandatory / Optional)	Bibliography Books • Schweikard, A / Ernst, F.: Medical robotics, Springer 2015 • Siciliano, B. / Khatib, O. (Eds.): Springer Handbook of Robotics, Springer 2016 • Corke, P.: Robotics, vision and control: fundamental algorithms in MATLAB, Springer 2011
Entry Requirements	• bachelor level of engineering/informatics • basic programming skills in MATLAB and the ability to adapt to other programming languages. • basic knowledge on control system modelling (C14 “Introduction to LTI Systems and Control) • basic knowledge of digital signal acquisition and filtering (C20 “Sensors and Signal Processing”) • experience on applying closed-loop feedback control (C35 “Applied Control”) • basic knowledge on serial robot kinematics or concurrent enrolment in C45 “Fundamentals in robotics"
Learning Outcome and Competences	After completing the module, students will be able to… • classify different types of medical robots (surgical robots, robotic prosthetics/orthoses, assistive devices, rehabilitation training devices, medical simulators). • remember covered examples from industry and research. • understand the functionality of covered medical robots. • remember different actuation principles and their benefits/limitations. • understand limitations of digital control. • design control charts reflecting cascaded feedback control loops. • compare different control paradigms (such as Position vs. Force control, Impedance vs. Admittance control, dynamics-based vs. kinematic control).

	• implement simple feedback controllers and tune their parameters. • evaluate different forms of user-robot interaction. • understand challenges of multi-objective control. • implement state estimation based on sensory fusion from multiple sensors with different update rates and delays • understand basic motion modelling of continuum robot segments • obtain first practical experience implementing solutions to a medical robotics related challenge
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294571
Last Updated	August 06, 2025

C48 / 27584-01

Digital Dentistry

Module	B. Image Acquisition and Analysis
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Exam type: Written answers of the tutorial questions and reports on experiments.
Workload	3 ECTS
Lecturer(s)	Georg Schulz <georg.schulz@unibas.ch> (Assessor) Hans Deyhle Andres Izquierdo Romy Marek Bert Müller Guido Sigron Christine Tanner
Course contents	Introduction to oral health from the clinical and engineering/research points of view, Fundamentals of hard X-ray imaging: Micro- and nanostructure of human crowns in health and disease, Ex vivo characterization of a human crown with a caries lesion: Excise at micro computed tomography system (SkyScan 1275), Mechanical removal of the caries-affected hard tissue, Ex vivo characterization of a human crown after removal of the caries lesions: Excise at micro computed tomography system, Preparation of dental fillings ex vivo using preselected materials, Ex vivo characterization of a human crown with dental filling: Excise at micro computed tomography system, Intraoral scanners: Function and accuracy, Intraoral scanners: Correct handling and training, Current and future aligner treatments, Devices to train the tongue muscles: Principles, medical applications and beyond, Studying the efficacy of bone graft materials and mineralization in jaw bone and teeth, Segmentation and data registration for the quantitative evaluation of the dental fillings,
Bibliography (Mandatory / Optional)	
Entry Requirements	
Learning Outcome and Competences	The students will become familiar with the dentistry-related human anatomy and restoration treatments. They will acquire knowledge on state-of-the-art dental materials and technologies applied in well-equipped dental offices and learn how to quantitatively characterize crowns and dental materials using a microtomography system and an intraoral scanner. The students will learn to efficiently communicate with dentists and medical doctors. Finally scientific and commercial activities will be presented related to current challenges in dental research.
Comments	Max number of students: 12 Priorities: Master students in Biomedical Engineering
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294525
Last Updated	August 06, 2025

C49 / 53824-01

Magnetic Resonance Imaging

Module	B. Image Acquisition and Analysis
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Written exam (a mix of multiple choice "Kprim", single possible questions "Apos" and descriptive questions)
Workload	3 ECTS
Lecturer(s)	Grzegorz Baumann <g.baumann@unibas.ch> (Assessor) Oliver Bieri Francesco Santini Claudia Weidensteiner
Course contents	The course gives an overview of Magnetic Resonance Imaging (MRI) which is a non-invasive and ionizing radiation free diagnostic imaging technique that has found widespread applications in clinical routine and research. In this course we will first introduce the fundamentals of MR physics including: nuclear spin, magnetic moments, magnetization, radiofrequency pulse excitation and relaxation processes, which will be followed by topics related to MRI hardware and safety. We will discuss basic concepts of pulse sequences, spatial encoding, k-space and image formation. The final portion of the course will introduce specialized applications such as cardiovascular imaging, spectroscopy, diffusion weighted imaging and functional brain MRI, image artifacts as well as advanced image reconstruction techniques.
Bibliography (Mandatory / Optional)	From Picture to Proton“ von Cambridge University Press.
Entry Requirements	The course is recommended for students who completed the Principles in Medical Imaging.
Learning Outcome and Competences	Upon completion of the course students should have understanding of: - the physical principles of nuclear magnetic resonance - MRI unit and its safety aspects - magnetization excitation and relaxation processes - generation of image contrasts - creation of spin and gradient echo including schematics of basic pulse sequences - spatial encoding and k-space - image reconstruction - spectroscopy Furthermore students should be able to demonstrate knowledge of more advanced MRI techniques including: diffusion weighted imaging, functional brain MRI and cardiovascular imaging as well as examples of its applications.
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294557
Last Updated	August 06, 2025

C51 / 70407-01

Forensic Imaging

Module	B. Image Acquisition and Analysis
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement • Attendance of lectures (80% to pass) • Exercises (during semester) (80% filled out to pass) • Scientific poster preparation (2/3 of grade) • Poster presentation (to be presented at the corresponding session during semester) (1/3 of grade)
Workload	3 ECTS
Lecturer(s)	Claudia Lenz <claudia.lenz@unibas.ch> (Assessor) Dominique Neuhaus Andrea Zirn
Course contents	Introduction • General introduction to forensic medicine Basic Research Tools • Literature research, referencing • Scientific poster preparation X-ray & CT • X-ray of living subjects in forensic medicine: general introduction, imaging tools, age estimation, fracture dating • Post mortem CT in forensic medicine: indication list, identification, research projects (automatic registration & detection of causes of death) • Exercises and poster presentations MRI • MRI of living subjects in forensic medicine: general introduction, strangulation, research projects • Post mortem MRI in forensic medicine: potential, pitfalls, research projects • Exercises and poster presentations Forensic Photography • General introduction to daylight & infrared photography, application in forensic medicine • Exercises and poster presentations Histology • General introduction, forensic applications • Exercises and poster presentations Biomechanics • General introduction, biomechanical models based on CT or MRI • Exercises and poster presentations
Bibliography *(Mandatory / Optional)*	
Entry Requirements	• Medical Image Processing • Principles in Medical Imaging Further required competences: • Programming basics in Matlab & Python

	• Basic knowledge in literature research & research methodologies
Learning Outcome and Competences	After completing the module, students will be able to… • Have an overview of current applied and future potential methods in forensic imaging • Differentiate forensic and clinical applications • Have an overview of the discussed research tools • Explain and compare application of X-ray & CT in forensic medicine for living and post mortem subjects • Analyze X-ray & CT imaging data • Explain and compare application of MRI in forensic medicine for living and post mortem subjects • Analyze MRI imaging data • Explain and compare application of Infrared (IR) photography • Analyze IR data • Have an overview of the different biomechanical challenges in forensic medicine • Analyze histological images • Explain and evaluate different biomechanical models based on CT imaging • Analyze imaging data of biomechanical challenges • Evaluate / discuss and create poster on a relevant course topic
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294569
Last Updated	August 06, 2025

C63 / 70408-01

Applied Methods in Forensic Genetics and Forensic Toxicology

Module	B. Image Acquisition and Analysis
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement • Presentation on selected topics of 10 minutes on last lecture blocks, groups of 2 (50%) • Written outline of presentation, including literature study (50%)
Workload	3 ECTS
Lecturer(s)	Iris Schulz <iris.schulz@unibas.ch> (Assessor) Urs Duthaler Götz Schlotterbeck Janine Schulte Alina Senst Anna Stoll
Course contents	Course contents Forensic Toxicology: Theme 1 Analytical methods in Forensic Toxicology (2h) • Analytical tools: LC-MS/MS, GC-MS/MS, Immunoassays… • Advantages and limitations Theme 2 Driving under the influence of alcohol and drugs (4h) • Biological matrices, sample preparation and measurement • Blood alcohol, limits, regulations • Relevant drugs, limit substances Theme 3 Hair analysis (2h) • Dealing with hair samples in the forensic context • Application of hair testing in abstinence control and crime case works Theme 4 New psychoactive substances (NPS) and knockout substances (2h) • Analytical tools to assess various compound classes • Case studies Forensic Genetics: Theme 1 Biological basis and current applied DNA analysis (4h) • Tasks of forensic genetics: trace, relationship and identification analyses • Human genome, structure and polymorphism; autosomal and gonosomal DNA short tandem repeats • DNA analysis methods: Immunological pre-tests, microscopy, staining, and differential lysis (DL), extraction, amplification and capillary electrophoresis, profile interpretation (biostatistics, database), law • RNA markers and mtDNA sequencing and their applications Theme 2 Specific DNA and RNA applications (3h) • Single cell isolation: Laser-Capture Microdissection (LCM), DEPArray and microfluidic principles, Flow-Cytometry (DEPArray) • Benefits and limits of classical (DL, LCM) and state-of-the-art technologies • RNA profiling and body fluid identification Theme 3 Future Methods (3h) • Principle of DNA sequencing • Pyrosequencing and Next Generation Sequencing • Phenotyping, biogeographic and age estimation
Bibliography *(Mandatory / Optional)*	
Entry Requirements	The course is designed for students holding a Bachelor’s degree of various backgrounds like

	engineering, natural sciences, computer sciences, medicine or health sciences
Learning Outcome and Competences	After completing the module, students will be able to… • possess scientific knowledge of the fundamental principles underlying forensic toxicology and forensic genetics. • know state-of-the-art technologies and future trends in forensic toxicological and forensic genetic methods, including their advances and limitations. • apply acquired knowledge to use existing instrumentations and techniques in forensic practices, and contribute to the development of new methodologies. • can clearly, effectively and concisely present their results to peers as well as to the public in written and oral form according to scientific standards.
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294570
Last Updated	August 06, 2025

C41 / M-SBME-MSc C41

Neurotechnologies

Module	C. Diagnostics and Therapeutic Technologies
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	- written exam at semester end (100%)
Workload	3 ECTS
Lecturer(s)	Simone Hemm <simone.hemm@fhnw.ch> (Coordinator) Indrit Bègue Raphael Guzman Alois C. Hopf Marcello Ienca Dorian Vogel
Course contents	Neurophysiology - signal generation and propagation in the brain Electrophysiological mapping - Microelectrode recording, single unit recording - Local field potentials - Electrocorticography - Electroencephalogram/ Event related potentials - Magnetoencephalography - Optics for mapping Neurostimulation methods - Transcranial magnetic stimulation - Transcranial alternating current stimulation - Transcranial direct current stimulation - Peripheral nerve stimulation (vagus nerve, spinal cord) Deep brain stimulation - DBS Surgery - Technology - Atlases, Group analysis - Electric field Modelling - Stem Cell Therapy - Lab: Stereotactic planning Brain computer interfaces - Neurofeedback / Training - Machine control, Protheses, orthosis, communication - Lab: BCI Neuroethics
Bibliography (Mandatory / Optional)	- Lecture slides, selected book chapters, papers suggested for paper reviews
Entry Requirements	Defined entry level - Basic knowledge on signal processing and image processing are a prerequisite to follow this course - basic knowledge in brain anatomy and physiology would be helpful but not mandatory
Learning Outcome and Competences	After completing the module, students will be able to… - understand the signal generation and propagation in the brain - know the different electrophysiological signals used for brain mapping and stimulation - know and understand different brain mapping techniques, neurostimulation methods and brain computer interfaces

	- know methods used for signal and data processing - know exemplary techniques used to analyse patient data to increase knowledge about mechanism of actions of stimulation - apply exemplary systems for diagnose and therapy - knows neuroethical concerns
Comments	The date of the practical exercise will be announced at the beginning of the lecture.
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	July 04, 2025

C42 / 52059-01

Clinical Biomechanics

Module	C. Diagnostics and Therapeutic Technologies
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement Data collection workshop mandatory at UKBB or USB and Exam: Exam Format: written exam (once per year, every autumn semester) Exam Duration: 1.5 hours (multiple choice questions) Exam date:tbd
Workload	3 ECTS
Lecturer(s)	Heide Elke Viehweger <heideelke.viehweger@unibas.ch> (Assessor) Matilde Bertoli Linda Bühl Lauren Stephanie Waiman Chee Eleonora Croci Beat Göpfert Sébastien Muheim Annegret Mündermann Corina Nüesch Barbara Elisabeth Postolka Jacqueline Romkes Morgan Sangeux Michèle Widmer
Course contents	Introduction Clinical Biomechanics Normal Walking and Observational Analysis Healthy Gait Kinematics: Clinical background Healthy Gait Kinematics: Mechanical understanding Inertial measurement units and their clinical utility and challenges Robotics in clinics Recap muscle physiology, Electromyography and its clinical application Kinetics: The kinetics of normal gait Kinetics: Mechanical background Musculoskeletal Modelling in clinical application Clinical applications (lower limb, knee) Clinical applications (foot, spine) Clinical applications Course wrap up; Q & A
Bibliography (Mandatory / Optional)	BAKER, R., & HART, H. M. (2013). Measuring walking a handbook of clinical gait analysis. London, Mac Keith Press. http://site.ebrary.com/id/10705870. WINTER, D. A. (2009). Biomechanics and motor control of human movement. Hoboken, New Jersey, John Wiley & Sons Armand S, Sawacha Z, Goudriaan M, Horsak B, van der Krogt M, Huenaerts C, Daly C, Kranzl A, Boehm H, Petrarca M, Guiotto A, Merlo A, Spolaor F, Campanini I, Cosma M, Hallemans A, Horemans H, Gasq D, Moissenet F, Assi A, Sangeux M. Current practices in clinical gait analysis in Europe: A comprehensive survey-based study from the European society for movement analysis in adults and children (ESMAC) standard initiative. Gait Posture. 2024 Jun;111:65-74. doi: 10.1016/j.gaitpost.2024.04.014. Epub 2024 Apr 22. PMID: 38653178. Campanini I, Disselhorst-Klug C, Rymer WZ, Merletti R. Surface EMG in Clinical Assessment and

Neurorehabilitation: Barriers Limiting Its Use. Front Neurol. 2020 Sep 2;11:934. doi: 10.3389/fneur.2020.00934. PMID: 32982942; PMCID: PMC7492208.

Entry Requirements

Participation to the following modules:
- «minimal requirements» Basics in Physiology and Anatomy (C08 OR C60 OR C61) AND Basics in Maths and Mechanics (C04 AND C16)
- «recommended requirements»: Extended knowledge in Maths and Mechanics (C05 and C21)
- «nice to have»: Basics in Statistics C56

Learning Outcome and Competences

Motion Capture Principles: Students will gain an understanding of how a center of motion capture is set up in a clinical setting. They will gain an insight into the process of preparing laboratory equipment and data acquisition in a hospital environment.

Motion Data Interpretation: By examining gait patterns and biomechanical parameters collected using various applications/technologies of clinical motion analysis, students gain a deeper understanding of human movement. Through examining a variety of cases from the fields of orthopaedics, neuroorthopaedics, sports and everyday life, students develop the ability to interpret movement data and identify abnormalities and their clinical consequences.

Knowledge on Technical Applications in Clinical Motion/Gait Analysis: Students become familiar with the technical applications commonly used in clinical motion and gait analysis. Moreover, they learn which applications provide certain types of data, and gain insight into the complexity of motion data analysis. Additionally, students explore how biomechanical parameters are calculated and learn to navigate the challenges and limitations inherent in data collection systems.

Transfer of Clinical Interpretation Knowledge: Through case studies, students learn to transfer their interpretation knowledge to different scenarios. By applying their understanding of biomechanical principles to various cases, students develop the ability to adapt their analytical skills to diverse clinical settings.

Comments

Data collection workshop mandatory at UKBB or USB: individual organization with lab coordinators from the hospitals, one single attendance needed (Responsible organizer: UKBB - beat.goepfert@unibas.ch; USB – c.nueesch@unibas.ch). The laboratory workshops at the UKBB will take place on specific Friday afternoons, which are announced at the beginning of the semester. The USB laboratory workshops will be announced at the beginning of the course. There will be several sessions to choose from.

Course Enrolment

Reg.: course registration, dereg: cancel course registration

Further Details

https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294554

Last Updated

August 06, 2025

C43 / 53823-01

Biomedical Acoustics

Module	C. Diagnostics and Therapeutic Technologies
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture with practical courses
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement 30 min oral exam, individual exam slot will be communicated by email
Workload	3 ECTS
Lecturer(s)	Christof Stieger <christof.stieger@unibas.ch> (Assessor) Hans Bernhard Yves Brand Tania Rinaldi Barkat
Course contents	ANATOMY AND PHYSIOLOGY OF THE HUMAN EAR BASIC ACOUSTICS HEARING LOSS AND SUBJECTIVE AUDIOMETRY OBJECTIVE AUDIOMETRY ELECTROACOUSTICS TRANSDUCER DESIGN CONVENTIONAL HEARING AIDS COCHLEAR IMPLANTS SURGICAL OR BIOLOGICAL REHABILITATION UPPER PATHWAYS PSYCHOACOUSTICS / BINAURAL HEARING
Bibliography (Mandatory / Optional)	
Entry Requirements	Limited number of students only, priority will be given to students of the Master in Biomedical Engineering.
Learning Outcome and Competences	
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294556
Last Updated	August 06, 2025

C53 / 53825-01

Technologies in Regenerative Surgery

Module	D. Implants and Regenerative Technology
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Lecture
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement - Written exam, Multiple Choice Questionnaire (MCQ), 1 hour - Attendance 9/12 lectures - Presentations by Students; mandatory
Workload	3 ECTS
Lecturer(s)	Arnaud Scherberich <arnaud.scherberich@unibas.ch> (Assessor) Martin Ehrbar Benjamin Gantenbein Andres Garcia-Garcia Alexander Haumer Ivan Martin Marcus Mumme Manuele Giuseppe Muraro Karoliina Pelttari-Göritz Florian Markus Thieringer
Course contents	Students will gain fundamental knowledge on regenerative surgery and its related aspects. Regenerative surgery is an interdisciplinary and rapidly emerging field of research and clinical applications aiming to repair, replace, or regenerate tissues or organs, with the goal of restoring loss of function due to congenital defects, diseases, damage/trauma or aging.
Bibliography (Mandatory / Optional)	
Entry Requirements	
Learning Outcome and Competences	
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294558
Last Updated	August 06, 2025

C54 / M-SBME-MSc C54

Biointerface Engineering

Module	D. Implants and Regenerative Technology
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	• Written exam, 90 minutes
Workload	3 ECTS
Lecturer(s)	Michael de Wild <michael.dewild@fhnw.ch> (Coordinator) Endre Horvath Bert Müller Guido Sigron Madduri Srinivas
Course contents	01: Introduction, presentation and overview of the lecture and lecturers (de Wild/Müller/Madduri, 2) 02: Tissue-material interface and interactions (Madduri, 2) 03: Biomaterials, biocompatibility and bio-interfaces. Principles of surface-tissue interactions (Madduri, 2) 04: Concept and testing of bio- and haemocompatibility, ISO 10993, classes of biomaterials. Classification of biomaterials according to the reaction of the biological system. Biologically relevant structures from the nm- to the mm length scale. Spatial-temporal behaviour of the tissue-material interface during osseointegration. Physico-chemical, in-vitro, in-vivo and clinical assessments (de Wild, 2) 05: Surface modification techniques using physical and chemical strategies (Müller, 2) 06: Micro- and nano-structuring techniques (Müller, 2) 07: Chemical, physical, mechanical, thermal, optical, plasma-technical, electrochemical methods to (bio)chemically and topographically modify und functionalize surfaces of biomaterials (de Wild, 2) 08: Experimental systems for analysis surface roughness, chemistry, tribology; porosity, defects, coatings (de Wild, 2) 09: Tailoring biomaterials for regenerative medicine (Madduri, 2) 10: Bio-inspired implants (Müller, 2) 11: Protein-resistance and biochemical functionalization (de Wild, 2) 12: Biofilm: formation, clinical consequences, treatments (de Wild, 2) 13: Clinical emergence, treatments (Müller/Sigron, 2) 14: Summary and Repetition (de Wild/Müller/ Madduri, 2)
Bibliography (Mandatory / Optional)	- Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen and Jack E. Lemons: "Biomaterials Science: An Introduction to Materials in Medicine", 2nd edition, Elsevier Academic Press. - H.M. Grandin, M. Textor, G.M. Whitesides, “Intelligent Surfaces in Biotechnology”, Wiley-vch, ISBN: 978-0-470-53650-6. - J. Breme, R. Thull, C.J. Kirkpatrick, “Metallic Biomaterial Interfaces”, Wiley-vch, ISBN 978-3-527-31860-5.
Entry Requirements	Defined entry level • Scientific background in medicine, chemistry, physics or analytical chemistry. • Basic lectures on chemistry and physics are a prerequisite to follow this course.
Learning Outcome and Competences	After completing the module, students will be able to… • explain the spatial-temporal behaviour of the tissue-material interface in detail. • describe biologically relevant structures from the nm- to the mm length scale. • sketch the mechanism of cell-adhesion. • argue why the cell-surface interaction is important and how it can be changed. • describe the consequences of a low contact angle implant surface in-vitro, in-vivo and clinically. • understand surface modification techniques using physical and chemical strategies.

- describe various chemical, physical, mechanical, thermal, optical, plasma-technical, electrochemical methods to modify surfaces of biomaterials.
- know about the use of surface functionalized materials and the importance of the properties of such materials for biomedical applications.
- explain the term and the idea “protein-resistance”.
- specify several approaches for antibacterial coatings.

Comments

- Lectures
- Power-point presentations as pdf-files
- Parts of textbooks
- Relevant journal articles
- Group work, experiment evaluation and interpretation
- Q&A session, Tutorial questions and example solutions

2 lectures per week à 45 Min, whole semester 14 weeks
(1st and last event 2 lecturers: intro/overview/requirements, resp. summary/important points for exam/Q&A-session)

Course Enrolment

Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published)
Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch

Further Details

FHNW Auxilium -> "Mein Studium"

Last Updated

May 28, 2025

C55 / M-SBME-MSc C55

Implant Design and Manufacturing

Module	D. Implants and Regenerative Technology
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Vorlesung Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	- Case studies - Project work
Workload	3 ECTS
Lecturer(s)	Daniel Seiler <daniel.seiler@fhnw.ch> (Coordinator) Bernhard Pultar Andreas Roser Neha Sharma
Course contents	- Medical implants - Designing “hands on” patient specific implants - Medical additive manufacturing - Manufacturing and testing methods for medical implants - In vitro/in vivo testing and test methods according standards
Bibliography *(Mandatory / Optional)*	- IMDRF/PMD WG/N49 FINAL:2018 - FDA – Draft guidance for industry / Technical Considerations for Additive Manufactured Devices - Milan Brandt (2017) Laser Additive Manufacturing- Materials, Design, Technologies, and Applications
Entry Requirements	none
Learning Outcome and Competences	After completing the module, students … - obtain an insight into different types of implants - obtain an insight into the design, development and testing implants - will be able to select appropriate fabrication technologies and procedures including additive manufacturing - will be able to select and apply testing methods for medical implants based on standards - will be able to decide on the applicability and to design patient specific implants
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	November 03, 2025

C46 / 55664-01

Hands-on Introduction to Medical Robotics Hardware (block course)

Module	Project Work and Practical Skills
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Block course
Assessment Regulations	Examination per registration: no repeat examination (Re-)registration: as often as necessary
Assessment Details	Assessment format: continuous assessment Participants will have to record and hand in instruction videos (5 min) on selected topics of the course in small groups and a video that addresses the overall impression on the course. In addition, the participants need to be present at least for 80% of the course. The course is rated as failed or passed.
Workload	2 ECTS
Lecturer(s)	Georg Rauter <georg.rauter@unibas.ch> (Assessor) Nicolas Gerig Murali Krishna Karnam
Course contents	Nowadays, there is large knowledge available about control from a theoretical point of view. However, getting an entire setup working from hardware integration, safety, control, up to the graphical user interface or virtual environment, is seldom taught. Participants will learn about basic differences in various automatization environments such as dSPACE, Matlab xPC Target, Matlab/Simulink, LabVIEW, and TwinCAT3. Within one week, the participants will learn how to integrate motors, sensors, and safety components in a predesigned electric cabinet for automation and control purposes. They will develop an automation application for an automated basket scoring task. In groups up to four, the participants will learn how to integrate different hardware components in a real-time control system (TwinCAT3, Beckhoff). They will learn how to account for software safety for an application involving servo motors. After successful hardware and software safety integration, different control schemes (model based controllers, non-linear controllers, vision-based non-linear controllers, etc.) will be integrated in Matlab/Simulink. After compilation for TwinCAT3, the controllers will work on an industrial embedded real-time PC. During runtime, the participants will be able adapting controllers-online, record data, and see the influence of different filters. Consequently, the participants will program their own graphical user interface (GUI) in PLC and if there is time using the Human Machine Interface (HMI) from Beckhoff. This GUI can be interfaced with the real-time environment through an Automation Device Specification (ADS), i.e. a field bus interface for TwinCAT3. Finally, the groups can work under guidance and also independently on different control algorithms for successfully automating throwing a ball into a basket. In case there should be time, also machine vision will be demonstrated to close the control loop using real-time machine learning algorithms implemented in PLC.
Bibliography (Mandatory / Optional)	
Entry Requirements	Basic knowledge in control, automation, computer vision, Matlab/Simulink and Unity programming is of advantage, but not required. Master program in Biomedical Engineering
Learning Outcome and Competences	Hardware, and software integration in real-time applications. Basic knowledge in applied control (model-based control, non-linear control, cascade control). GUI-programming for real-time applications. Real-time data extraction using computer vision algorithms.
Comments	

Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294573
Last Updated	August 06, 2025

C50 / 53821-01

Hands-on Deep Learning

Module	Project Work and Practical Skills
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Internship
Assessment Regulations	Examination per registration: no repeat examination (Re-)registration: as often as necessary
Assessment Details	Assessment format: continuous assessment continuous assessment, short presentation and competition in the last week of the semester.
Workload	3 ECTS
Lecturer(s)	Philippe Claude Cattin <philippe.cattin@unibas.ch> (Assessor)
Course contents	This lecture is designed to equip students to put their deep-learning knowledge into practice on a real-world clinical case.
Bibliography (Mandatory / Optional)	
Entry Requirements	Limited number of students only, priority will be given to students of the Master in Biomedical Engineering.
Learning Outcome and Competences	
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294555
Last Updated	August 06, 2025

C52 / 70406-01

Bioengeneering Lab

Module	Project Work and Practical Skills
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Internship
Assessment Regulations	Examination per registration: no repeat examination (Re-)registration: as often as necessary
Assessment Details	Assessment format: continuous assessment
Workload	3 ECTS
Lecturer(s)	Pablo Sinues <pablo.sinues@unibas.ch> (Assessor) Valentina Basoli Olivier Braissant Mélina Richard
Course contents	Hands on training on: • Mass spectrometry • Spectrophotometric assays • Microscopy • Calorimetry Laboratory visits at: • Forensic toxicology • Clinical chemistry laboratories at University Hospitals
Bibliography (Mandatory / Optional)	
Entry Requirements	Bioengineering I and II
Learning Outcome and Competences	
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294568
Last Updated	August 06, 2025

C58 / M-SBME-MSc C58

Characterizing Materials in Medicine: Structure and Mechanics

Module	Project Work and Practical Skills
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Laborpraktikum Mode: MScBME - full semester
Assessment Regulations	Examination per registration: one repetition, best attempt counts (Re-)registration: as often as necessary
Assessment Details	Course-related performance review: Reports, poster- and oral presentations.
Workload	3 ECTS
Lecturer(s)	Romy Marek <romy.marek@fhnw.ch> (Coordinator) Michael de Wild Lydia Feller
Course contents	After an introduction event, the following analytical methods and experimental studies are performed in the materials science laboratories of the FHNW in Muttenz in groups: - tensile testing, - microstructural analysis and fractography, - impact testing, - SEM investigations, - XRD-analysis, - Surface functionalization and characterization, - Corrosion measurements, - Non-destructive testing (NDT, US), - thickness analysis.
Bibliography (Mandatory / Optional)	Experimental instructions with detailed description of each experiment.
Entry Requirements	Defined entry level • Module C13 passed • Scientific background in medicine, chemistry, physics or analytical chemistry. • Basic lectures on chemistry and physics are a prerequisite to follow this course. • The number of participants is limited to 12 students.
Learning Outcome and Competences	After completing the module, students will be able to… • operate the characterization system independently • interpret the results of the measurements
Comments	4 practical hours bi-weekly, whole semester 14 weeks 1st lecture: intro/overview/requirements/rules. The date of the practical exercise will be announced at the beginning of the lecture.
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	May 28, 2025

C59 / 70405-01

Hands-on Clinical Biomechanics and Ergonomics Engineering

Module	Project Work and Practical Skills
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Internship
Assessment Regulations	Examination per registration: no repeat examination (Re-)registration: as often as necessary
Assessment Details	Assessment format: continuous assessment Group presentation mini projects (1/3) and written group report mini project (2/3) (once per year, every fall semester)
Workload	3 ECTS
Lecturer(s)	Annegret Mündermann <annegret.muendermann@unibas.ch> (Assessor) Linda Bühl Lauren Stephanie Waiman Chee Eleonora Croci Sébastien Muheim Corina Nüesch Barbara Elisabeth Postolka
Course contents	Mini project human movement invluding study design, data collection with different lab equipment, data processing, data analysis, final report Focus on synchronized real-time data analysis methods from the gait rehabilitation robot the FLOAT, IMUs, motion tracking, etc. applied to different small research questions. EMG-based control of an arm exoskeleton (Eduexo) using Arduino
Bibliography (Mandatory / Optional)	
Entry Requirements	Only students attending the lecture C42 Clinical Biomechanics during the same semester will be allowed to register. In maximum, 12 students can attend (first come, first serve).
Learning Outcome and Competences	
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=295655
Last Updated	August 06, 2025

C62 / 70412-01

Hands on MRI and CT

Module	Project Work and Practical Skills
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Internship
Assessment Regulations	Examination per registration: no repeat examination (Re-)registration: as often as necessary
Assessment Details	Assessment format: continuous assessment • Attendance of practical sessions minimum 80% • Scientific reports, to be submitted 2 weeks after practical session (80% filled out to pass) • Exercises, to be submitted 2 weeks after every assignment (during semester) (80% filled out to pass) • Presentation, to be presented at the end of the semester • Final grading: pass/fail
Workload	3 ECTS
Lecturer(s)	Oliver Bieri <oliver.bieri@unibas.ch> (Assessor) Grzegorz Baumann Claudia Lenz Dominique Neuhaus Francesco Santini Claudia Weidensteiner Andrea Zirn
Course contents	Session CT I (4 lessons) • General introduction • Safety instructions • Instruction for writing reports • Image acquisition of object I, try different reconstruction kernels • Convert images to dicom, measure object dimension, discuss contrast & resolution • Find out which object it is Session MRI I (4 lessons) • General introduction • Safety instructions • Instruction for writing reports • Image acquisition of object I, try different sequences • Convert images to dicom, measure object dimension, discuss contrast & resolution • Find out which object it is Session CT II (4 lessons) • Image acquisition of object II • Try 3D segmentation • Find out which object it is Session MRI II (4 lessons) • Image acquisition of object II • Try 3D segmentation • Find out which object it is Session CT III (4 lessons) • Image acquisition of object III • Try tissue segmentation • Find out which object it is Session MRI III (4 lessons)

	• Image acquisition of object III • Try tissue segmentation • Find out which object it is Session Student Presentations (4 lessons) • Presentation and feedback • Comparison of CT & MRI
Bibliography (Mandatory / Optional)	
Entry Requirements	Only students attending the lectures Forensic Imaging & MR Imaging during the same semester will be allowed to register. In maximum, 6 students can attend (first come, first serve).
Learning Outcome and Competences	After completing the module, students will be able to… • Perform CT scans on objects/phantoms • Perform MRI scans on objects/phantoms • Know MR/CT safety reasons and rules • Explain the advantages and disadvantages of MRI/CT • Understand and explain image sequences and protocols • Know and discuss how to improve image sequences and protocols • Analyze CT images • Analyze MRI images • Evaluate and compare MRI and CT images • Illustrate and discuss results in scientific reports • Present and critically discuss results
Comments	
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294572
Last Updated	August 06, 2025

C64 / tbd

Data Sciences Project

Module	Project Work and Practical Skills
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Type: Laborpraktikum Mode: MScBME - full semester
Assessment Regulations	Examination per registration: (Re-)registration:
Assessment Details	
Workload	6 ECTS
Lecturer(s)	
Course contents	
Bibliography (Mandatory / Optional)	
Entry Requirements	
Learning Outcome and Competences	
Comments	-
Course Enrolment	
Further Details	
Last Updated	July 07, 2025

C65 / 70360-01

3D Human Movement Studies – A Biomechanical, Physiological and Technical Perspective

Module	Project Work and Practical Skills
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Block course weekly
Assessment Regulations	Examination per registration: no repeat examination (Re-)registration: as often as necessary
Assessment Details	Assessment format: continuous assessment Attendance is mandatory. Report on one of the course topics. The topics will be provided in the last session.
Workload	3 ECTS
Lecturer(s)	Annegret Mündermann <annegret.muendermann@unibas.ch> (Assessor) Linda Bühl Lauren Stephanie Waiman Chee Eleonora Croci Oliver Faude Sébastien Muheim Barbara Elisabeth Postolka Paul Ritsche Arno Schmidt-Trucksäss Fabian Schwendinger
Course contents	Modular course in 4 locations with an online theoretical introduction and an onsite training: Institute for Sport and Sport Sciences, University of Freiburg, Germany Department of Sport, Exercise and Health, University of Basel, Switzerland Institute for Sport and Sport Sciences, Karlsruhe Institute of Technology, Germany Department of Biomedical Engineering, University of Basel, Switzerland
Bibliography (Mandatory / Optional)	
Entry Requirements	For students of the DBE, only students attending the lecture C42 Clinical Biomechanics and C59 Hands-on Clinical Biomechanics and Ergonomics Engineering during the same semester will be allowed to register
Learning Outcome and Competences	The aim of the EUCOR course "3D Dimensions & 3D Destinations of Biomechanics - 3D Biomechanics" is to combine the expertise, resources and content differentiation of biomechanical research-related teaching at the three university locations Basel, Freiburg and Karlsruhe in the EUCOR network in a common teaching concept. The aim is to enable students to familiarize themselves with the broad spectrum of research and professional fields in the analysis of human movement and biomechanics in the related disciplines of sports science, medicine and engineering. Students will understand the diversity of research and career opportunities across the sites and fields.
Comments	Please bring your own food, food can be consumed during lunch time at the respective institution. Travel costs can be reimbursed for students of the University of Basel via Eucor (https://www.unibas.ch/de/Studium/Mobilitaet/Mobilitaet-Region/Eucor.html). For this purpose, the following documents must be sent to info.eucor@unibas.ch no later than three months after the end of the course(s) attended: - Tickets - Copy of a valid student ID or the current confirmation of matriculation - Signed confirmation of attendance of the course (received via course coordinator) - Bank account details and home address A maximum of 200 CHF for Fribourg and 500 CHF for Karlsruhe (for all EUCOR) courses can be refunded per semester. Students are responsible for informing themselves about the current conditions for reimbursement at

	Eucor. No costs will be covered by the university or the department."
Course Enrolment	Reg.: course registration, dereg: cancel course registration
Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=295652
Last Updated	August 06, 2025

C66 / 74111-01

Fundamentals of Entrepreneurship

Module	Project Work and Practical Skills
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Colloquium
Assessment Regulations	Examination per registration: no repeat examination (Re-)registration: as often as necessary
Assessment Details	Assessment format: record of achievement
Workload	3 ECTS
Lecturer(s)	Pascal Gantenbein <pascal.gantenbein@unibas.ch> (Assessor) Michael Nash Anna-Elina Pekonen Christian Elias Schneider Pablo Sinues
Course contents	The course provides a comprehensive understanding of entrepreneurship, developing your mindset, and competencies to create impact. It fosters creativity and innovation, empowering you to develop venture ideas with the necessary knowledge and skills, crucial for careers in startups, industry, and academia. You can join the course with your own venture idea or without! You will explore venture ideas, discuss practical applications, and understand key topics in entrepreneurship such as idea development, business plan creation, financing, customer insights, and crucial competencies such as leadership, problem-solving, team building, and creativity. The course includes lectures, and team-based projects, emphasizing active participation and learning-by-doing in a real-world context. Experienced professionals and academic experts contribute their expertise to the topics covered. Each session will comprise three key components: • Introduction and exploration of core concepts, frameworks, and real-world examples aimed at equipping you with tools to refine your entrepreneurial skills. • Collaborative teamwork to address challenges pertinent to the business projects. • Presentations to showcase progress by each team and get feedback based on peer evaluation.
Bibliography (Mandatory / Optional)	Literature and additional materials are available online.
Entry Requirements	
Learning Outcome and Competences	Upon successful completion of this course, you will: • have developed a comprehensive understanding of entrepreneurship and essential concepts, know how to embrace an entrepreneurial mindset, and demonstrate an understanding of how creativity, innovation, and risk-taking are essential for driving change and making impactful decisions in various contexts; • be able to navigate the initial stages of business creation with competence, from ideation to developing a viable concept based on modern methods; • possess foundational entrepreneurial competencies, including effective leadership and teamwork, strategic decision-making, and problem-solving skills, all tailored to meet the unique challenges of starting and managing entrepreneurial ventures; • be inspired to drive societal change and develop your venture ideas. • know how to engage in practical experiences to prepare for future challenges and apply theory through team projects based on real-world examples; • and commit to personal and professional growth by actively developing your entrepreneurial skills, incorporating reflective practices into your learning process, and showing readiness to adapt and thrive in the dynamic landscape of entrepreneurship.
Comments	-
Course Enrolment	Reg.: course registration, dereg: cancel course registration

Further Details	https://vorlesungsverzeichnis.unibas.ch/en/course-directory?id=294185
Last Updated	August 14, 2025

C95 / M-SBME-MSc C95

Semester Thesis / Internship at FHNW HLS

Module	Project Work and Practical Skills
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Autumn semester
Format	Type: Studierendenprojekt Mode: MScBME - full semester
Assessment Regulations	Examination per registration: Projektarbeit (Project Work) (Re-)registration:
Assessment Details	
Workload	12 ECTS
Lecturer(s)	Michael de Wild Maurizio Gullo Simone Hemm David Hradetzky Marc Jermann Romy Marek Joris Pascal Erik Schkommodau Daniel Seiler Reto Wildhaber
Course contents	
Bibliography (Mandatory / Optional)	
Entry Requirements	
Learning Outcome and Competences	
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	June 04, 2025

C96 / tbd

Semester Thesis / Internship at University Basel

Module	Project Work and Practical Skills
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Autumn semester
Format	Type: Praktikum Mode: MScBME - full semester
Assessment Regulations	Examination per registration: (Re-)registration:
Assessment Details	
Workload	12 ECTS
Lecturer(s)	
Course contents	
Bibliography (Mandatory / Optional)	
Entry Requirements	
Learning Outcome and Competences	
Comments	-
Course Enrolment	
Further Details	
Last Updated	July 07, 2025

C98 / M-SBME-MSc C98

Master Thesis at FHNW HLS

Module	Master Thesis
Institute / Site	FHNW HLS Muttenz
Language	English
Semester	Spring semester
Format	Type: Master-Thesis Mode: MScBME - full semester
Assessment Regulations	Examination per registration: Projektarbeit (Project Work) (Re-)registration:
Assessment Details	
Workload	25 ECTS (Thesis) + 5 ECTS (Defense)
Lecturer(s)	Maurizio Gullo David Hradetzky Romy Marek Dominik Meinel Daniel Preisig Erik Schkommodau Daniel Seiler Dorian Vogel Reto Wildhaber Christopher Wood
Course contents	
Bibliography (Mandatory / Optional)	
Entry Requirements	
Learning Outcome and Competences	
Comments	-
Course Enrolment	Reg: https://esp.hls.fhnw.ch (registration dates will be announced and published) Dereg.: before end calendar week 12 (spring) and 42 (autumn) via email to studierendenadministration.lifesciences@fhnw.ch
Further Details	FHNW Auxilium -> "Mein Studium"
Last Updated	June 13, 2025

C99 / tbd

Master Thesis at University Basel

Module	Master Thesis
Institute / Site	University of Basel, Department of Biomedical Engineering
Language	English
Semester	Spring semester
Format	Type: Master-Thesis Mode: MScBME - full semester
Assessment Regulations	Examination per registration: (Re-)registration:
Assessment Details	
Workload	25 ECTS (Thesis) + 5 ECTS (Defense)
Lecturer(s)	
Course contents	
Bibliography (Mandatory / Optional)	
Entry Requirements	
Learning Outcome and Competences	
Comments	-
Course Enrolment	
Further Details	
Last Updated	July 07, 2025