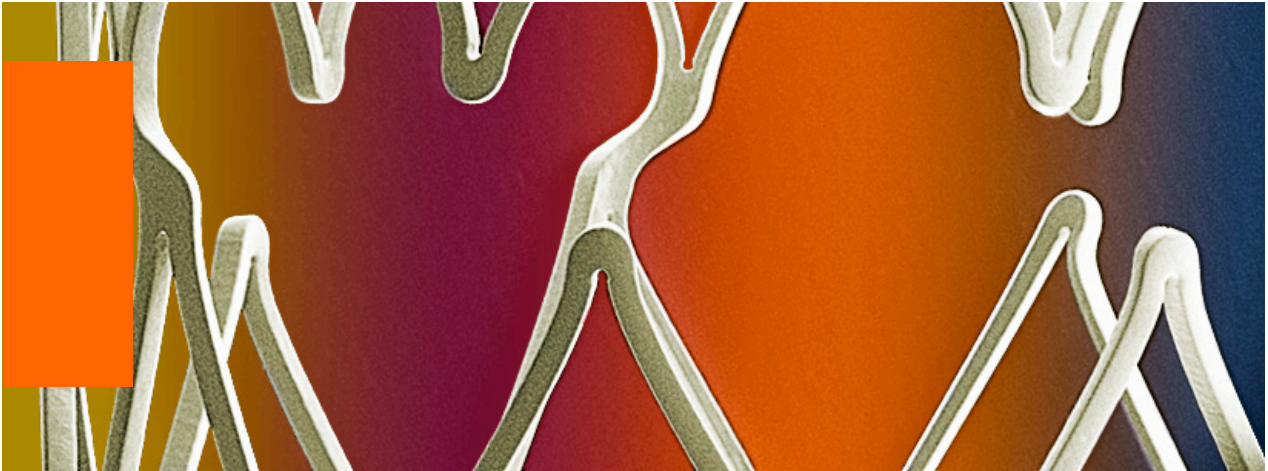


## ***School of Life Sciences FHNW***



### ***Module Handbook***

### ***Master of Science in Life Sciences***

#### ***Majors***

***Molecular Technologies***

***-and-***

***Therapeutic Technologies***

***September 2011***

## The Essentials: Master of Science in Life Sciences FHNW

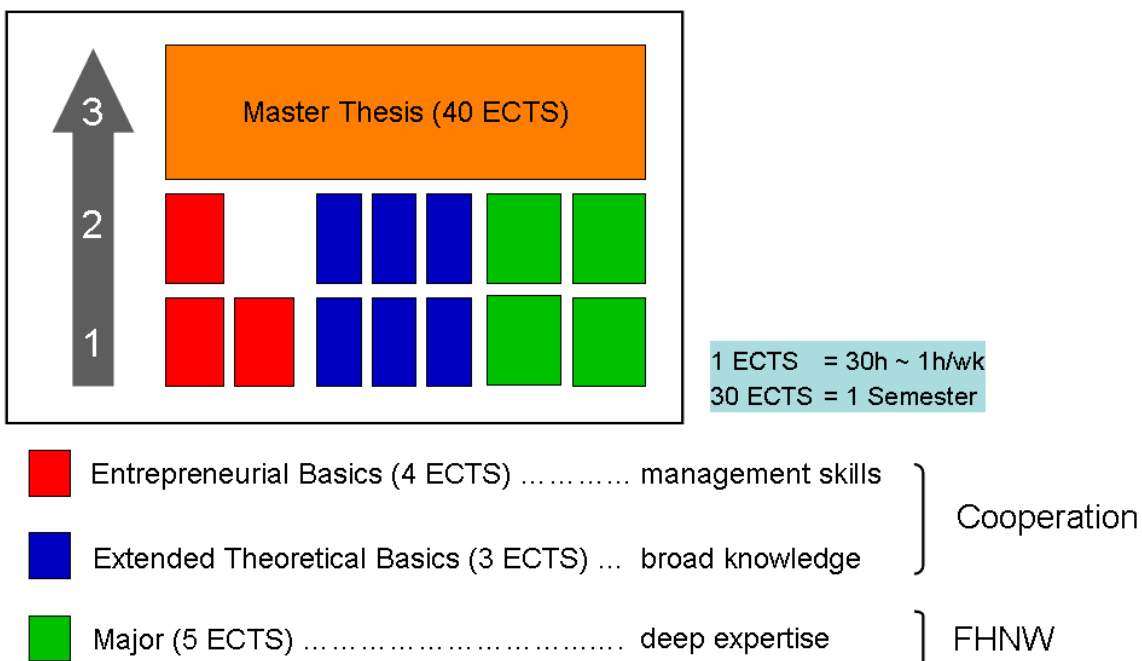
- a coordinated master programme in Life Sciences conducted by the Swiss Universities of Applied Sciences
- designed for motivated students interested in applied research
- provides improved and additional career opportunities in research, development and production
- majors offered by the University of Applied Sciences Northwestern Switzerland:
  - **Molecular Technologies**  
*synthesis and analysis of active compounds and biological systems*
  - **Therapeutic Technologies**  
*pharmaceutical techniques and medical engineering for disease treatment*
- three semesters full-time study, 90 ECTS
- part-time study possible
- master thesis: 40 ECTS, courses: 50 ECTS
- admission: good bachelor degree in a relevant subject
- good knowledge of English required
- admission deadlines: April 30<sup>th</sup> (autumn semester) and December 31<sup>th</sup> (spring semester)
- start of studies: mid-September and mid-February
- tuition fee: CHF 700.- per semester

# Curriculum

The University of Applied Sciences Northwestern Switzerland, School of Life Sciences offers two majors: **Molecular Technologies** and **Therapeutic Technologies**.

The **Entrepreneurial Basics** and the **Extended Theoretical Basics** modules are provided jointly by the Swiss Universities of Applied Sciences.

The **Master Thesis** (40 ECTS) is conducted at one of the institutes of the School of Life Sciences FHNW or externally in cooperation with companies or other institutes.

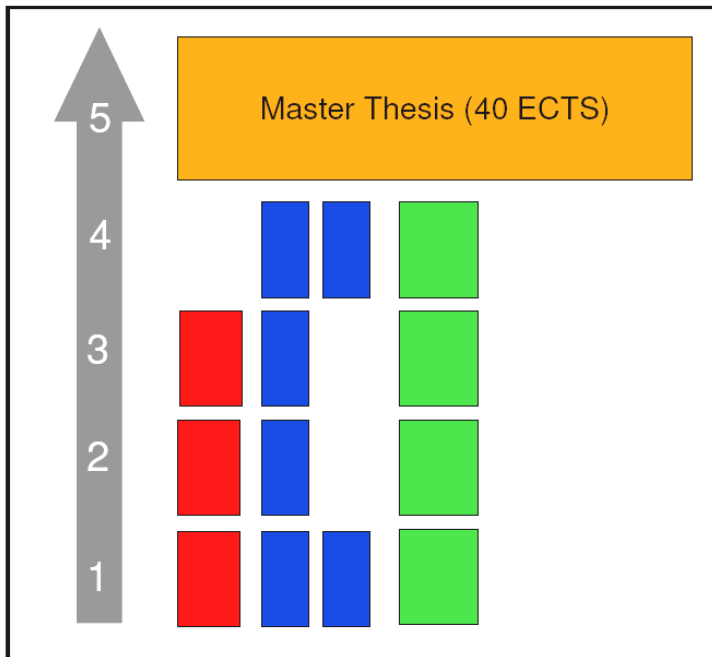


**Figure 1: Organisation of the study programme (full-time)**

Every student chooses three modules Entrepreneurial Basics and six modules Extended Theoretical Basics. These modules are organized jointly by the Swiss Universities of Applied Sciences. The modules are offered once a year. Therefore the number of modules taken in the first and second semester depends upon the choice of the student. The Entrepreneurial Basics modules take place during a single week on a full-day basis. In contrast, the Extended Theoretical Basics modules take place on three consecutive weeks on Thursdays and Fridays. The modules will be offered in Berne. The modules of the major Molecular Techniques or Therapeutic Techniques are provided by the School of Life Sciences FHNW and take place from Monday through Wednesday in Muttenz or Basel. The study programme finishes with a Master Thesis which is conducted at the School of Life Science FHNW or in cooperation with a company during the third semester.

One ECTS (European Credit Transfer System) is equivalent to a student work load of 30 hours. In case of lecture one ECTS is equivalent a lesson per week for one semester; the remaining time is for self-study.

## Example of a of a part-time study programme (e.g. 5 semesters)



**Figure 2: Part-time study programme**

It is possible to attend the master study programme on a part-time basis. Shown here is a study programme of five semesters. The Entrepreneurial Basics modules take place during a single week on a full-day basis. In contrast, the Extended Theoretical Basics modules take place on three consecutive weeks on Thursdays and Fridays. The modules will be offered in Berne. The modules of the major Molecular Techniques or Therapeutic Techniques are provided by the School of Life Sciences FHNW and take place from Monday to Wednesday on two evenings in MuttENZ or Basel. The study programme finishes with a Master Thesis which is conducted at the School of Life Science FHNW or in cooperation with a company during the third semester. Shown is a case where the Master Thesis is performed on a full-time basis, i.e. within eight months.

## Grading

All modules are graded with the Swiss grading system (1 through 6 with 6 being the best grade). The rounded grades 4.0, 4.5, 5.0, 5.5 and 6.0 are passing grades, the rounded grade 3.5 ("FX") can be improved to grade 4.0 provided an extra work as requested by the lecturer is provided; the rounded grades 3.0 and below are non-passing grades.

Students who fail a module have the opportunity to resit the examination a year later. In general there is no obligation to revisit the module. However the subject of the module might have changed and it is highly recommended to visit the lecture again.

Students have to choose at least three modules of the module type Entrepreneurial Basics, six modules of the module type Extended Theoretical Basics and four modules from the major Molecular Technologies or Therapeutic Technologies.

Students may visit additional modules when agreed by the head of master programme. If more modules than required are passed all the modules are listed with the grade in the transcript of records and are used for the calculation of the final grade of the master studies. If an extra module is failed, the course and its grade are not listed in the transcript of records; however they appear as a failed module in the semester record. If the student chooses not to go to the examination of the extra module the module will neither appear in the semester record nor in the transcript of records.

The final grade of the master studies is the arithmetic average of the three grades obtained for 1. the modules of the entrepreneurial basics and the extended theoretical basics, 2. the modules of the majors and 3. the grade of the master thesis. The final grade will be expressed with the rank grade of the ECTS system (grade A through E, with A the top 10% of students) provided that the statistical basis is given.

## eLearning platform

The courses of the master programme are deposited on the Moodle eLearning platforms (<https://moodle.fhnw.ch/course/category.php?id=75> and <https://masterlifesciences.ch/>). Registration is required for most courses.

Entrepreneurial Basics and Extended Theoretical Basics:

Compiled by Coordination Office *Master of Science in Life Sciences*, ZHAW, Aline Strolz, CH-8820 Wädenswil, +41 58 934 59 92, [strz@zhaw.ch](mailto:strz@zhaw.ch)

Molecular Technologies and Therapeutic Technologies:

Compiled by University of Applied Sciences Northwestern Switzerland, Prof. Dr. Georg Lipps, Head of Master Programme, +41 61 467 43 01, [georg.lipps@fhnw.ch](mailto:georg.lipps@fhnw.ch)

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## Overview of the modules in the Majors Molecular Technologies and Therapeutic Technologies

		interest					
		bioanalytics/diagnostics	analytic chemistry	synthetic chemistry	clean technologies	pharmatechnology	medical technology
Molecular Technologies	<b>Applied organic chemistry</b> (Organic synthesis, Selected topics in medicinal chemistry, Special methods in NMR spectroscopy)						
	<b>Chemical engineering</b> (Microreactors, Rheology, Production of semi-solids materials)						
	<b>Instrumental analytics</b> (Hyphenated mass spectrometric methods, Advanced spectroscopy and imaging)						
	<b>Profiling of bioactive compounds (Molecular Assays)</b> (From target to effect: concepts, assays & models, Advanced technologies)						
	<b>Applied bioanalytics</b> (Advanced toxicology and pharmacology, Radioanalytics, Ecotoxicology, Systems biology)						
	<b>Bio-Nanotechnology</b> ((Bio-)sensors, Surface technology, Advanced (bio-)materials)						
	<b>Sustainable production and clean technologies</b> (Process integrated preventive environmental protection, Industrial environmental technologies)						
Therapeutic Technologies	<b>Drug formulation and delivery</b> (Controlled release technologies, Biopharmaceutical modelling and simulation, Oral formulations of poorly water soluble drugs, Alternative routes of drug delivery and drug targeting)						
	<b>Drug manufacturing</b> (Advanced pharmaceutical production units, System dynamics of production processes, Technical services and process media)						
	<b>Medical systems</b> (Development of medical devices, Interactive Systems, Distributed medical systems)						
	<b>Implant development</b> (Image processing for surgical planning, Surgical support systems, Medical additive manufacturing)						
	<b>Life cycle assessment and regulatories</b> (Life cycle and environmental impact assessment, Environmental regulatories, Registration of chemicals, drugs and medical products)						

**Figure 3: Modules offered in the Majors**

Students have to choose four modules (5 ECTS each). Three of the modules have to be from the major chosen but the fourth module can be chosen freely among the offered modules. The interdisciplinary modules *Bio-Nanotechnology* and *Sustainable production and clean technologies* belong to both majors. The table shows possible combinations which may correspond to students' specific fields of interest.

## Major Molecular Technologies

**module** *Applied organic chemistry*

Angewandte Organische Chemie

- courses**
- *Organic synthesis*  
Organische Synthese/Retrosynthese
  - *Selected topics in medicinal chemistry*  
Ausgewählte Themen der Medizinalchemie
  - *Special methods in NMR spectroscopy*  
Spezialisierung NMR Spektroskopie

**code** M-SLS-F 02 010**institute** FHNW - School of Life Sciences**degree programme** M.Sc. in Life Sciences**major** Molecular Technologies**level** Advanced**type** Core module, elective**ECTS-credits** 5**student workload** 150 hours**module leader** Gerhard Grundler**assessment** Average of ECTS credit weighted marks of courses**requirements** bachelor level of organic chemistry**comments**

<b>Course</b>	<i>Organic synthesis</i> Organische Synthese/Retrosynthese
<b>code</b>	M-SLS-F 02 010 a
<b>corresponding module</b>	Applied organic chemistry
<b>format</b>	2 lessons per week
<b>ECTS-credits</b>	2
<b>student workload</b>	Lectures            24 h Private study      36 h
<b>lecturer</b>	Marianne Hürzeler
<b>intended learning outcomes</b>	<p>The students learn to differentiate between chemo-selectivity, regio-selectivity and stereo-selectivity. They devise synthetic methods to direct the selectivities in the desired direction.</p> <p>The students are familiarized with the most important methods for C-C bond making, such as the use of organometallic and specifically organolithium reagents, homogeneous catalysis using transition metals as well as the use of enolates and enolate equivalents.</p> <p>They learn about the primary methods to prepare optically active and enantiomerically pure compounds. They formulate catalytic, chemical and enzymatic strategies for the formation of asymmetric C-O, C-H, C-N and C-C bonds. They practice the use of chiral reagents including aluminium hydrides and boranes in asymmetric synthesis.</p>
<b>contents</b>	<p>This module expands on the planning and developing of methods for the synthesis of chosen target molecules and active organic agents. Particular emphasis is given to C-C bond using organometallic reagents and transition metal catalysts as well as asymmetric synthesis of optically active molecules.</p>
<b>assessment</b>	written examination
<b>teaching and learning strategies</b>	Lecture and group exercises
<b>language</b>	English
<b>bibliography</b>	Required: Organic Synthesis, Strategy and Control, P. Wyatt, S. Warren Recommended: Hodgson, D.M., Organolithiums in Enantioselective Synthesis, Springer, Berlin 2003 Schlosser, M., Organometallics in Synthesis, John Wiley, West Sussex 2002 Hegedus, L., Transition metal organometallics in Organic Synthesis Tsuji, Jiro, Transition Metal Reagents and Catalysis, John Wiley, West Sussex 2002 Procter, G., Asymmetric Synthesis, Oxford University Press, New York 1999 Katsuki, T., Asymmetric Oxidation Reactions, Oxford University Press, New York 2002 Web resources:

<b>Course</b>	<i>Selected topics in medicinal chemistry</i> Ausgewählte Themen der Medizinalchemie
<b>code</b>	M-SLS-F 02 010 b
<b>corresponding module</b>	Applied organic chemistry
<b>format</b>	2 lessons per week
<b>ECTS-credits</b>	2
<b>student workload</b>	Lectures            24 h Private study      36 h
<b>lecturer</b>	Gerhard Grundler, Beat Zehnder
<b>intended learning outcomes</b>	Student will: <ul style="list-style-type: none"><li>• know the basic strategies for lead discovery and lead optimization.</li><li>• understand the concepts of drug receptor interaction and structure-activity relationships.</li><li>• apply modern organic chemistry to the synthesis of pharmacologically active molecules.</li></ul>
<b>contents</b>	Introduction to Drug Discovery: <ul style="list-style-type: none"><li>• From Hits to Leads to Candidate Drugs</li><li>• Exploration of Structure Activity Relationships</li><li>• Optimizing target Interactions</li><li>• Molecular variations in homologous chemical series</li><li>• Conformational restrictions and stereochemical aspects</li></ul> Case studies of modern drug synthesis: <ul style="list-style-type: none"><li>• Natural product guided Medicinal Chemistry</li><li>• Kinase Inhibitors</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture and Blended learning
<b>language</b>	English
<b>bibliography</b>	Required: Patrick, G.L., An Introduction to Medicinal Chemistry, Oxford University Press, New York 2005 Recommended: Wermuth, C.G., The Practice of Medicinal Chemistry, Academic Press, London 2002 Li, J.J. et al. Contemporary Drug Synthesis, Wiley Interscience, 2004 Johnson, D.S., Li, J.J., The Art of Drug Synthesis, Wiley Interscience, 2007 Web resources:

<b>Course</b>	<i>Special methods in NMR spectroscopy</i> Spezialisierung NMR Spektroskopie
<b>code</b>	M-SLS-F 02 010 c
<b>corresponding module</b>	Applied organic chemistry
<b>format</b>	2 lessons per week, half a semester
<b>ECTS-credits</b>	1
<b>student workload</b>	Lectures 12 h Private study 18 h
<b>lecturer</b>	Götz Schlotterbeck, Christelle Jablonski
<b>intended learning outcomes</b>	Students will: <ul style="list-style-type: none"><li>• know how to apply and use modern and complex NMR techniques for structure elucidation of small molecules.</li><li>• become familiar with the interpretation of more complex NMR spectra.</li><li>• understand the concept of an integrated approach for structure elucidation by using different spectroscopic information including NMR-, MS-, and other types of spectra.</li><li>• learn strategies how to apply modern NMR spectroscopic techniques in combination with other spectroscopic techniques for structure elucidation and verification.</li></ul>
<b>contents</b>	Theoretical background in advanced NMR spectroscopy: <ul style="list-style-type: none"><li>• Selected one- and two-dimensional NMR experiments with complex pulse series</li></ul> Case studies and exercises: <ul style="list-style-type: none"><li>• Structure elucidation with the aid of homo- and hetero-nuclear 1D- and 2D NMR spectra of small molecules.</li><li>• Interpretation of 1D- and 2D NMR spectra in combination with MS- and other spectra.</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture Consultation Exercises
<b>language</b>	English
<b>bibliography</b>	Required: Horst Friebolin: Ein- und zweidimensionale NMR-Spektroskopie, ISBN-13: 978-3-527-31571-0 - Wiley-VCH, Weinheim Recommended:  Web resources:
<b>requirements</b>	know the principles of NMR, understand chemical shift, spin-spin couplings, relaxation, able to interpret simple NMR spectra

**module** ***Chemical engineering***

Chemieingenieurtechnik

- courses**
- Micro process technology  
Mikroprozesstechnologie
  - Process control and automatisisation  
Prozesskontrolle und Prozessautomation
  - Production of semi-solids materials  
Produktion halbfester Formen

**code** M-SLS-F 02 020

**institute** FHNW - School of Life Sciences

**degree programme** M.Sc. in Life Sciences

**major** Molecular Technologies

**level** Advanced

**type** Core module, elective

**ECTS-credits** 5

**student workload** 150 hours

**module leader** Wolfgang Riedl

**assessment** Average of ECTS credit weighted marks of courses

**requirements** bachelor level of chemical engineering, mechanical engineering, food/pharma technology, industrial systems theory (recommended)

**comments**

<b>course</b>	<i>Microprocess technology</i> Mikroprozestechnik
<b>code</b>	M-SLS-F 02 020 a
<b>corresponding module</b>	<i>Chemical Engineering</i>
<b>format</b>	2 lessons per week
<b>ECTS-credits</b>	2
<b>student workload</b>	Lectures            24 h Private study      36 h
<b>lecturer</b>	Wolfgang Riedl, N.N.
<b>intended learning outcomes</b>	<ul style="list-style-type: none"> <li>• Overview about available micro processes for both reaction and separation tasks</li> <li>• Generation of a process chain (incl. definition of interfaces) for the production of a target component</li> <li>• Rationals for the design and calculation of process equipment and trials</li> <li>• Specific requirements for successful implementation of micro processes</li> </ul>
<b>contents</b>	<ul style="list-style-type: none"> <li>• Advanced reaction and separation technologies principals and calculation (e.g. thermodynamics, kinetics, phase equilibrium, characteristic numbers)</li> <li>• Miniaturized equipment and its specific requirements for proper operation</li> <li>• Rationals for micro-process development and implementation</li> <li>• “building block” approach: “from plain table to microlab”</li> </ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture and Blended learning
<b>language</b>	English
<b>bibliography</b>	Required: script Recommended: Ehrfeld, W. et al., Microreactors, Wiley-VCH Verlag GmbH, Weinheim 2000 Hessel, V. et al., Chemical Micro Process Engineering, Wiley-VCH Verlag GmbH, Weinheim 2004 Baerns, M. et al., Chemische Reaktionstechnik, Georg Thieme Verlag, Stuttgart 1999 Levenspiel, O., Chemical Reaction Engineering, John Wiley, New York 1999 Sattler, K.: Thermische Trennverfahren, Wiley-VCH Verlag GmbH, Weinheim, 2001 Web resources:

<b>Course</b>	<i>Process control and automation</i> Prozesskontrolle und Prozessautomation
<b>code</b>	M-SLS-F 02 020 b
<b>corresponding module</b>	<i>Chemical Engineering</i>
<b>format</b>	2 lessons per week, half a semester
<b>ECTS-credits</b>	1
<b>student workload</b>	Lectures            12 h Private study       18 h
<b>lecturer</b>	W. Riedl / external referent(s)
<b>intended learning outcomes</b>	<ul style="list-style-type: none"><li>• Measurement and regulation fundamentals for lab scale and production purposes</li><li>• Handling of control (room) systems for reliable process operation</li><li>• competence to choose best suited control system for dedicated purposes</li></ul>
<b>contents</b>	<ul style="list-style-type: none"><li>• Overview of available measurement/control/automation systems for both the lab and production scale</li><li>• Visualizing processes and process control on PC screen</li><li>• Choice of measurement and its compatibility to existing systems / requirements for implementation</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture and Blended learning
<b>language</b>	English
<b>bibliography</b>	Recommended:  Required: script Web resources:

<b>Course</b>	<i>Production of semi-solids materials</i> Produktion halbfester Stoffe
<b>code</b>	M-SLS-F 02 020 c
<b>corresponding module</b>	<i>Chemical Engineering</i>
<b>format</b>	2 lessons per week
<b>ECTS-credits</b>	2
<b>student workload</b>	Lectures            24 h Private study      36 h
<b>lecturer</b>	Andreas Schreiner
<b>intended learning outcomes</b>	Students will know the basics and the methods for the characterization of the flow of non-Newtonian fluids. Participants will understand the special characteristics of production and processing of semi-solid materials, know how to work with these materials on a production scale and can develop processes, choose and implement equipment for manufacturing successfully.
<b>contents</b>	Flow characteristics and behaviour of non-Newtonian fluids: <ul style="list-style-type: none"><li>• Pseudo plastics and dilatants substances</li><li>• Thixotrope and rheopectic substances</li><li>• Viscoelastic substances</li><li>• Processing of semi-solid materials</li><li>• Transport, stirring, pumping, storage</li><li>• Homogenization</li><li>• Emulsification</li><li>• Equipment, plants</li><li>• Process design and development</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture and Blended learning
<b>language</b>	English
<b>bibliography</b>	Required:  Recommended:  Web resources:

**module** *Instrumental analytics*

Instrumentalanalytik

- courses**
- *Hyphenated mass spectrometric methods*  
Gekoppelte massenspektrometrische Methoden
  - *Advanced spectroscopy and imaging*  
Spektroskopie, Bildgebung

**code** M-SLS-F 02 030

**institute** FHNW - School of Life Sciences

**degree programme** M.Sc. in Life Sciences

**major** Molecular Technologies

**level** Advanced

**type** Core module, elective

**ECTS-credits** 5

**student workload** 150 hours

**module leader** Götz Schlotterbeck

**assessment** Average of ECTS credit weighted marks of courses

**requirements** bachelor level of chemistry

**comments**

<b>course</b>	<i>Hyphenated mass spectrometric methods</i> Gekoppelte massenspektrometrische Methoden
<b>code</b>	M-SLS-F 02 030 a
<b>corresponding module</b>	<i>Instrumental analytics</i>
<b>format</b>	3 lessons per week
<b>ECTS-credits</b>	3
<b>student workload</b>	Lectures            36 h Private study      54 h
<b>lecturer</b>	Götz Schlotterbeck
<b>intended learning outcomes</b>	Students will: <ul style="list-style-type: none"><li>• know the differences and advantages of the individual hyphenated techniques and the relations to the type of different instrumentation.</li><li>• get familiar with hyphenated spectroscopic technologies for structure elucidation, profiling and quantification of small molecules and proteins.</li><li>• obtain a basic understanding of NMR- and MS- spectrum interpretation, structure elucidation and of protein characterization.</li></ul>
<b>contents</b>	Overview on hyphenated spectroscopic methods for structure elucidation, profiling and quantification: <ul style="list-style-type: none"><li>• GC-MS (Theory, interpretation of spectra, applications, MS/MS)</li><li>• HPLC-MS (Theory, interpretation of spectra, applications, MS/MS)</li><li>• CE-MS (Theory, interpretation of spectra, applications, MS/MS)</li><li>• MALDI-TOF (Theory, interpretation of spectra, applications, MS/MS)</li><li>• Advanced MS-Ionization methods (DESY, DART, nanoSpray)</li><li>• LC-NMR (Theory, interpretation of spectra, applications, 2D NMR techniques)</li></ul>
<b>assessment</b>	Written/oral examination in between (1/10) and at the end of the semester (6/10), student presentations (3/10)
<b>teaching and learning strategies</b>	lecture and case studies
<b>language</b>	English
<b>bibliography</b>	Required:  Recommended: de Hoffmann, E., Stroobant, V., Mass Spectrometry, John Wiley & Sons, New York, 2002 Web resources:

<b>course</b>	<i>Advanced spectroscopy and imaging</i> Spektroskopie, Bildgebung	
<b>code</b>	M-SLS-F 02 030 b	
<b>corresponding module</b>	<i>Instrumental analytics</i>	
<b>format</b>	2 lessons per week	
<b>ECTS-credits</b>	2	
<b>student workload</b>	Lectures	24 h
	Private study	36 h
<b>lecturer</b>	Uwe Pieles	
<b>intended learning outcomes</b>	Student will: <ul style="list-style-type: none"> <li>• become familiar with the function principle of MRI.</li> <li>• be familiar with the basics of solid state NMR and their application to solid matter.</li> <li>• become familiar with specialized Infrared and Raman technologies and the most recent imaging modalities.</li> <li>• know the function principle of X-Ray diffraction to determine the crystal structure of small organic molecules.</li> <li>• be familiar with the basics of crystallography.</li> <li>• be familiar with the fundamentals in CD spectroscopy for structure determination of biomolecules.</li> </ul>	
<b>contents</b>	NMR Microscopy for ultra high resolution Basics of MRI (Magnetic resonance imaging) <ul style="list-style-type: none"> <li>• Applications of MRI in Medicine</li> <li>• Methods to enhance the contrast e.g. paramagnetic iron or Magnevist</li> </ul> Basics of solid state NMR <ul style="list-style-type: none"> <li>• Magic angle spinning</li> <li>• Applications of solid state NMR</li> <li>• Introduction into the fundamentals of NMR of Biomolecules</li> </ul> Special - Infrared and Raman Spectroscopy <ul style="list-style-type: none"> <li>• Grazing angle, diffuse reflection, acoustic wave</li> <li>• Imaging techniques with FPA (Focal plane array detectors) systems</li> <li>• Confocal Raman Principal</li> <li>• X-ray Diffraction</li> </ul> CD Spectroscopy for analysing the structure of biomolecules Advanced Tomography (CT, OCT, PET, Terahertz) Photoacoustics	
<b>assessment</b>	Written examination at the end of the semester	
<b>teaching and learning strategies</b>	lecture and case studies	
<b>language</b>	English with accompanying material in English.	
<b>bibliography</b>	Required: selected publications Recommended:  Web resources:	

**module** ***Profiling of bioactive compounds (Molecular Assays)***

Charakterisierung von bioaktiven Substanzen

- courses**
- *From target to effect: concepts, assays & models*  
Von der Zielstruktur zum Effekt: Konzepte, Assays und Modelle
  - *Advanced technologies*  
Fortgeschrittene Technologien für die Assayentwicklung

**code** M-SLS-F 02 040

**institute** FHNW - School of Life Sciences

**degree programme** M.Sc. in Life Sciences

**major** Molecular Technologies

**level** Advanced

**type** Core module, elective

**ECTS-credits** 5

**student workload** 150 hours

**module leader** Daniel Gygax

**assessment** Average of ECTS credit weighted marks of courses

**requirements** bachelor level of molecular biology, biochemistry and cell biology

**comments**

<b>course</b>	<i>From target to effect: concepts, assays &amp; models</i> Von der Zielstruktur zum Effekt: Konzepte, Assays und Modelle
<b>code</b>	M-SLS-F 02 040 a
<b>corresponding module</b>	<i>Profiling of bioactive compounds</i>
<b>format</b>	3 lessons per week
<b>ECTS-credits</b>	3
<b>student workload</b>	Lectures            36 h Private study      54 h
<b>lecturer</b>	Daniel Gygax, Eric Kübler, Achim Wach, Armin Zenker
<b>intended learning outcomes</b>	Students will understand the process of identifying and developing molecules with useful bioactive properties. They know concepts, models and assays used to profile a compound in the frame from target to effect.
<b>contents</b>	Process related development of pharmacokinetic and bioanalytical systems on the level of biomolecules, cells, tissues and organisms: <ul style="list-style-type: none"><li>• Understanding of techniques and methods to analyze biological systems</li><li>• Mathematical description and modelling of biological systems (physiology based pharmacokinetic modelling)</li><li>• Target identification</li><li>• Molecular binding in the context of biological effect</li><li>• <i>In-vivo</i> testing</li><li>• Group work</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture and case studies
<b>language</b>	English
<b>bibliography</b>	Required: Orchard Sandra et al., Minimum information about a bioactive entity (MIABE), Nature Reviews Drug Discovery (2011), 10, 661-669 Recommended: Manz, Andreas, Pamme, Nicole, Iossifidis, Dimitri, Bioanalytical chemistry. Imperial College Press. 2004 (ISBN 1-86094-371-3, pbk) Biomarkers in Clinical Drug Development, J.C. Bloom, M. Dekker, Informa Healthcare (Mai 2003) ISBN: 978-0-824-74026-9 Web resources:

<b>course</b>	<i>Advanced technologies</i> Fortgeschrittene Technologien
<b>code</b>	M-SLS-F 02 040 b
<b>corresponding module</b>	<i>Profiling of bioactive compounds</i>
<b>format</b>	2 lessons per week
<b>ECTS-credits</b>	2
<b>student workload</b>	Lectures 24 h Private study 36 h
<b>lecturer</b>	Kurt Furrer, Ron Tynes, Eric Kübler, Daniel Gygax
<b>intended learning outcomes</b>	Students know and understand some advanced technologies and their use for the profiling of bioactive compounds.
<b>contents</b>	Advance techniques used for profiling of bioactive compounds <ul style="list-style-type: none"><li>• Isothermal titration calorimetry</li><li>• iRNA and molecular beacons</li><li>• Static and dynamic light scattering</li><li>• Ultrasonic storage modulus</li><li>• Antibody technologies</li><li>• Group work</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture and case studies
<b>language</b>	English
<b>bibliography</b>	Required:  Recommended: Manz, Andreas, Pamme, Nicole, Iossifidis, Dimitri, Bioanalytical chemistry. Imperial College Press. 2004 (ISBN 1-86094-371-3, pbk) Web resources:

**module** ***Applied bioanalytics***

Angewandte Bioanalytik

- courses**
- *Advanced toxicology and pharmacology*  
Fortgeschrittene Toxikologie und Pharmakologie
  - *Radioanalytics*  
Radioanalytik
  - *Ecotoxicology*  
Ökotoxikologie
  - *Systems biology*  
Systembiologie

**code** M-SLS-F 02 050

**institute** FHNW - School of Life Sciences

**degree programme** Master of Life Sciences

**major** Molecular Technologies

**level** Advanced

**type** Core module, elective

**ECTS-credits** 5

**student workload** 150 hours

**module leader** Georg Lipps

**assessment** Average of ECTS credit weighted marks of courses

**requirements** bachelor level of molecular biology, biochemistry and physiology

**comments**

<b>course</b>	<i>Advanced toxicology and pharmacology</i> Fortgeschrittene Toxikologie und Pharmakologie
<b>code</b>	M-SLS-F 02 050 a
<b>corresponding module</b>	<i>Applied bioanalytics</i>
<b>format</b>	2 lessons per week, half a semester
<b>ECTS-credits</b>	1
<b>student workload</b>	Lectures            12 h Private study      18 h
<b>lecturer</b>	Armin Wolf
<b>intended learning outcomes</b>	Knowledge and understanding of the basic concept of toxicology and safety evaluations during drug development. Understanding the basic molecular mechanisms by which drugs interact with biological systems.
<b>contents</b>	<ul style="list-style-type: none"><li>• Introduction to the basics of drug safety in the integrated drug development process.</li><li>• Role of regulatory toxicology and mechanistic toxicology during drug development.</li><li>• Interactions of drugs with biological targets at the cellular and molecular level. This includes pharmacokinetic (i.e. transport and drug metabolism), pharmacological (i.e. receptor binding) and the formation of toxic intermediates.</li><li>• Advanced insight into the mechanisms of target organ toxicities of the liver, kidney and other selected organs.</li><li>• Non-organ directed toxicities: basics of chemical carcinogenesis and genetic toxicology.</li><li>• Experimental <i>in vivo</i> and <i>in vitro</i> models for safety testing.</li><li>• Extrapolation from animal data to human. Critical review of the safety factor concept. Introduction to safety biomarker.</li></ul>
<b>assessment</b>	Written examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture, interactive discussions
<b>language</b>	English
<b>Bibliography</b>	Required: Klaassen, C.D. (Ed), Toxicology: The Basic Science of Poisons. McGraw-Hill, New York 2008 Urs.A. Boelsterli, Mechanistic Toxicology, The molecular basis of how chemicals disrupt biological targets, Taylor & Francis, London 2003 Recommended: Aktories, Förstermann, Hofmann, Starke, Allgemeine und Spezielle Pharmakologie und Toxikologie, Urban und Fischer 2009. Web resources:

<b>course</b>	<i>Radioanalytics</i> Radioanalytik
<b>code</b>	M-SLS-F 02 050 b
<b>corresponding module</b>	<i>Applied bioanalytics</i>
<b>format</b>	2 lessons per week, half a semester
<b>ECTS-credits</b>	1
<b>student workload</b>	Lectures            12 h Private study      18 h
<b>lecturer</b>	Philippe Corvini
<b>intended learning outcomes</b>	<ul style="list-style-type: none"><li>• understand and master radioanalytical methods</li><li>• set and apply a radiomonitoring strategy to assess the fate of organic compounds in complex environmental matrices</li></ul>
<b>contents</b>	<ul style="list-style-type: none"><li>• basics in radioisotope chemistry and work in radioisotope lab</li><li>• radioanalytical methods: LC-MS/MS coupled to radiodetector, liquid scintillation counting, combustion (biological oxidizer)</li><li>• calculation of radioactivity balances and application to fate studies</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture
<b>language</b>	English
<b>bibliography</b>	Required:  Recommended:  Web resources:

<b>course</b>	<i>Ecotoxicology</i> Ökotoxikologie
<b>code</b>	M-SLS-F 02 050 c
<b>corresponding module</b>	<i>Applied bioanalytics</i>
<b>format</b>	2 lessons per week, half a semester
<b>ECTS-credits</b>	1
<b>student workload</b>	Lectures            12 h Private study      18 h
<b>lecturer</b>	Karl Fent
<b>intended learning outcomes</b>	<ul style="list-style-type: none"><li>• knowledge of natural and anthropogenic toxins</li><li>• understanding of modes of actions of toxins on the molecular level: interactions with biomolecules</li><li>• understanding of the fate of chemicals in organisms and their metabolism</li></ul>
<b>contents</b>	<ul style="list-style-type: none"><li>• test systems in ecotoxicology: molecular, cellular, organism and model ecosystem tests</li><li>• natural and man-made toxins</li><li>• fate of chemicals in organisms: uptake, metabolism, bio-accumulation, elimination</li><li>• effects of chemicals on the molecular level: mode of actions and interaction with biomolecules</li><li>• effects of chemicals on cells, organs, organisms and populations</li><li>• cancerogenesis: what is cancer, what do we know about involvement of oncogenes and tumour suppressor genes.</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture
<b>language</b>	English
<b>bibliography</b>	Required:  Recommended:  Web resources:

<b>course</b>	<i>Systems biology</i> Systembiologie	
<b>code</b>	M-SLS-F 02 050 d	
<b>corresponding module</b>	<i>Applied bioanalytics</i>	
<b>format</b>	2 lessons per week	
<b>ECTS-credits</b>	2	
<b>student workload</b>	Lectures	24 h
	Private study	36 h
<b>lecturer</b>	Georg Lipps	
<b>intended learning outcomes</b>	The students shall obtain an overview on the high-throughput techniques available to study organism and will understand how the data is analyzed and visualized. The student will be able to use the public databases containing the results of the high throughput approaches. The student understands the basic design principles of biological networks.	
<b>contents</b>	<p>Genomics</p> <ul style="list-style-type: none"> <li>• sequencing techniques (dideoxysequencing, pyrosequencing, Solexa)</li> <li>• sequencing of the human genome</li> <li>• annotation of genome sequences</li> <li>• data bases, genome browser, ENCODE</li> <li>• mutations, single nucleotide polymorphism, selection, population genomics</li> <li>• analysis of inherited diseases</li> </ul> <p>Comparative genomics</p> <ul style="list-style-type: none"> <li>• alignment</li> <li>• trees</li> <li>• phylogenetic footprinting</li> <li>• COG (cluster of orthologous groups)</li> <li>• genomic profiling</li> </ul> <p>Transcriptomics</p> <ul style="list-style-type: none"> <li>• microarray, serial analysis of gene expression, expressed sequence tags, cDNA</li> <li>• cluster analysis, dendrogram</li> <li>• analysis of genetic networks by perturbations</li> <li>• application of microarrays: ChIP to chip, splicing, tiling arrays</li> </ul> <p>Functional genomics</p> <ul style="list-style-type: none"> <li>• bioinformatic approaches: phylogenetic and transcriptional profiling, Rosetta Stone, operon structure</li> <li>• genetic approaches: knock-outs, knock-downs, epistasis, yeast two hybrid screen</li> <li>• proteomic approaches: localisation, protein complexes, functional screens</li> </ul> <p>Proteomics</p> <ul style="list-style-type: none"> <li>• protein identification by mass spectroscopy (ESI, MALDI)</li> <li>• absolute and relative protein quantification</li> <li>• analysis of posttranslational modifications</li> <li>• identification of protein complexes by tandem affinity purification</li> <li>• "biochemical genomics": analysis of protein function on a genome-wide scale</li> <li>• protein microarrays</li> </ul> <p>Biological networks</p> <ul style="list-style-type: none"> <li>• general properties of biological networks</li> <li>• metabolic networks, <i>in silico</i> cells</li> <li>• regulatory networks, network motifs, synthetic networks</li> </ul>	

**assessment** Written/oral examination at the end of the semester (2/3) and student work (1/3)

**teaching and learning strategies** Lecture  
Case studies

**language** English

**bibliography** Required:

Recommended:

Brown, T.A., Genomes, 3<sup>rd</sup> Edition, Garland Science 2006

Alon, U., An Introduction to Systems Biology: Design Principles of Biological Circuits. CRC Press 2006

Web resources:

<http://www.ncbi.nlm.nih.gov/Database/>

<http://genome.ucsc.edu/cgi-bin/hgGateway>

<http://www.genome.gov/10005107>

[http://en.wikipedia.org/wiki/Microarray\\_databases](http://en.wikipedia.org/wiki/Microarray_databases)

<http://www.microbesonline.org/>

<http://www.yeastgenome.org/>

<http://www.expasy.ch/tools/>

<http://www.cytoscape.org/>

## Molecular Technologies and Therapeutic Technologies

**module** ***Bio-Nanotechnology***

Bio/Nanotechnologie

- courses**
- (Bio-)sensors  
Biosensoren
  - *Surface technology*  
Oberflächentechnologie
  - Advanced (bio-)materials  
(Bio-)Materialien

**code** M-SLS-F 03 010

**institute** FHNW - School of Life Sciences

**degree programme** M.Sc. in Life Sciences

**major** Molecular Technologies and Therapeutic Technologies

**level** Advanced

**type** Core module, elective

**ECTS-credits** 5

**student workload** 150 hours

**module leader** Uwe Pieles

**assessment** Average of ECTS credit weighted marks of courses

**requirements** Scientific background in chemistry, physics and analytical chemistry.  
Basics in biology

**comments**

<b>course</b>	<i>(Bio-)sensors</i> Biosensoren	
<b>code</b>	M-SLS-F 03 010 a	
<b>corresponding module</b>	<i>Bio-Nanotechnology</i>	
<b>format</b>	2 lessons per week, half a semester	
<b>ECTS-credits</b>	1	
<b>student workload</b>	Lectures	12 h
	Private study	18 h
<b>lecturer</b>	Uwe Pieles	
<b>intended learning outcomes</b>	Students will: <ul style="list-style-type: none"> <li>• become familiar with the most recent sensing strategies and detection principles in Life Sciences (chemical, biological, medical, environmental and pharmaceutical applications).</li> <li>• become familiar with the physical, biological background of the sensing techniques.</li> <li>• critically evaluate the scope and limitations of the applied methods, the range of sensitivity and the influence of disturbing factors on the results.</li> <li>• be able to identify artefacts derived from the used methods.</li> <li>• know applications of sensing technologies in the field of medical/pharmaceutical technologies (e.g. detection of blood gases, sugar, cholesterol), in biosciences (e.g. for the detection of biomolecules and study of the interactions of these molecules with each other) and in environmental technologies for the sensitive detection of ions and organic and inorganic pollutants.</li> <li>• be familiar with the most recent techniques to functionalize sensor surfaces and to immobilize bio-molecules.</li> </ul>	
<b>contents</b>	Advanced Sensing Technologies <ul style="list-style-type: none"> <li>• Surface plasmon resonance</li> <li>• Cantilever based sensors for the detection of biomolecules and small organic and inorganic molecules.</li> <li>• Nano electronic sensors (nano wire)</li> <li>• Array technology</li> <li>• QCMB/Acoustic wave</li> <li>• Trace analysis of micropollutants (hormonally active compounds, pharmaceuticals) in the environment, environmental toxicology.</li> <li>• Waveguide detection principle (planar waveguide and optical fibres) with fluorescence and label free detection</li> </ul>	
<b>assessment</b>	Written/oral examination	
<b>teaching and learning strategies</b>	Lecture Exercises Lab visit with practical demonstrations	
<b>language</b>	English	
<b>bibliography</b>	Recommended:  Required: Selected publications and excerpts from specialized books Web resources:	

<b>course</b>	<i>Surface technologies</i> Oberflächentechnologien	
<b>code</b>	M-SLS-F 03 010 b	
<b>corresponding module</b>	<i>Bio-Nanotechnology</i>	
<b>format</b>	2 lessons per week	
<b>ECTS-credits</b>	2	
<b>student workload</b>	Lectures	24 h
	Private study	36 h
<b>lecturer</b>	Uwe Pieles, Michael de Wild	
<b>intended learning outcomes</b>	Students will: <ul style="list-style-type: none"> <li>• become familiar with general aspects of the importance of surfaces.</li> <li>• know the principal methods of sample preparation for analytical techniques required to accurately analyse the surface e.g. metallurgical preparation techniques.</li> <li>• get to know most recent methods to functionalize, activate and structure surfaces.</li> <li>• be familiar with technologies to immobilize biomolecules to the materials surface.</li> <li>• know about the use of surface functionalized materials and the importance of the properties of such materials for applications in environmental technologies (e.g. porous membranes, filters, sorbants), in pharmaceutical technologies (e.g. drug delivery), chemistry (e.g. catalysis) biosensing and medtech applications.</li> <li>• comprehend methods to analyse the surface morphology and topography of various materials and are able to interpret the microscopic and spectroscopic data.</li> <li>• know methods to analyse the chemical composition of material surfaces.</li> <li>• be able to select the right combination of surface analytical techniques to properly analyze the surface properties of various materials.</li> </ul>	
<b>contents</b>	Advanced microscopic techniques <ul style="list-style-type: none"> <li>• Advanced SEM techniques; Interpretation of SEM images</li> <li>• Advanced Atomic Force Microscopy measuring modes             <ul style="list-style-type: none"> <li>– Friction force, phase imaging, constant amplitude</li> <li>– Mode, pulsed force mode</li> </ul> </li> <li>• TEM techniques: TEM Sample preparation, contrasting techniques.</li> <li>• Microscopic imaging techniques</li> <li>• Advanced confocal microscopy in material/ life sciences</li> <li>• Ellipsometry/Imaging Ellipsometry</li> <li>• Profilometry</li> <li>• Micro and Nanotribology – friction force, adhesion, hardness</li> </ul> Spectroscopy in surfaces <ul style="list-style-type: none"> <li>• EDX and WDX Analysis</li> <li>• Raman analysis coupled to SEM</li> <li>• Confocal Raman microscopy</li> <li>• Tip Enhanced Raman spectroscopy</li> <li>• TOF-SIMS techniques</li> <li>• FTIR</li> <li>• MALDI-TOF-MS</li> <li>• XPS and Auger spectroscopy and their applications</li> </ul> Surface Structuring technologies <ul style="list-style-type: none"> <li>• FIB</li> </ul>	

- RIE
  - mechanical structuring
  - Wet-etching
  - Photolithography
  - chemical patterning
  - Microstructuring, microcontact printing, nanolithography a.o.
- Surface Functionalisation and Surface coatings
- CVD
  - Silanisation
  - Layer by layer - Polyelectrolytes
  - Self-assembly
  - Block-Copolymer
  - Thin film coatings
  - Metallic coating
  - Ceramic coating
  - Plasma coating
  - Sputtering
  - Plasma polymerization
  - Ion implanting
- Electrochemical surface modification
- Anodisation, electro polishing, passivation, galvanic deposition
- Preparation techniques
- Embedding
  - Cutting
  - Grinding
  - Polishing
  - Etching
- Miscellaneous techniques
- BET, Porosimetry
  - Ellipsometry
  - Dynamic Contact Angle measurement

**assessment** Written/oral examination

**teaching and learning strategies** Lecture  
 Exercises  
 Lab visit with practical demonstrations

**language** English

**bibliography** Recommended:

Required:

Selected publications and excerpts of specialized books

Web resources:

<b>course</b>	<i>Advanced (bio-)materials</i> (Bio-)Materialien	
<b>code</b>	M-SLS-F 03 010 c	
<b>corresponding module</b>	<i>Bio-Nanotechnology</i>	
<b>format</b>	2 lessons per week	
<b>ECTS-credits</b>	2	
<b>student workload</b>	Lectures	24 h
	Private study	36 h
<b>lecturer</b>	Michael de Wild	
<b>intended learning outcomes</b>	Students will: <ul style="list-style-type: none"> <li>• know the most frequent biocompatible materials.</li> <li>• be familiar with aspects of new and highly sophisticated materials used in medicinal technique and pharmaceutical technique.</li> <li>• get to know the selection criteria of the desired materials depending on the application and their chemical, biological and mechanical behaviour.</li> <li>• understand selected synthetic procedures e.g. introduction to polymer chemistry or ceramic processes to generate the materials with the desired properties.</li> <li>• become familiar with methods to characterize the mechanical, structural and chemical behaviour of biomaterials.</li> <li>• know the most recent methods to generate 3D structures from bio or biocompatible materials.</li> <li>• know the importance of structural features of surfaces with respect to cell-surface interactions.</li> </ul>	
<b>contents</b>	<ul style="list-style-type: none"> <li>• Implants and medical devices, biocompatibility, sterility and biodegradation.</li> <li>• Principles of cell-surface interactions, importance of structural features, surface-tissue interface.</li> <li>• Functional polymers: Hydrogels, blockcopolymers, vesicles and nanomaterials, anti-inflammatory coatings.</li> <li>• Particle technology: Micellar techniques, sol gel processes, extrusion, pyrolysis etc.</li> <li>• Principle of triggered functions e.g. controlled release/drug-delivery systems.</li> <li>• Importance of hydrophilicity, chemistry and roughness to the implant-body interface.</li> <li>• Applications of functional polymers in medical field.</li> <li>• Inorganic materials: Hydroxyapatite, titanium, bioceramics a.o.</li> <li>• Particle synthesis and methods to characterize particles properties e.g. BET, LD, PCS, <math>\mu</math>CT.</li> <li>• Natural biomaterials e.g. collagen, chitosan.</li> <li>• Principle of rapid prototyping and 3D manufacturing methods.</li> <li>• 3D structures by scaffolding, vacuum impregnation, sintering etc.</li> </ul>	
<b>assessment</b>	Written exam	
<b>teaching and learning strategies</b>	Lecture Blended learning Lab visit	
<b>language</b>	English	



**bibliography** Recommended:

Required:

selected publications and excerpts from specialized books

Web resources:

**module*****Sustainable production and clean technologies***

Nachhaltige Produktion und Prozessintegrierter Umweltschutz

**courses**

- *Process integrated preventive environmental protection*  
Prozessintegrierter präventiven Umweltschutz
- *Industrial environmental technologies*  
Industrieller nachsorgender Umweltschutz

**code** M-SLS-F 03 070**institute** FHNW – Hochschule für Life Sciences**degree programme** Master of Life Sciences**major** Therapeutic Technologies and Molecular Technologies**level** Advanced**type** Core module, elective**ECTS-credits** 5**student workload** 150 hours**module leader** Philippe Corvini**assessment** Average of ECTS credit weighted marks of courses**requirements** bachelor level knowledge of environmental technology**comments**

<b>course</b>	<i>Process integrated preventive environmental protection</i> Prozessintegrierter präventiver Umweltschutz
<b>code</b>	M-SLS-F 03 070 a
<b>corresponding module</b>	<i>Sustainable production and clean technologies</i>
<b>format</b>	2 lessons per week
<b>ECTS-credits</b>	2
<b>student workload</b>	Lectures            24 h Private study      36 h
<b>lecturer</b>	Thomas Wintgens, Anders Nättorp, N.N.
<b>intended learning outcomes</b>	Knowledge about environmental management principles which can be utilised in the sustainable production in the Life Science sector
<b>contents</b>	<ul style="list-style-type: none"><li>• Cleaner Production and Clean Technologies</li><li>• Energy and Material Flows</li><li>• Best Available Technologies</li><li>• Membrane technologies</li><li>• Resource Efficiency</li><li>• Recycling and Recovery</li><li>• Industrial Ecology</li><li>• Economical aspects of process integrated environmental care</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture Case studies with group work
<b>language</b>	English
<b>bibliography</b>	Required: Förstner, Ulrich, Umweltschutztechnik, VDI-Springer Verlag, Berlin 2008 Recommended: to be determined Web resources: <a href="http://www.bafu.admin.ch/">http://www.bafu.admin.ch/</a>

<b>course</b>	<i>Industrial environmental technologies</i> Industrieller nachsorgender Umweltschutz
<b>code</b>	M-SLS-F 03 070 b
<b>corresponding module</b>	<i>Sustainable production and clean technologies</i>
<b>format</b>	3 lessons per week
<b>ECTS-credits</b>	3
<b>student workload</b>	Lectures            36 h Private study      54 h
<b>lecturer</b>	Thomas Wintgens, Anders Nättorp, Philippe Corvini, Markus Lenz, NN
<b>intended learning outcomes</b>	<ul style="list-style-type: none"><li>• Knowledge about environmental technologies which can be utilised in the sustainable production in the Life Science sector</li><li>• Advanced knowledge about technical principles as well as application areas</li></ul>
<b>contents</b>	<ul style="list-style-type: none"><li>• Wastewater treatment</li><li>• Water recycling and reuse</li><li>• Exhaust gas treatment</li><li>• Soil treatment and site rehabilitation</li><li>• Solid waste treatment and valorisation (recycling, composting, methanation)</li><li>• Environmental biotechnology (microorganisms and enzymes)</li><li>• Emerging technologies: Nanotechnologies for environmental care</li><li>• Excursions</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture Case studies with group work
<b>language</b>	English
<b>bibliography</b>	Required: Förstner, Ulrich, Umweltschutztechnik, VDI-Springer Verlag, Berlin 2008 Recommended: to be determined Web resources: <a href="http://www.bafu.admin.ch/">http://www.bafu.admin.ch/</a>

## Therapeutic Technologies

**module** ***Drug formulation and delivery***

Arzneimittelformulierung/Wirkstoffverabreichung

- courses**
- *Controlled release technologies*  
Kontrollierte Wirkstofffreisetzung
  - *Biopharmaceutical modelling and simulation*  
Biopharmazeutische Modellierung und Simulation
  - *Oral formulations of poorly water soluble drugs*  
Perorale Formulierungen von schwer-wasserlöslichen Wirkstoffen
  - *Alternative routes of drug delivery and drug targeting*  
Alternative Verabreichungsmethoden

**code** M-SLS-F 03 020

**institute** FHNW - School of Life Sciences

**degree programme** M.Sc. in Life Sciences

**major** Therapeutic Technologies

**level** Advanced

**type** Core module, elective

**ECTS-credits** 5

**student workload** 150 hours

**module leader** Georgios Imanidis

**assessment** Average of ECTS credit weighted marks of courses

**requirements** Comparative physiology, Bachelor level chemistry, mathematics, biology, galenics

**comments**

<b>course</b>	<i>Controlled release technologies</i> Kontrollierte Wirkstofffreisetzung
<b>code</b>	M-SLS-F 03 020 a
<b>corresponding module</b>	<i>Drug formulation and delivery</i>
<b>format</b>	2 lessons per week, half of a semester
<b>ECTS-credits</b>	1
<b>student workload</b>	Lectures            12 h Private study      18 h
<b>lecturer</b>	Georgios Imanidis and Martin Kuentz
<b>intended learning outcomes</b>	Participants will know the technologies applied to achieve controlled drug release of medications by different routes of administration; they will understand the mechanism of action of these technologies, they can develop formulations and manufacturing methods for these drug products and can evaluate their performance using experimental and theoretical methodology including physicochemical kinetic modelling and pharmacokinetics.
<b>contents</b>	<ul style="list-style-type: none"><li>• Theory of drug diffusion in pharmaceutical dosage forms</li><li>• Kinetics of drug release</li><li>• Crystals</li><li>• Hydrophilic/lipophilic matrix systems</li><li>• Swellable matrix systems</li><li>• Hydrogels</li><li>• Heterogeneous/multi-phasic systems</li><li>• Osmotic systems</li><li>• Membrane coated dosage forms</li><li>• Biodegradable/bioerodable systems</li><li>• Multi-particulate systems; Microcapsules microspheres</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture
<b>language</b>	English
<b>bibliography</b>	Required: Aulton, Michael E., Aulton's <i>Pharmaceutics: The Design and Manufacture of Medicines</i> , Churchill Livingstone, 3rd Revised edition (REV), September 2007 Recommended:  Web resources:

<b>course</b>	<i>Biopharmaceutical modelling and simulation</i> Biopharmazeutische Modellierung und Simulation
<b>code</b>	M-SLS-F 03 020 b
<b>corresponding module</b>	<i>Drug formulation and delivery</i>
<b>format</b>	2 lessons per week, half of a semester
<b>ECTS-credits</b>	1
<b>student workload</b>	Lectures            12 h Private study      18 h
<b>lecturer</b>	Georgios Imanidis and Hilde Spahn
<b>intended learning outcomes</b>	<ul style="list-style-type: none"><li>• Knowing the most important application fields of modelling and simulation in the area of pharmaceuticals and biopharmaceuticals</li><li>• Basic understanding of the biopharmaceutical concepts</li><li>• Ability to assess new drug candidates from a biopharmaceutical perspective and to analyse pharmacokinetic data with computational models</li><li>• Use of computer models to simulate the impact of chemicals on organisms with a focus on pharmacokinetic modelling</li></ul>
<b>contents</b>	Introduction and repetition of basic pharmaceutical and biopharmaceutical concepts. <ul style="list-style-type: none"><li>• Prediction of ADME-related properties based on molecular predictors</li><li>• Introduction to compartmental and physiologically-based pharmacokinetic models</li><li>• Computer-based exercises</li><li>• Analysis of pharmacokinetic and pharmacodynamic data</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture and practical group work
<b>language</b>	English
<b>bibliography</b>	Required:  Recommended: Gabrielsson, J. and Weiner, D., Pharmacokinetic and Pharmacodynamic Data Analysis: Concepts and Applications. Swedish Pharmaceutical Press, Stockholm 2000 Klaassen, C.D. (Ed), Toxicology: The Basic Science of Poisons. McGraw-Hill, New York 2001  Web resources:

<b>course</b>	<i>Oral formulations of poorly water soluble drugs</i> Perorale Formulierungen von schwer-wasserlöslichen Wirkstoffen
<b>code</b>	M-SLS-F 03 020 c
<b>corresponding module</b>	<i>Drug formulation and delivery</i>
<b>format</b>	2 lessons per week, half of a semester
<b>ECTS-credits</b>	1
<b>student workload</b>	Lectures            12 h Private study      18 h
<b>lecturer</b>	Martin Kuentz
<b>intended learning outcomes</b>	Participants will know the issues of poorly water soluble drugs from a biopharmaceutical perspective. They will understand the different technologies to overcome the hurdle of poor water solubility and are able to develop drug formulations in this area of pharmaceuticals.
<b>contents</b>	<ul style="list-style-type: none"><li>• Theory from physico-chemistry to biopharmaceutics</li><li>• Drug solubilisation technologies</li><li>• Lipid drug delivery systems</li><li>• Solid drug dispersions</li><li>• Nanoparticles</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture
<b>language</b>	English
<b>bibliography</b>	Required: Aulton, Michael E., Aulton's Pharmaceutics: The Design and Manufacture of Medicines, Churchill Livingstone, 3rd Revised edition (REV), September 2007 Recommended:  Web resources:

<b>course</b>	<i>Alternative routes of drug delivery and drug targeting</i> Alternative Verabreichungsmethoden
<b>code</b>	M-SLS-F 03 020 d
<b>corresponding module</b>	<i>Drug formulation and delivery</i>
<b>format</b>	2 lessons per week
<b>ECTS-credits</b>	2
<b>student workload</b>	Lectures            24 h Private study      36 h
<b>lecturer</b>	Georgios Imanidis and guest lecturer
<b>intended learning outcomes</b>	The participants will know advanced concepts of the different routes of administration. A special knowledge exists in the area of pulmonary, nasal and transdermal drug delivery. The participants will be able to develop, manufacture and test such formulations and can contribute to the development of modern drug targeting systems.
<b>contents</b>	<ul style="list-style-type: none"><li>• Advanced physiological pharmaceuticals</li><li>• Dermal and transdermal delivery</li><li>• Electrically assisted drug delivery</li><li>• Bioadhesion</li><li>• Pulmonary delivery</li><li>• Nasal delivery</li><li>• Ocular delivery</li><li>• Rectal delivery</li><li>• Implants</li><li>• Devices, pumps, stents</li><li>• Drug targeting concepts</li><li>• Liposomes</li><li>• Nanoparticles</li><li>• Magnetic particles</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture
<b>language</b>	English
<b>bibliography</b>	Required: Aulton, Michael E., Aulton's Pharmaceuticals: The Design and Manufacture of Medicines, Churchill Livingstone, 3rd Revised edition (REV), September 2007 Recommended:  Web resources:

**module** ***Drug manufacturing***

Produktionsanlagen für pharmazeutische Produkte

- courses**
- *Advanced pharmaceutical production units*  
Moderne pharmazeutische Produktionsanlagen
  - *System dynamics of production processes*  
Systemdynamik von Produktionsprozessen und -anlagen
  - *Technical services and process media*  
Produktionsinfrastruktur und Prozessmedien

**Code** M-SLS-F 03 030

**institute** FHNW - School of Life Sciences

**degree programme** M.Sc. in Life Sciences

**major** Therapeutic Technologies

**level** Advanced

**type** Core module, elective

**ECTS-credits** 5

**student workload** 150 hours

**module leader** Berndt Joost

**assessment** Average of ECTS credit weighted marks of courses

**requirements** Background in process engineering and technical understanding

**comments**

<b>course</b>	<i>Advanced pharmaceutical production units</i> Moderne pharmazeutische Produktionsanlagen
<b>code</b>	M-SLS-F 03 030 a
<b>corresponding module</b>	<i>Drug manufacturing</i>
<b>format</b>	2 lessons per week
<b>ECTS-credits</b>	2
<b>student workload</b>	Lectures            24 h Private study      36 h
<b>lecturer</b>	Berndt Joost, Andreas Schreiner
<b>intended learning outcomes</b>	Students will understand and master the design process of selected pharmaceutical process units. They will be able to define requirement and performance specifications for dedicated technical equipment and to qualify implemented installations with regard to the process requirements respectively. Furthermore they will get basic understanding of the planning and procurement processes of technical installations.
<b>contents</b>	<ul style="list-style-type: none"><li>• Crystallization</li><li>• Drying units and auxiliary installations</li><li>• Nanomilling and mixing units</li><li>• Dispersing units for nanoscale particles</li><li>• Fluid bed granulation and auxiliary installations</li><li>• Granulation, (tableting) and coating units</li></ul>
<b>assessment</b>	Presentation and project report (50%) as well as written examination at the end of the semester (50%)
<b>teaching and learning strategies</b>	Blended learning
<b>language</b>	English
<b>bibliography</b>	Recommended:  Required: Detailed bibliography and reading list follows Web resources:

<b>course</b>	<i>System dynamics of production processes</i> Systemdynamik von Produktionsprozessen und -anlagen	
<b>code</b>	M-SLS-F 03 030 b	
<b>corresponding module</b>	<i>Drug manufacturing</i>	
<b>format</b>	5 weeks with 2 hours lectures and 2 hours examples per week	
<b>ECTS-credits</b>	1	
<b>student workload</b>	Lectures	10 h
	Examples	10 h
	Private study	10 h
<b>lecturer</b>	Matej Janovjak	
<b>intended learning outcomes</b>	<p>Students will know about and understand process management and its methodologies, especially the system dynamics approach They will be able to map, analyse and optimize complex processes.</p> <p>This approach enables students to master the complexity of pharmaceutical production processes.</p>	
<b>contents</b>	<ul style="list-style-type: none"> <li>• Context of modelling and simulation in business and compliance environment</li> <li>• System Dynamics methodology</li> <li>• Causal Process and Product Mapping</li> <li>• Modelling of pharmaceutical production processes</li> <li>• Case studies (Lean optimization of the production &amp; supply chain processes; Understanding cause and effect relationships of process parameter and product attributes; multivariate risk assessment; Product Life cycle Mgmt.)</li> </ul>	
<b>assessment</b>	Written/oral examination at the end of the semester	
<b>teaching and learning strategies</b>	Blended learning	
<b>language</b>	English	
<b>bibliography</b>	<p>Recommended:</p> <p>Required:</p> <p>Detailed bibliography and reading list follows</p> <p>Web resources:</p>	



<b>course</b>	<i>Technical services and process media</i> Produktionsinfrastruktur und Prozessmedien	
<b>code</b>	M-SLS-F 03 030 c	
<b>corresponding module</b>	<i>Drug manufacturing</i>	
<b>format</b>	Lectures/examples 2 hours per week	
<b>ECTS-credits</b>	2	
<b>student workload</b>	Lectures	20 h
	Examples	10 h
	Private study	30 h
<b>lecturer</b>	Berndt Joost (coordination) Michael Kuhn, Reune Runyon, Christian Bachofen	
<b>intended learning outcomes</b>	Students will understand and master the design of technical facilities for pharmaceutical production plants. They will be able to define requirement and performance specifications for dedicated technical equipment which is necessary for process and product quality. Furthermore they get basic understanding of the planning and installation processes of technical installations.	
<b>contents</b>	<ul style="list-style-type: none"> <li>• Facility management of production plants</li> <li>• Heating, ventilation and air-conditioning systems</li> <li>• Clean room and isolator/RABS installations and operation</li> <li>• WFI and purified water production and distribution</li> <li>• Vapour generation and distribution</li> <li>• Gas distribution installations</li> </ul>	
<b>assessment</b>	Written examination at the end of the semester	
<b>teaching and learning strategies</b>	Blended learning	
<b>language</b>	English	
<b>bibliography</b>	Recommended:	
	Required:	
	Detailed bibliography and reading list follows	
	Web resources:	

**module** *Medical systems*

Medizinische Systeme

- courses**
- *Development of medical devices*  
Entwicklung medizinischer Geräte
  - *Interactive systems*  
Interaktive Systeme
  - *Distributed medical systems*  
Verteilte medizinische Systeme

**code** M-SLS-F 03 040

**institute** FHNW - School of Life Sciences

**degree programme** Master of Life Sciences

**major** Therapeutic Technologies

**level** Advanced

**type** Core module, elective

**ECTS-credits** 5

**student workload** 150 hours

**module leader** Dominique Brodbeck

**assessment** Average of ECTS credit weighted marks of courses

**requirements** analysis, linear algebra, systems and signals, fundamentals of computers and operating systems, basic programming  
courses: Applied Statistics and Mathematics and Industrial System Theory

**comments**

<b>course</b>	<i>Development of medical devices</i> Entwicklung medizinischer Geräte	
<b>code</b>	M-SLS-F 03 040 a	
<b>corresponding module</b>	<i>Medical systems</i>	
<b>format</b>	2 lessons per week	
<b>ECTS-credits</b>	2	
<b>student workload</b>	Lectures	20 h
	Exercises, labs	6 h
	Project	4 h
	Private study	30 h
<b>lecturer</b>	Michael Stanimirov	
<b>prerequisites</b>	Programming in C, embedded systems, basics on electrical engineering and electronics, basics on digital signal processing (design of standard IIR & FIR filters), systems & signals	
<b>intended learning outcomes</b>	The students will become familiar with the design & implementation for/on small embedded systems (acquisition, processing, control and visualization) based on the commercial platform LABView	
<b>contents</b>	<p>This course introduces fundamental concepts of the design and rapid prototyping of intelligent medical devices based on commercial platforms for digital (bio)signal processing and control. All methods will be developed to answer concrete questions on specific data.</p> <p>Introduction</p> <ul style="list-style-type: none"> <li>• Biosignals</li> <li>• Overview of sensors for biosignal acquisition</li> <li>• Overview of standard signal processing methods</li> </ul> <p>The system design of medical devices with embedded systems building blocks</p> <ul style="list-style-type: none"> <li>• Sensor and communication interfaces</li> <li>• Programming</li> </ul> <p>Application of digital signal processing</p> <ul style="list-style-type: none"> <li>• Transformations</li> <li>• Correlation</li> <li>• Filtering (e.g. IIR, FIR, Kalman)</li> </ul> <p>Application specific implementation</p> <ul style="list-style-type: none"> <li>• Bioimpedance</li> <li>• Specific project</li> </ul>	
<b>assessment</b>	Course grades & Written/oral examination at the end of the semester	
<b>teaching and learning strategies</b>	Lecture Exercises Project	
<b>language</b>	English	
<b>bibliography</b>	<p>Required:</p> <p>Recommended:</p> <p>Stearns, Samuel P., Hush, Don R., Digitale Verarbeitung analoger Signale (Digital signal analysis), Oldenbourg 1999</p> <p>Webster, John G., Biomedical instrumentation</p> <p>Web resources:</p>	



<b>course</b>	<i>Interactive systems</i> Interaktive Systeme
<b>code</b>	M-SLS-F 03 040 b
<b>corresponding module</b>	<i>Medical Systems</i>
<b>format</b>	2 lessons per week
<b>ECTS-credits</b>	2
<b>student workload</b>	Lectures            24 h Private study      36 h
<b>lecturer</b>	Dominique Brodbeck
<b>intended learning outcomes</b>	Students will know the basic techniques for how to design and evaluate an interactive system.
<b>contents</b>	Design <ul style="list-style-type: none"><li>• Mental models</li><li>• Principles, guidelines</li><li>• Prototyping</li><li>• User-centered design process</li></ul> Usability <ul style="list-style-type: none"><li>• Accessibility</li><li>• Evaluating a design</li><li>• Usability testing</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lectures Guided self-study Case studies
<b>language</b>	English
<b>bibliography</b>	Recommended:  Required: Norman, D., <i>The Design of everyday things</i> , MIT Press, Cambridge 1998 Schneiderman, B., <i>Designing the User Interface</i> , Addison-Wesley Longman, Amsterdam 1997 (3 rd ed.) Web resources:



<b>course</b>	<i>Distributed medical systems</i> Verteilte medizinische Systeme
<b>code</b>	M-SLS-F 03 040 c
<b>corresponding module</b>	<i>Medical systems</i>
<b>format</b>	2 lessons per week, half a semester
<b>ECTS-credits</b>	1
<b>student workload</b>	Lectures            12 h Private study      18 h
<b>lecturer</b>	Markus Degen
<b>intended learning outcomes</b>	The students are able to evaluate an adequate telecommunication technology for a given distributed medical software system
<b>contents</b>	<ul style="list-style-type: none"><li>• Overview and basics</li><li>• Clinical IT systems</li><li>• Personal area networks and protocols</li><li>• Telemedical therapeutic Systems</li><li>• IT systems and classifications in public health care</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lectures Guided self-study
<b>bibliography</b>	Recommended:  Required: Kramme, R., Medizintechnik, Springer-Verlag, Berlin 2007 Web resources:

**module** ***Implant development***

Implantatentwicklung

- courses**
- *Image processing for surgical planning*  
Bildverarbeitung für die chirurgische Planung
  - *Surgical support systems*  
Chirurgische Unterstützungssysteme
  - *Medical additive manufacturing*  
Medizinisches Additive Manufacturing

**code** M-SLS-F 03 050

**institute** FHNW - School of Life Sciences

**degree programme** M.Sc. in Life Sciences

**major** Therapeutic Technologies

**level** Advanced

**type** Core module, elective

**ECTS-credits** 5

**student workload** 150 hours

**module leader** Erik Schkommodau

**assessment** Average of ECTS credit weighted marks of courses

**requirements** bachelor level knowledge in medical engineering

**comments**



<b>course</b>	<i>Image processing for surgical planning</i> Bildverarbeitung für chirurgische Planung	
<b>code</b>	M-SLS-F 03 050 a	
<b>corresponding module</b>	<i>Implant development</i>	
<b>format</b>	2 lessons per week	
<b>ECTS-credits</b>	2	
<b>student workload</b>	Lectures	24 h
	Private study	36 h
<b>lecturer</b>	Alex Ringenbach	
<b>intended learning outcomes</b>	<p>The objective of this module is the basic knowledge in digital imaging in the field of medicine, with emphasis on algorithmic.</p> <p>The students will become familiar with the basic imaging-procedure (acquisition, processing and visualisation) and will know the concepts of image-analysis (segmentation, feature extraction, etc.)</p>	
<b>contents</b>	<p>Basics</p> <ul style="list-style-type: none"> <li>• Human visual perception</li> <li>• Digital images: sampling, quantization, statistical parameters, etc.</li> <li>• Colour spaces: RGB, HIS, ..</li> <li>• Pinhole camera model</li> </ul> <p>Imaging in medicine</p> <ul style="list-style-type: none"> <li>• Image-Acquisition &amp; -Reconstruction: Computer tomography CT, Magnetic Resonance MRI Imaging, Positron Emission Tomography PET, Sonography etc.</li> <li>• DICOM: Format, Standards, etc</li> <li>• Visualisation: Windowing, Volume Rendering</li> </ul> <p>Image Processing - basics</p> <ul style="list-style-type: none"> <li>• Image Enhancement &amp; Reconstruction: contrast optimization, smoothing, sharpening, edge filters, Noise Reduction, etc.</li> <li>• Image Transformation: frequency space representation: FFT, frequency filtering, Gabor filters, etc.</li> <li>• Data compression</li> </ul> <p>Image Processing - advanced</p> <ul style="list-style-type: none"> <li>• Image-Registration and Fusion</li> <li>• Segmentation (image- and model-based)</li> <li>• Features Extraction: Texture Analysis, invariants, etc.</li> </ul>	
<b>assessment</b>	Written/oral examination at the end of the semester	
<b>teaching and learning strategies</b>	Lectures	
<b>language</b>	English	
<b>bibliography</b>	<p>Recommended:</p> <p>Required:</p> <p>Kramme, R., Medizintechnik, Springer-Verlag, Berlin 2007          Tönnies, K., Grundlagen der Bildverarbeitung, Pearson Studium, München 2005</p> <p>Web resources:</p>	



<b>course</b>	<i>Surgical support systems</i> Chirurgische Unterstützungssysteme
<b>code</b>	M-SLS-F 03 050 b
<b>corresponding module</b>	<i>Implant development</i>
<b>format</b>	2 lessons per week
<b>ECTS-credits</b>	2
<b>student workload</b>	Lectures            24 h Private study      36 h
<b>lecturer</b>	Erik Schkommodau, Simone Hemm
<b>intended learning outcomes</b>	Participants know standard optimisation algorithms methods and can apply them. They will be exercised in examples.
<b>contents</b>	Linear Optimization Nonlinear Optimization <ul style="list-style-type: none"><li>• Stochastic (Nature analog, evolution)</li><li>• Deterministic (direct and indirect search strategies)</li></ul> for implant planning and intraoperative positioning
<b>assessment</b>	Student work (oral presentations, report) during the course
<b>teaching and learning strategies</b>	Lectures
<b>language</b>	English
<b>bibliography</b>	

<b>course</b>	<i>Medical additive manufacturing</i> Medizinisches Additive Manufacturing
<b>code</b>	M-SLS-F 03 050 c
<b>corresponding module</b>	<i>Implant Development</i>
<b>format</b>	3 lessons per week, part of the semester
<b>ECTS-credits</b>	1
<b>student workload</b>	Lectures            12 h Private study      18 h
<b>lecturer</b>	Ralf Schumacher
<b>intended learning outcomes</b>	The students will be able to design patient specific bone implants and will get an overview of AM technologies to produce them.
<b>contents</b>	<p>Basics</p> <ul style="list-style-type: none"> <li>• Short overview on implant development process</li> <li>• Comparison of process for standard implants vs. process for patient specific implants</li> </ul> <p>Designing "hands on" patient specific implants</p> <ul style="list-style-type: none"> <li>• Segmentation of CT images à conversion to triangulated 3D dataset.</li> <li>• "Reverse Engineering" of achieved data à CAD model</li> <li>• Different ways to design specific implants</li> </ul> <p>Additive Manufacturing AM</p> <ul style="list-style-type: none"> <li>• Short overview on Additive Manufacturing (past, present, future)</li> <li>• Rapid Prototyping and implant manufacturing → pro-cons of different technologies</li> </ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lectures, workshop with specific software → installed on students PC (Windows)
<b>language</b>	English
<b>bibliography</b>	<p>Required: Handout/Reader</p> <p>Recommended:          Additive Manufacturing State of the Industry - Annual Worldwide Progress Report          Terry Wohlers, ISBN 0-9754429-6-1, annually          Additive Manufacturing – Rapid Prototyping to Direct Digital Manufacturing          Ian Gibson, David W. Rosen, Brent Stucker, ISBN 978-1-4419-1119-3, 2010          Advanced Manufacturing Technology for Medical Applications          Ian Gibson, ISBN 0-470-01688-4, 2006          Innovative Developments in Design and Manufacturing          Paulo Jorge Bártolo, ISBN 978-0-415-87307-9, 2009          Medizintechnik – Life Science Engineering          Erich Wintermantel, ISBN 978-3-540-93935-1, 2009</p> <p>Web resources:</p>

**module** ***Life cycle assessment and regulatories***

Lebenszyklusanalyse und rechtliche Rahmenbedingungen

- courses**
- *Registration of chemicals, drugs and medical products*  
Registrierung von Chemikalien, Arzneimitteln und Medizintechnikprodukten
  - *Environmental regulatories*  
Umweltrecht
  - *Life cycle and environmental impact assessment*  
Lebenszyklusanalyse und Bewertung der Umweltbilanz

**code** M-SLS-F 03 060

**institute** FHNW – Hochschule für Life Sciences

**degree programme** Master of Life Sciences

**major** Therapeutic Technologies

**level** Advanced

**type** Core module, elective

**ECTS-credits** 5

**student workload** 150 hours

**module leader** Thomas Wintgens

**assessment** Average of ECTS credit weighted marks of courses

**requirements**

**comments**

<b>course</b>	<i>Registration of chemicals, drugs and medical products</i> Registrierung von Chemikalien, Arzneimitteln und Medizintechnikprodukten	
<b>code</b>	M-SLS-F 03 060 a	
<b>corresponding module</b>	<i>Life cycle assessment and regulatories</i>	
<b>format</b>	2 lessons per week	
<b>ECTS-credits</b>	2	
<b>student workload</b>	Lectures	24 h
	Private study	36 h
<b>lecturer</b>	Hans Ulrich Gally, Georg Imanidis,, N.N.	
<b>intended learning outcomes</b>	<ul style="list-style-type: none"> <li>• Advanced knowledge about requirements and procedures for registration of products with regulatory authorities [and processes] in pharmaceutical and medical technology</li> <li>• Knowledge about national and international environmental regulatory framework conditions for industries to foster sustainable production</li> </ul>	
<b>contents</b>	<ul style="list-style-type: none"> <li>• Registration workshop with case studies for drugs, chemicals and medical products in three separate groups</li> <li>• Theoretical introduction into registration requirements; differences between pharmaceuticals and medical products (including devices for therapy and diagnostics)</li> <li>• Project(s) in groups dealing with the compilation of documentation for registration</li> <li>• Chemical Regulation (e.g. REACH)</li> </ul>	
<b>assessment</b>	Written/oral examination at the end of the semester	
<b>teaching and learning strategies</b>	Lecture Case studies in groups	
<b>language</b>	English	
<b>bibliography</b>	Required: Panorama des Umweltrechts, Kompendium der Umweltschutzvorschriften des Bundes (Gesetze, Verordnungen, Staatsverträge), 4. Auflage 2005 Heilmittelgesetz ( <a href="http://www.admin.ch/ch/d/sr/8/812.21.de.pdf">http://www.admin.ch/ch/d/sr/8/812.21.de.pdf</a> ) Recommended: to be determined Web resources: <a href="http://www.bafu.admin.ch/dokumentation/umweltrecht/index.html?lang=de">http://www.bafu.admin.ch/dokumentation/umweltrecht/index.html?lang=de</a> <a href="http://eur-lex.europa.eu/Repview.do?rep=15">http://eur-lex.europa.eu/Repview.do?rep=15</a> <a href="http://www.swissmedic.ch">www.swissmedic.ch</a> <a href="http://www.ema.europa.eu">www.ema.europa.eu</a> <a href="http://www.fda.gov">www.fda.gov</a>	

<b>course</b>	<i>Environmental regulatories</i> Registrierung und Umweltrecht
<b>code</b>	M-SLS-F 03 060 b
<b>corresponding module</b>	<i>Life cycle assessment and regulatories</i>
<b>format</b>	2 lessons per week, half a semester
<b>ECTS-credits</b>	1
<b>student workload</b>	Lectures            12 h Private study       18 h
<b>lecturer</b>	Corinne Wacker, Thomas Wintgens, N.N.
<b>intended learning outcomes</b>	<ul style="list-style-type: none"><li>• Knowledge about national and international environmental regulatory framework conditions for industries to foster sustainable production</li></ul>
<b>contents</b>	<ul style="list-style-type: none"><li>• Environmental regulatory framework for industrial production (water, soil, air pollution control, integrated management)</li><li>• National and international environmental standards</li><li>• Hazardous Waste Management Regulations</li><li>• Statutory order on hazardous incidents</li><li>• Health and safety regulations</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture Case studies with group work
<b>language</b>	English
<b>bibliography</b>	Required: Panorama des Umweltrechts, Kompendium der Umweltschutzvorschriften des Bundes (Gesetze, Verordnungen, Staatsverträge), 4. Auflage 2005 Recommended: to be determined Web resources: <a href="http://www.bafu.admin.ch/dokumentation/umweltrecht/index.html?lang=de">http://www.bafu.admin.ch/dokumentation/umweltrecht/index.html?lang=de</a> <a href="http://eur-lex.europa.eu/Repview.do?rep=15">http://eur-lex.europa.eu/Repview.do?rep=15</a>



<b>course</b>	<i>Life cycle and environmental impact assessment</i> Lebenszyklusanalysen und Bewertung der Umweltbilanz
<b>code</b>	M-SLS-F 03 060 c
<b>corresponding module</b>	<i>Life cycle assessment and regulatories</i>
<b>format</b>	2 lessons per week
<b>ECTS-credits</b>	2
<b>student workload</b>	Lectures            24 h Private study       36 h
<b>lecturer</b>	Thomas Wintgens, Fredy Dinkel, Emmanuel Oertle, N.N.
<b>intended learning outcomes</b>	<ul style="list-style-type: none"><li>• Knowledge about life cycle assessment and environmental impact assessment methodologies</li><li>• Knowledge about the application of the methods in the area of pharmaceutical and medical technology processes and products</li></ul>
<b>contents</b>	<ul style="list-style-type: none"><li>• Environmental Management Standards</li><li>• Environmental Impact Assessment methods and tools</li><li>• Life cycle inventories</li><li>• Environmental impact assessment methods</li><li>• Risk and liability assessment</li><li>• Life cycle costing</li><li>• Application case studies in the Life Science Industry</li></ul>
<b>assessment</b>	Written/oral examination at the end of the semester
<b>teaching and learning strategies</b>	Lecture Case studies with group work
<b>language</b>	English
<b>bibliography</b>	Recommended: to be determined Web resources: <a href="http://www.bafu.admin.ch/">http://www.bafu.admin.ch/</a>

## English

### module *English academic writing & exam preparation*

**code**
**institute** FHNW – Hochschule für Life Sciences

**degree programme** Master of Sciences in Life Sciences

**specialization** Molecular Technologies and Therapeutic Technologies

**level** Advanced

**type** Optional preparatory module

**format** Seminar - 3 hours per week

**ECTS-credits** 3

**student workload** Lectures 36 h  
 Private study 54 h

**lecturer** Andrew Brown

**intended learning outcomes**

- The course is designed to enable students to become autonomous in writing English in a scientific context accurately and with appropriate register, as well as prepare them to write their Master's theses in English.
- At the end of the course students should be in a position to pass the Cambridge BEC Higher or CAE exam.

**contents**

- Input will be given on the structures, vocabulary and register of scientific English via targeted exercises and real-world texts.
- Students have to complete reading and writing assignments.
- Written assignments are done at home & sent to the lecturer by e-mail.
- Students will also be given training for the Cambridge English C1 level exams.
- The BEC Higher and CAE exams will be presented, along with the knowledge & techniques required to complete each section successfully.
- In-class practice will be supplemented by further exercises to complete at home with self-correction and lecturer feedback where necessary.

**assessment**

This module requires students to complete a number of written assignments outside the classroom. Feedback and marks will be given for the written assignments.

As this is a preparatory module, there will be no internal FHNW exam at the end of the semester. Students are expected to pass the Cambridge BEC Higher or CAE in the Spring session following this course.

Credit points will be awarded on successful completion of either the BEC Higher or CAE exam.

**teaching and learning strategies**

Lecture & a range of classroom activities.

**language**

English

**requirements**

Pre-course: English level B2 under the Common European Framework, e.g. successful completion of the English II module in MLS or LST or a recent pass in the Cambridge First Certificate exam (or equivalent).

**comments**

This module is to assist students to meet the entry requirements in English for the Master of Sciences in Life Sciences FHNW.

**bibliography** Advice on supplementary printed materials will be provided if required.

Language:

<http://owl.english.purdue.edu/owl/>

[http://www.bristol.ac.uk/arts/exercises/grammar/grammar\\_tutorial/index.htm](http://www.bristol.ac.uk/arts/exercises/grammar/grammar_tutorial/index.htm)

<http://learnenglish.britishcouncil.org/en/>

Reading texts:

[www.newscientist.com](http://www.newscientist.com)

[www.economist.com](http://www.economist.com)

[www.guardian.co.uk](http://www.guardian.co.uk)

[www.ft.com](http://www.ft.com)

## Entrepreneurial Basics

<b>Module</b>	<b><i>Innovation and Knowledge Management</i></b>	
<b>Code</b>	MSc_A1	
<b>Course</b>	1. Innovation and knowledge management foundations 2. Intellectual property management 3. Information acquisition and information collaboration 4. Scientific problem solving	
<b>Status</b>	Restricted option subject (3 out of 5)	
<b>ECTS Credits</b>	4	
<b>Composition of the module mark</b>	Test (30%) and essay (70%)	
<b>Contact person Person responsible</b>	Dr. Hugo Bertschy	
<b>Address</b>	F. Hoffmann-La Roche AG Pharma Research Scientific Informatics Bldg. 92 / 6.01 Grenzacherstrasse CH-4070 Basel	
<b>Telephone / Email</b>	+4161 688 24 36	hugo.bertschy@roche.com
<b>Person involved</b>	Additional lecturers from private sector TBA	
<b>Comments</b>	Students who complete this module successfully will understand innovation as a manageable process and know how to effectively deal with knowledge and information resources in this process. Team work and exploratory learning play an important role in this module, and courses are strongly interconnected, reflecting the systemic nature of innovation and knowledge management.	

<b>Course</b>	<i>Innovation and knowledge management foundations</i>					
<b>Code</b>	MSc_A1_1					
<b>Part of Module</b>	Innovation and Knowledge Management					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>	4	<i>Self-study</i>	14
<b>Lecturers</b>	Dr. Hugo Bertschy					
<b>Learning outcomes and competences</b>	<p>Students...</p> <ul style="list-style-type: none"> <li>... know key concepts of innovation and knowledge management</li> <li>... understand innovation as a manageable process</li> <li>... know some relevant management methods and techniques</li> <li>... know to select appropriate approach for a given innovation and knowledge management challenge</li> </ul>					
<b>Course content</b>	<p>Key concepts of innovation and knowledge management, covering strategic, tactical and operational aspects. Historical overview, critical success factors, methods and techniques, example cases.</p> <p>Basics of related management areas, including organizational design and development, idea management, complexity management, portfolio management, change management, project management (focusing only on facets relevant for innovation and knowledge management)</p>					
<b>Teaching/learning methods</b>	Classes, team work, case studies, reading of books and papers					
<b>Assessment</b>	Test and essay (together with other courses of this module)					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Detailed bibliography and reading list follows					
<b>Prior knowledge</b>	No specific knowledge required. However, basic knowledge in business administration is useful					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Course</b>	<i>Intellectual property management</i>					
<b>Code</b>	MSc_A1_2					
<b>Part of Module</b>	Innovation and Knowledge Management					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>	4	<i>Self-study</i>	14
<b>Lecturers</b>	Dr. Hugo Bertschy					
<b>Learning outcomes and competences</b>	<p>Students...</p> <p>... understand importance of IP management</p> <p>... know essentials of patent, copyright and trademark law</p> <p>... understand how this impacts daily work with patent or copyright protected material</p> <p>... know how to design innovation processes to maximize patentability</p>					
<b>Course content</b>	<p>Foundations of patent, copyright and trademark law. Historical overview, national distinctions (Europe, US, Japan), organizational distinctions (private, public sector, commercial / industries).</p> <p>Patent research and strategies for patent applications.</p> <p>Copyright and the internet: electronic content and DRM (digital rights management)</p>					
<b>Teaching/learning methods</b>	Classes, team work, case studies, reading of books and papers					
<b>Assessment</b>	Test and essay (together with other courses of this module)					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Detailed bibliography and reading list follows					
<b>Prior knowledge</b>	No specific knowledge required.					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Course</b>	<i>Information acquisition and information collaboration</i>					
<b>Code</b>	MSc_A1_3					
<b>Part of Module</b>	Innovation and Knowledge Management					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>	4	<i>Self-study</i>	14
<b>Lecturers</b>	Dr. Hugo Bertschy					
<b>Learning outcomes and competences</b>	<p>Students...</p> <p>... know to assess information and knowledge needs</p> <p>... find relevant information and can assess information quality</p> <p>... know essentials of information and knowledge sharing</p>					
<b>Course content</b>	<p>Concepts for information and knowledge needs assessment.</p> <p>Search strategies, information sources (public domain and commercial) and information services. Classification systems and its use in well-established and future oriented approaches.</p> <p>How to make implicit knowledge available. Essentials of team collaboration, information presentation and knowledge visualization.</p>					
<b>Teaching/learning methods</b>	Classes, team work, case studies, reading of books and papers					
<b>Assessment</b>	Test and essay (together with other courses of this module)					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Detailed bibliography and reading list follows					
<b>Prior knowledge</b>	No specific knowledge required.					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Course</b>	<i>Scientific problem solving</i>					
<b>Code</b>	MSc_A1_4					
<b>Part of Module</b>	Innovation and Knowledge Management					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>	4	<i>Self-study</i>	14
<b>Lecturers</b>	Dr. Hugo Bertschy					
<b>Learning outcomes and competences</b>	<p>Students...</p> <p>... know the essentials of decision making</p> <p>... know how to tackle a problem, choosing the right problem solving methods</p> <p>... know to capture results for reuse</p>					
<b>Course content</b>	<p>Foundations of problem solving and decision making (the big picture, complex problems, processes and approaches, systematic step by step approaches and intuitive decision making).</p> <p>Scientific problem solving (problem analysis, hypothesis generation, experimental design and execution, result analysis and documentation).</p> <p>Decision making and context</p>					
<b>Teaching/learning methods</b>	Classes, team work, case studies, reading of books and papers					
<b>Assessment</b>	Test and essay (together with other courses of this module)					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Detailed bibliography and reading list follows					
<b>Prior knowledge</b>	No specific knowledge required.					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Module</b>	<b>Leadership</b>	
<b>Code</b>	MSc_A2	
<b>Course</b>	1. Personnel management and team building 2. Context analysis and techniques for discussion / negotiation 3. Conflict and crisis management 4. Project management	
<b>Status</b>	Restricted option subject (3 out of 5)	
<b>ECTS Credits</b>	4	
<b>Composition of the module mark</b>	Written final module exam at the end of the block week, lasting 60 minutes (closed books) Course weighting: - Personnel management and team building 40% - Conflict and crisis management 20% - Context analysis and techniques for discussions / negotiations 20% - Project management 20%	
<b>Contact person Person responsible</b>	Prof. Dr. Sibylle Olbert-Bock	
<b>Address</b>	FHSG Teufener Str. 4 CH-9000 St.Gallen	
<b>Telephone / Email</b>	+4171 228 70 66	ols@fhsg.ch
<b>Person involved</b>	Prof. Dr. Lukas Scherer, Prof. Dr. Sibylle Olbert-Bock, Kurt Eisenring	
<b>Comments</b>		

<b>Course</b>	<i>Personnel management and team building</i>					
<b>Code</b>	MSc_A2_1					
<b>Part of Module</b>	Leadership					
<b>Workload (h)</b>	<b>Total</b>	<b>48</b>				
	<i>Contact</i>	19	<i>Exercises</i>	12	<i>Self-study</i>	17
<b>Lecturers</b>	Prof.Dr. Sibylle Olbert-Bock, Roger Martin					
<b>Learning outcomes and competences</b>	<p>Participants will be able to:</p> <ul style="list-style-type: none"> <li>- explain essential management activities (including performance reviews, communication, goal agreements).</li> <li>- identify relevant management competencies in different situations, classify and develop their own management competencies.</li> <li>- explain the criterias and choice of an adequate leadership style in different situations (individual, teams, international cooperation).</li> <li>- describe and and use methods and instruments necessary for human resources work concerning recruitment/ selection, personnel evaluation and development of staff.</li> <li>- develop solution approaches and organisational recommendations for work situations, considering motivation of employees, structure and culture of the company.</li> </ul>					
<b>Course content</b>	<p>Reflection on own competencies for management/ leadership</p> <p>Reflection on own leadership behaviour and style</p> <p>Reflection on specific needs in different leadership situations</p> <p>HRM-related tasks of leaders</p> <p>Detection of employee potential (personnel recruitment, selection)</p> <p>Approaches of personnel evaluation and development</p> <p>Motivation, communication and dialogue in the company (incentives, appraisal interviews, team building)</p>					
<b>Teaching/learning methods</b>	Lectures, case work / case studies, group exercises, role plays					
<b>Assessment</b>	Practical exercise task in the final module exam					
<b>Language of instruction</b>	German, English					
<b>Bibliography</b>	<p>Lecturer's handout / Reader</p> <p>Northouse, P.G., Leadership Theory and Practice, Thousand Oaks , Sage 2010</p> <p>Recommended further reading:</p> <ul style="list-style-type: none"> <li>- Stock-Homburg, R., Personalmanagement, Wiesbaden, Gabler 2008</li> <li>- Gmür, M., Thommen, J.P., Human Ressource Management, Zürich, Versus, 2005</li> </ul>					

<b>Prior knowledge</b>	For successful participation in the module, basic knowledge of questions of company management and, ideally, some professional experience are required.
<b>Follow-up module(s) course(s)</b>	Course: Context analysis and techniques for discussions / negotiations
<b>Comments</b>	Participants are expected to complete the preparatory reading assignments, case studies and exercises.

<b>Course</b>	<i>Context analysis and techniques for discussion / negotiation</i>					
<b>Code</b>	MSc_A2_2					
<b>Part of Module</b>	Leadership					
<b>Workload (h)</b>	<b>Total</b>	<b>24</b>				
	<i>Contact</i>	9	<i>Exercises</i>	8	<i>Self-study</i>	7
<b>Lecturers</b>	Prof. Dr. Sibylle Olbert-Bock, Prof. Dr. Lukas Scherer further lecturers					
<b>Learning outcomes and competences</b>	<p>Participants will be able to:</p> <ul style="list-style-type: none"> <li>- understand situations of negotiation with awareness of their broader context.</li> <li>- evaluate framework conditions, such as institutional involvement, social and political climate, personal characteristics of key participants and persons affected, national, economic and other contexts.</li> <li>- describe the basics of negotiation psychology and techniques.</li> <li>- explain how personality is the most important element of communication.</li> <li>- list the most important focal points for their own personal development.</li> </ul>					
<b>Course content</b>	<p>Basics of Communication</p> <p>Conditions and situational influences in negotiation situations</p> <p>Basics of negotiation psychology and techniques</p> <p>Benefit-oriented argumentation and discussion / negotiation strategies</p> <p>Success factors and focal points for development</p> <p>Personality as the most important element in communication</p> <p>Application in various sample situations</p>					
<b>Teaching/learning methods</b>	Group work, lectures, exercises					
<b>Assessment</b>	Practical exercise task in the module final exam					
<b>Language of instruction</b>	German, English					
<b>Bibliography</b>	<p>Lecturer's handout / Reader</p> <p>Recommended further reading:</p> <ul style="list-style-type: none"> <li>- Fisher, Roger, Ury, William, Patton, Bruce, Das Harvard-Konzept : der Klassiker der Verhandlungstechnik, Campus 2006</li> <li>- Fisher, Roger, Shapiro, Daniel, Erfolgreicher verhandeln mit Gefühl und Verstand, Campus, 2007</li> <li>- Schraner, Matthias, Der Verhandlungsführer : Strategien und Taktiken, die zum Erfolg führen, Deutscher Taschenbuch Verlag, 2006</li> <li>- Erbacher, Christian Eric [Hrsg.], Grundzüge der Verhandlungsführung, vdf, Hochschulverlag an der ETH Zürich, 2005</li> </ul>					

<b>Prior knowledge</b>	Willingness to examine the own behaviour critically, openness for criticism and change, ability to criticise
<b>Follow-up module(s) course(s)</b>	Course: Conflict and crisis management
<b>Comments</b>	Participants are expected to complete the preparatory reading assignments, case studies and exercises.

<b>Course</b>	<i>Conflict and crisis management</i>					
<b>Code</b>	MSc_A2_3					
<b>Part of Module</b>	Leadership					
<b>Workload (h)</b>	<b>Total</b>	<b>24</b>				
	<i>Contact</i>	9	<i>Exercises</i>	8	<i>Self-study</i>	7
<b>Lecturers</b>	Prof. Dr. Sibylle Olbert-Bock, Prof. Dr. Lukas Scherer, further lecturers					
<b>Learning outcomes and competences</b>	<p>Participants will be able to:</p> <ul style="list-style-type: none"> <li>- understand difficult leadership situations with regard to interests of employee and company</li> <li>- describe the development of conflicts and explain escalation mechanisms.</li> <li>- describe mediation methods and techniques.</li> <li>- analyse conflicts and choose the right actions to solve them.</li> <li>- apply selected methods and techniques.</li> </ul>					
<b>Course content</b>	<p>Introduction to communication and conflict theory</p> <p>Conflict analysis and escalation stages</p> <p>Mediation methods and techniques and their application</p> <p>Exercises and training sequences for constructive handling of resistance, debates and conflict-solving</p>					
<b>Teaching/learning methods</b>	Lectures, case work / case studies, group exercises, role play					
<b>Assessment</b>	Practical exercise task in the module final exam					
<b>Language of instruction</b>	German, English					
<b>Bibliography</b>	<p>Lecturer's handout / Reader</p> <p>Recommended further reading:</p> <ul style="list-style-type: none"> <li>- Kreyenberg, Jutta, Handbuch Konflikt-Management, Cornelsen 2004</li> <li>- Jiranek, Heinz, Edmüller, Andreas, Als Führungskraft Konflikten vorbeugen, sie erkennen und lösen, Haufe 2003</li> <li>- Schwarz, Gerhard, Konfliktmanagement, Gabler Verlag 2005</li> </ul>					
<b>Prior knowledge</b>	Willingness to do practical work on issues in exercises is expected.					
<b>Follow-up module(s) course(s)</b>	Course: Project management					
<b>Comments</b>	Participants are expected to complete the preparatory reading assignments, case studies and exercises.					

<b>Course</b>	<i>Project management</i>					
<b>Code</b>	MSc_A2_4					
<b>Part of Module</b>	Leadership					
<b>Workload (h)</b>	<b>Total</b>	<b>24</b>				
	<i>Contact</i>	9	<i>Exercises</i>	8	<i>Self-study</i>	7
<b>Lecturers</b>	Kurt Eisenring					
<b>Learning outcomes and competences</b>	<p>Participants will be able to:</p> <ul style="list-style-type: none"> <li>- create a project structure for a fictitious sample enterprise in collaboration with other participants.</li> <li>- describe the essential project phases and project instruments.</li> <li>- list drivers and stumbling blocks of successful project initiation, project management and project completion.</li> <li>- evaluate the role and importance of leadership in projects.</li> </ul>					
<b>Course content</b>	<p>Introduction to project management</p> <p>Project phases and sequence</p> <p>Project initiation</p> <p>Project order</p> <p>Procedure for project structuring</p> <p>Team building</p> <p>Roles of clients, project leaders and project team members</p> <p>Successful kick-off</p> <p>Proven project planning instruments</p> <p>Project management / Leadership in projects</p> <p>Teamwork</p> <p>Keeping the balance between goal/quality – time – costs</p> <p>Dealing with difficult situations and conflicts</p> <p>Project completion (adjourning)</p> <p>Final report / presentation of results</p> <p>Outlook – project controlling</p>					
<b>Teaching/learning methods</b>	Lectures, case work / case studies, group exercises					
<b>Assessment</b>	Practical exercise task in the module final exam					
<b>Language of instruction</b>	German, English					
<b>Bibliography</b>	<p>Lecturer's handout / Reader</p> <p>Recommended further reading:</p> <p>Litke, Hans-Dieter, Projektmanagement, Carl Hanser Verlag, 2007</p>					
<b>Prior knowledge</b>	Basic understanding of general management problems and, ideally, project experience.					

<b>Follow-up module(s) course(s)</b>	
<b>Comments</b>	Participants are expected to complete the preparatory reading assignments, case studies and exercises.

<b>Module</b>	<b><i>Business Management</i></b>	
<b>Code</b>	MSc_A3	
<b>Course</b>	1. Entrepreneurial Thinking and Acting 2. Strategic Management 3. Financial Accounting and Capital Budgeting 4. Business Plan	
<b>Status</b>	Restricted option subject (3 out of 5)	
<b>ECTS Credits</b>	4	
<b>Composition of the module mark</b>	Written exam at the end of the module; time: 90 min.	
<b>Contact person Person responsible</b>	lic.oec. HSG / Dipl. Hdl. Anthony Castiglioni	
<b>Address</b>	FHS St. Gallen Institute of Business Management Davidstrasse 38 Postfach 638 CH-9001 St. Gallen	
<b>Telephone / Email</b>	+4171 226 13 90	anthony.castiglioni@fhsg.ch
<b>Person involved</b>	Prof. Dr. Marcus A. Hauser	
<b>Comments</b>		

<b>Course</b>	<i>Entrepreneurial Thinking and Acting</i>					
<b>Code</b>	MSc_A3_1					
<b>Part of Module</b>	Business Management					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	lic.oec. HSG / Dipl. Hdl. Anthony Castiglioni					
<b>Learning outcomes and competences</b>	<p>After completion of this course, students are able to</p> <ul style="list-style-type: none"> <li>- distinguish the three levels of management and know the core tasks and functions of management</li> <li>- understand management as a system oriented discipline, know the most popular models and methods and can apply them in simple examples</li> <li>- understand Value Based Management as the leading principle of Strategic Management</li> <li>- explain the critical success factors of Value Based Management and their impact on the organization</li> </ul>					
<b>Course content</b>	<p>Normative, Strategic and Operative Management          Overview of the St. Gallen Management-Modell          Frame model of entrepreneurial thinking and acting          Problem solving and decision process in management          Value Based Management and stakeholder orientation          PIMS Research Programme</p>					
<b>Teaching/learning methods</b>	<p>Lectures          Discussions          Group work          Case study and presentation</p>					
<b>Assessment</b>	Written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	<p>Slides and accompanying texts</p> <p>Malik F. (2005): What management really is and what it isn't – Part I. <i>Malik on Management</i>, 3/05, p. 42 – 56</p> <p>Rüegg-Stürm, J. (2005): The New St. Gallen Management Model. Berne: Paul Haupt</p>					
<b>Prior knowledge</b>						
<b>Follow-up module(s) course(s)</b>	Strategic Management					
<b>Comments</b>	Before class students are asked to read the required texts and/or case study and complete the exercises					

<b>Course</b>	<i>Strategic Management</i>					
<b>Code</b>	MSc_A3_2					
<b>Part of Module</b>	Business Management					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	lic.oec. HSG / Dipl. Hdl. Anthony Castiglioni					
<b>Learning outcomes and competences</b>	<p>After completion of this course, students are able to</p> <ul style="list-style-type: none"> <li>- understand the principle of interrelated thinking by applying it to a basic model of functioning competition</li> <li>- understand the implications of strategic management on the central business cycle</li> <li>- apply selected concepts and instruments of strategic analysis and strategy development</li> </ul>					
<b>Course content</b>	<p>Entry barriers for competitors: differentiation or cost leadership  Five forces model / competitive analysis (Porter)  SWOT Analysis  SWOT Matrix  Portfolio analysis and standard strategies  Product-Market-Strategies (Ansoff)  Generic strategy types (Porter)  Core competencies (Prahalad und Hamel)</p>					
<b>Teaching/learning methods</b>	<p>Lectures  Discussions  Group work  Case study and presentation</p>					
<b>Assessment</b>	Written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	<p>Slides and accompanying texts</p> <p>Tiffany P., Peterson S. &amp; Barrow C. (2009): Business Plans for Dummies. Chichester: John Wiley &amp; Sons Ltd. ISBN 978-0-470-74717-9, Chapters 12, 13,14</p>					
<b>Prior knowledge</b>						
<b>Follow-up module(s) course(s)</b>	Financial & Management Accounting					
<b>Comments</b>	Before class students are asked to read the required texts and/or case studies and complete the exercises					

<b>Course</b>	<i>Financial Accounting and Capital Budgeting</i>					
<b>Code</b>	MSc_A3_3					
<b>Part of Module</b>	Business Management					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	Prof. Dr. Marcus A. Hauser					
<b>Learning outcomes and competences</b>	<p>Understand the financial statements of a company (balance sheet, income and cashflow statement)</p> <p>Analyze and assess the performance of a company based on financial ratios</p> <p>Use the discounted cashflow (DCF) method for an investment decision (capital budgeting)</p>					
<b>Course content</b>	<p>Basics of balance sheet, income statement and cashflow statement</p> <p>Analysis and evaluation of financial statements based on financial ratios (e.g. liquidity, profitability, capital-structure, market-valuation)</p> <p>DCF-method for investment decisions (capital budgeting)</p>					
<b>Teaching/learning methods</b>	<p>Lectures</p> <p>Partner and group work (exercises)</p> <p>Discussions</p>					
<b>Assessment</b>	Written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	<p>Slides and accompanying exercises</p> <p>Tiffany P., Peterson S. &amp; Barrow C. (2009): <i>Business Plans for Dummies</i>. (Chapter 10; p. 169-180, 182-187) Chichester: John Wiley &amp; Sons Ltd. ISBN 0-7645-7026-9</p>					
<b>Prior knowledge</b>	<p>Introduction into balance sheet, income and cashflow statement (pre-work Chapter 10, p. 169-180, 182-187)</p>					
<b>Follow-up module(s) course(s)</b>	Business Plan					
<b>Comments</b>						

<b>Course</b>	<i>Business Plan</i>					
<b>Code</b>	MSc_A3_4					
<b>Part of Module</b>	Business Management					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	lic.oec. HSG / Dipl. Hdl. Anthony Castiglioni					
<b>Learning outcomes and competences</b>	<p>After completion of this course, students are able to</p> <ul style="list-style-type: none"> <li>- understand the meaning and purpose of a business plan</li> <li>- understand and selectively go through the crucial steps in developing a business plan by looking at a fictitious example</li> <li>- assess the content and significance of the various steps</li> </ul>					
<b>Course content</b>	<p>Business Idea / Mission  Management team / legal aspects / structure / domicile  Products / services  Analysis: market, competitors, customers, own organization  Strategy: SEP, target customers, positioning, objectives  Realization Plan: Marketing, projects / innovation, infrastructure, personnel planning, investments  Finances: plan incomes statement, plan CF statement, plan balance sheet and financing</p>					
<b>Teaching/learning methods</b>	<p>Lectures  Discussions  Group work  Case study and presentation</p>					
<b>Assessment</b>	Written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	<ul style="list-style-type: none"> <li>- Slides</li> <li>- Tiffany P., Peterson S. &amp; Barrow C. (2009). Introduction, Chapter 1</li> </ul> <p>Additional recommended readings:</p> <ul style="list-style-type: none"> <li>- Tiffany P., Peterson S. &amp; Barrow C. (2009). Business Plans For Dummies. Chapters 2 - 9</li> <li>- McKinsey&amp;Company, Inc. (2001). Planen, gründen, wachsen. Mit dem professionellen Businessplan zum Erfolg (2. Auflage). Zürich: Ueberreuter</li> </ul>					
<b>Prior knowledge</b>	<p>Course Entrepreneurial Thinking and Acting  Course Strategic Management  Course Financial Accounting and Capital Budgeting</p>					

<b>Follow-up module(s) course(s)</b>	A4 Marketing and Communication
<b>Comments</b>	Before class students are asked to read the required texts and/or case study and complete the exercises

<b>Module</b>	<b>Communication and Market</b>	
<b>Code</b>	MSc_A4	
<b>Course</b>	1. Introduction to Marketing & Marketing Research 2. Marketing Strategy 3. Integrated Marketing Communication 4. Markets	
<b>Status</b>	Restricted option subject (3 out of 5)	
<b>ECTS Credits</b>	4	
<b>Composition of the module mark</b>	Written exam at the end of the module; time: 90 min.	
<b>Contact person Person responsible</b>	Mag. Sigrid Hofer	
<b>Address</b>	FHS St.Gallen Hochschule für Angewandte Wissenschaften Institut IFU-FHS Davidstrasse 38 Postfach 638 CH-9001 St.Gallen	
<b>Telephone / Email</b>	+41 71 226 13 96	sigrid.hofer@fhsg.ch
<b>Person involved</b>	Mag. Sigrid Hofer	
<b>Comments</b>		

<b>Course</b>	<i>Introduction to Marketing &amp; Marketing Research</i>					
<b>Code</b>	MSc_A4_1					
<b>Part of Module</b>	Communication and Market					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	9	<i>Exercises</i>		<i>Self-study</i>	21
<b>Lecturers</b>	Mag. Sigrid Hofer					
<b>Learning outcomes and competences</b>	<p>After completion of this course, students are able to</p> <ul style="list-style-type: none"> <li>- define marketing and outline the core steps in the marketing process</li> <li>- understand the marketing information system</li> <li>- outline the marketing research process</li> <li>- plan and coordinate simple marketing research projects</li> <li>- analyze marketing research with simple methods</li> <li>- use marketing information for decision making</li> </ul>					
<b>Course content</b>	<p>Introduction to marketing and its core processes and principles.</p> <p>Overview over the marketing information system, marketing research and in-house systems and external systems of marketing research.</p> <p>Marketing research process</p> <p>Planning of research projects and methods of data collection</p>					
<b>Teaching/learning methods</b>	<p>Lectures</p> <p>Discussions</p> <p>Group work</p> <p>Case study and presentation</p>					
<b>Assessment</b>	Written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	<p>Kotler, P., Armstrong, G., et. al. (2008): Principles of Marketing (5th European Edition). Prentice Hall, Pearson Education Limited.</p> <p>Chapters: 1, 7</p>					
<b>Prior knowledge</b>	The typical competences of a post graduate student are required, in particular cognitive skills. Marketing expertise is not required.					
<b>Follow-up module(s) course(s)</b>	Marketing Strategy					
<b>Comments</b>						

<b>Course</b>	<i>Marketing Strategy</i>					
<b>Code</b>	MSc_A4_2					
<b>Part of Module</b>	Communication and Market					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	9	<i>Exercises</i>		<i>Self-study</i>	21
<b>Lecturers</b>	Mag. Sigrid Hofer					
<b>Learning outcomes and competences</b>	<p>After completion of this course, students are able to</p> <ul style="list-style-type: none"> <li>- discuss the concept of marketing strategy and its core principles</li> <li>- outline the marketing planning process</li> <li>- understand the major steps of a customer-driven marketing strategy</li> <li>- analyze competitors</li> <li>- identify competitive strategies</li> </ul>					
<b>Course content</b>	<p>Basics of marketing strategy</p> <p>Principles of segmentation, targeting, differentiation and positioning</p> <p>Fundamentals of competitive strategy</p>					
<b>Teaching/learning methods</b>	<p>Lectures</p> <p>Discussions</p> <p>Group work</p> <p>Case study and presentation</p>					
<b>Assessment</b>	Written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	<p>Kotler, P., Armstrong, G., et. al. (2008): Principles of Marketing (5th European Edition). Prentice Hall, Pearson Education Limited.</p> <p>Chapters: 3, 9, 10</p>					
<b>Prior knowledge</b>	The typical competences of a post graduate student are required, in particular cognitive skills. Marketing expertise is not required.					
<b>Follow-up module(s) course(s)</b>	Integrated Marketing Communication					
<b>Comments</b>						

<b>Course</b>	<i>Integrated Marketing Communication</i>					
<b>Code</b>	MSc_A4_3					
<b>Part of Module</b>	Communication and Market					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	9	<i>Exercises</i>		<i>Self-study</i>	21
<b>Lecturers</b>	Mag. Sigrid Hofer					
<b>Learning outcomes and competences</b>	<p>After completion of this course, students are able to</p> <ul style="list-style-type: none"> <li>- understand the process of integrated marketing communication and the main instruments of communication</li> <li>- outline the main steps in developing effective communication</li> <li>- discuss personal selling and sales promotions</li> <li>- reflect on direct and online marketing</li> </ul>					
<b>Course content</b>	<p>Basics of the communication process and promotional mix</p> <p>Process of planning market communication</p> <p>Basics of integrated market communication</p> <p>Characteristics and effects of</p> <ul style="list-style-type: none"> <li>- advertising</li> <li>- public relations</li> <li>- personal selling</li> <li>- sales promotion</li> <li>- direct marketing</li> <li>- online marketing</li> </ul>					
<b>Teaching/learning methods</b>	<p>Lectures</p> <p>Discussions</p> <p>Group work</p> <p>Case study and presentation</p>					
<b>Assessment</b>	Written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	<p>Kotler, P., Armstrong, G., et. al. (2008): Principles of Marketing (5th European Edition). Prentice Hall, Pearson Education Limited.</p> <p>Chapters: 15, 16, 17, 18</p>					
<b>Prior knowledge</b>	The typical competences of a post graduate student are required, in particular cognitive skills. Marketing expertise is not required.					
<b>Follow-up module(s) course(s)</b>	Markets					
<b>Comments</b>						

<b>Course</b>	<i>Markets</i>					
<b>Code</b>	MSc_A4_4					
<b>Part of Module</b>	Communication and Market					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	9	<i>Exercises</i>		<i>Self-study</i>	21
<b>Lecturers</b>	Mag. Sigrid Hofer					
<b>Learning outcomes and competences</b>	<p>After completion of this course, students are able to</p> <ul style="list-style-type: none"> <li>- identify the characteristics of consumer and business markets</li> <li>- understand the process of consumer buyer behavior</li> <li>- distinguish different consumer decision making processes</li> <li>- discuss the particularity of the business buying process</li> <li>- identify factors that influence business buyers</li> </ul>					
<b>Course content</b>	<p>Process of consumer and business markets</p> <p>Characteristics of consumer and business markets</p> <p>Influencing factors on consumer and company buying behavior and types of buying behavior</p>					
<b>Teaching/learning methods</b>	<p>Lectures</p> <p>Discussions</p> <p>Group work</p> <p>Case study and presentation</p>					
<b>Assessment</b>	Written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	<p>Kotler, P., Armstrong, G., et. al. (2008): Principles of Marketing (5th European Edition). Prentice Hall, Pearson Education Limited.</p> <p>Chapters: 5, 6</p>					
<b>Prior knowledge</b>	The typical competences of a post graduate student are required, in particular cognitive skills. Marketing expertise is not required.					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Module</b>	<b><i>Society, Legislation and Politics</i></b>	
<b>Code</b>	MSc_A5	
<b>Course</b>	1. Political Ecology and Development policies	
<b>Status</b>	Restricted option subject (3 out of 5)	
<b>ECTS Credits</b>	4	
<b>Composition of the module mark</b>	Written and oral examinations	
<b>Contact person Person responsible</b>	Blaettler Dominic	
<b>Address</b>	Swiss College of Agriculture (SHL) 3052 Zollikofen Switzerland	
<b>Telephone / Email</b>	+41 31 910 22 50	dominic.blaettler@bfh.ch
<b>Person involved</b>		
<b>Comments</b>		

<b>Course</b>	<i>Political Ecology and Development policies</i>					
<b>Code</b>	MSc_A5_1					
<b>Part of Module</b>	Society, Legislation and Politics					
<b>Workload (h)</b>	<b>Total</b>	<b>120</b>				
	<i>Contact</i>	48	<i>Exercises</i>	12	<i>Self-study</i>	60
<b>Lecturers</b>	Yves Hausser, EIL					
<b>Learning outcomes and competences</b>	<p>Acquire an understanding of concepts, problems and challenges that characterise Human-Nature relationships.</p> <p>Ability to identify future challenges in the field of political ecology.</p> <p>Establish comprehensive links between conservation and development policies.</p> <p>Acquire practical knowledge for planning cooperation project, considers their full life-cycle, in contact to exchange with development cooperation professionals.</p>					
<b>Course content</b>	<p>I Political ecology</p> <p>I.1 Alarming diagnosis in a changing world</p> <p>I.2 Key concepts</p> <p>I.3 Political ecology history</p> <p>i.4 Multiple answers to a globalised challenge</p> <p>I.5 Success and failures</p> <p>I.6 XXIst century challenges.</p> <p>II Development policies</p> <p>II.1 Development policies: a western belief ?</p> <p>II.2 Developing, Third World, South...: a semantic problem?</p> <p>II.3 Costs and practices.</p> <p>II.4 Development challenges of the XXIst century: Which sustainability?</p> <p>II.5 Successes and failures: critical analysis</p> <p>III. Project planning and implementation</p> <p>III.1 Project definition and planning</p> <p>III. 2 Project partners and scales</p> <p>III. 3 Resources</p> <p>III.4 Management instruments</p> <p>III.5 Project monitoring and evaluations</p> <p>III.6 Best practices.</p>					
<b>Teaching/learning methods</b>	Contact, Exercises, Self-study					
<b>Assessment</b>	Written and oral examinations					
<b>Language of instruction</b>	English					

<b>Bibliography</b>	<p>Adams William M., Against Extinction: The Story of Conservation, 2005</p> <p>Adams William M., Mulligan Martin, Decolonising nature, 2004</p> <p>Grinevald, Jacques, La Biosphère de l'Anthropocène; climat et pétrole, la double menace. Repères transdisciplinaires (1824-2007), 2007</p> <p>Ramade François, Ecologie fondamentale, 2002.</p> <p>Rist, Gilbert, Le développement : histoire d'une croyance occidentale, 2007</p>
<b>Prior knowledge</b>	
<b>Follow-up module(s) course(s)</b>	
<b>Comments</b>	

## Extended Theoretical Basics

<b>Module</b>	<b>Quality Excellence</b>	
<b>Code</b>	MSc_T1	
<b>Course</b>	1. Current Concepts in Quality Management 2. Quality Performance	
<b>Status</b>	Restricted option subject (6 out of 11)	
<b>ECTS Credits</b>	3	
<b>Composition of the module mark</b>	Final exam (written or oral) on entire module	
<b>Contact person Person responsible</b>	Evelyn Kirchsteiger-Meier	
<b>Address</b>	ZHAW Zürcher Hochschule für Angewandte Wissenschaften Life Sciences and Facility Management Campus Grüental, Postfach CH-8820 Wädenswil	
<b>Telephone / Email</b>	+4158 934 57 04	Evelyn.Kirchsteiger-Meier@zhaw.ch
<b>Person involved</b>		
<b>Comments</b>	The 2 courses are inter-related. The module will not focus on quality <i>assurance</i> in specific industry sectors, but will discuss horizontal quality <i>management</i> models, concepts and philosophies applicable to all sectors.	

<b>Course</b>	<i>Current Concepts in Quality Management</i>					
<b>Code</b>	MSc_T1_1					
<b>Part of Module</b>	Quality Excellence					
<b>Workload (h)</b>	<b>Total</b>	<b>45</b>				
	<i>Contact</i>	18	<i>Exercises</i>	7	<i>Self-study</i>	20
<b>Lecturers</b>	Evelyn Kirchsteiger-Meier Guest speakers from the business sector Work with case studies supervised by research associates					
<b>Learning outcomes and competences</b>	Students learn about the current concepts of Quality Management. They are familiar with different models, philosophies and methods, and are able to apply these appropriately.					
<b>Course content</b>	Definition and history of the term Quality Management. Theory of different models (e.g. TQM, CI), philosophies (e.g. Deming) and methods (e.g. EFQM model, ISO 9004) and experience of quality excellence in practice. Risk management (e.g. ISO 31000) and quality management. Quality in the value chain (e.g. traceability, sustainability, embedding quality objectives across the value chain).					
<b>Teaching/learning methods</b>	In-class lectures, case-studies and literature study.					
<b>Assessment</b>	Final exam (written or oral) on entire module					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Deming, Edwards, W. Out of the crisis. The MIT Press, Cambridge, Massachusetts and London, England, (2000) ISBN 0-262-54115-7 Additional literature will be communicated in the preparatory lecture and in the class.					
<b>Prior knowledge</b>	Basic background in Quality Management is mandatory (e.g. knowledge and/or experience of the norm ISO 9001 or TQM models).					
<b>Follow-up module(s) course(s)</b>	Course T1_2: Quality Performance					
<b>Comments</b>	Students are expected to acquire the theoretical background through self studies. The literature to be studied before commencement of the first course will be communicated in advance. In class, more in-depth knowledge is developed by working with case studies, practice reports and exercises.					

<b>Course</b>	<i>Quality Performance</i>					
<b>Code</b>	MSc_T1_2					
<b>Part of Module</b>	Quality Excellence					
<b>Workload (h)</b>	<b>Total</b>	<b>45</b>				
	<i>Contact</i>	18	<i>Exercises</i>	7	<i>Self-study</i>	20
<b>Lecturers</b>	Evelyn Kirchsteiger-Meier Speakers from business and management Work with case studies supervised by research associates					
<b>Learning outcomes and competences</b>	Students are able to describe processes. They are able to define and describe KPIs (Key Performance Indicators) as tools to measure and improve processes. They understand the process of conducting internal audits as tool to continuous improvement of processes. Furthermore, they are able to understand variability and analyse processes by SPC (statistical process control).					
<b>Course content</b>	Understanding processes: Types of processes, defining processes, measuring / analysing processes via KPIs, improving processes. Auditing processes: Conducting internal audits according to ISO 19011. Understanding variability: statistical process control (SPC)					
<b>Teaching/learning methods</b>	In-class lectures, case-studies and literature study					
<b>Assessment</b>	Final exam (written or oral) on entire module.					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Osterloh, Margit, Frost, Jetta. Prozessmanagement als Kernkompetenz. Gabler (2003), ISBN 3-409-43788-6 Additional literature will be communicated in the preparatory lecture and in the class.					
<b>Prior knowledge</b>	Completion of the course T1_1.					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>	Students are expected to acquire the theoretical background through self studies. The literature to be studied before commencement of the first course will be communicated in advance. In class, more in-depth knowledge is developed by working with case studies, practice reports and exercises.					

<b>Module</b>	<b><i>Health and Nutrition</i></b>	
<b>Code</b>	MSc_T2	
<b>Course</b>	1. Health 2. Nutrition	
<b>Status</b>	Restricted option subject (6 out of 11)	
<b>ECTS Credits</b>	3	
<b>Composition of the module mark</b>	1/3 health 2/3 nutrition	
<b>Contact person Person responsible</b>	Beatrice Baumer	
<b>Address</b>	ZHAW Zürcher Hochschule für Angewandte Wissenschaften Life Sciences and Facility Management Campus Grüental, Postfach CH-8820 Wädenswil	
<b>Telephone / Email</b>	+4158 934 57 08	Beatrice.baumer@zhaw.ch
<b>Person involved</b>		
<b>Comments</b>		

<b>Course</b>	<i>Health</i>					
<b>Code</b>	MSc_T2_1					
<b>Part of Module</b>	Health and Nutrition					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>	6	<i>Self-study</i>	12
<b>Lecturers</b>	Beatrice Baumer, Janice Sych					
<b>Learning outcomes and competences</b>	Students will be able to explain the major health policies and nutritional objectives in Switzerland, the EU and the WHO. They will be able to discuss and give their opinion on programs and actions in Switzerland aimed at improving the population's state of health as well to become familiar with the responsible co-ordinating institutions and departments.					
<b>Course content</b>	Health Policy and Programs in Switzerland, in the EU and WHO. Health programs and actions Nutritional recommendations and possible applications in different nutritional cultures (e.g. Switzerland).					
<b>Teaching/learning methods</b>	Frontal instruction, case studies and literature study					
<b>Assessment</b>	Evaluation of written assignments					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Policies, Health Strategies in Switzerland and the EU					
<b>Prior knowledge</b>	Basic knowledge of Nutrition					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>	Students are expected to acquire the theoretical background in self-study mode. In class, more in-depth knowledge will be developed by working with case studies, practice reports and exercises.					

<b>Course</b>	<i>Nutrition</i>					
<b>Code</b>	MSc_T2_2					
<b>Part of Module</b>	Health and Nutrition					
<b>Workload (h)</b>	<b>Total</b>	<b>60</b>				
	<i>Contact</i>	24	<i>Exercises</i>	4	<i>Self-study</i>	32
<b>Lecturers</b>	Beatrice Baumer, Dr. Christine Brombach, B. Baumer, invited speakers from industry and research centres					
<b>Learning outcomes and competences</b>	Students are able to: Describe dietary habits and their impact on nutritional status and chronic diseases. Describe the physiological effects of selected food components and thus justify their applications in preventing / minimizing nutrition-related diseases.					
<b>Course content</b>	Nutritional implications on medical conditions, with a focus on the following topics: Current data on food intake: German national nutrition survey II Nutrition-related diseases: general overview, impact on public health issues Insulin resistance/ metabolic syndrome, including inflammatory and stress-related cofactors Nutrients with potential for disease prevention, health promotion, and medical nutrition therapy: inputs on recent research in the fields of: milk components, plant components, omega-3 fatty acids					
<b>Teaching/learning methods</b>	Lectures, case studies, excursions					
<b>Assessment</b>	Written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>						
<b>Prior knowledge</b>	Basic knowledge in nutrition, biochemistry, gastrointestinal anatomy and physiology					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>	Students will acquire and deepen basic nutrition knowledge in self study. The courses will focus on the application of this knowledge with case studies, industrial reports and excursions					

<b>Module</b>	<b><i>Applied Statistics and Mathematics</i></b>	
<b>Code</b>	MSc_T3	
<b>Course</b>	1. Analysis of variance and experimental design 2. Regression models and analysis of survey data 3. Analysis of categorical data; individual focus	
<b>Status</b>	Restricted option subject (6 out of 11)	
<b>ECTS Credits</b>	3	
<b>Composition of the module mark</b>	Evaluation of assignments Final written exam	
<b>Contact person Person responsible</b>	PD Dr. Sabine Güsewell	
<b>Address</b>	Schweizerische Hochschule für Landwirtschaft SHL (Swiss College of Agriculture) Länggasse 85 CH-3052 Zollikofen	
<b>Telephone / Email</b>	+4131 910 21 20	Sabine.guesewell@bfh.ch
<b>Person involved</b>	Assistants will be involved in computer laboratories	
<b>Comments</b>		

<b>Course</b>	<i>Analysis of variance and experimental design</i>					
<b>Code</b>	MSc_T3_1					
<b>Part of Module</b>	Applied Statistics and Mathematics					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	8	<i>Exercises</i>	8	<i>Self-study</i>	14
<b>Lecturers</b>	PD Dr. Sabine Güsewell					
<b>Learning outcomes and competences</b>	<p>After this course, students should be able to:</p> <ul style="list-style-type: none"> <li>- analyse data from multiple-factor experiments, including those with complex designs, with the software R</li> <li>- compare factor levels with appropriate methods for multiple comparisons</li> <li>- handle unbalanced data sets</li> <li>- explain basic principles of experimental design and some common types of designs</li> <li>- account for the experimental design in data analysis</li> </ul>					
<b>Course content</b>	Analysis of variance with multiple factors; interpretation of tests for main factors and interactions; methods for multiple comparisons of factor levels; consequences of unbalance in data sets; types of experimental design (blocked, nested, repeated measures) and implications for data analysis					
<b>Teaching/learning methods</b>	Individual preparation, literature study, lectures, computer laboratories					
<b>Assessment</b>	Evaluation of assignments, written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	<p>Quinn, G.P. and Keough, M.J.. 2002. Experimental design and Data Analysis for Biologists. Cambridge University Press.</p> <p>Concepts and Applications of Inferential Statistics. Online course. <a href="http://faculty.vassar.edu/lowry/webtext.html">http://faculty.vassar.edu/lowry/webtext.html</a></p> <p>Statistics reviews. Series of short review articles published in the journal <i>Critical Care</i>, 2002-2005</p> <p>Crawley, M .J. 2009. The R book. Wiley, Chichester</p>					

<b>Prior knowledge</b>	<p>A basic statistics course is necessary. This should include:</p> <p>Descriptive statistics:</p> <ul style="list-style-type: none"><li>- Summarize data sets using graphics and tabular methods;</li><li>- Compute and interpret measures of central tendency, dispersion and correlation.</li></ul> <p>Basic knowledge of inferential statistics:</p> <ul style="list-style-type: none"><li>- Understand the distribution function of a variable</li><li>- Compute and interpret confidence interval for a mean</li><li>- Understand the principles of statistical tests (Hypotheses, test variable, Error, Power)</li></ul> <p>Handling data with the statistical software R</p> <p>Materials will be provided through Moodle, so that students can evaluate their knowledge and fill the identified gaps before the course.</p>
<b>Follow-up module(s)</b>	None
<b>Comments</b>	

<b>Course</b>	<i>Regression models and analysis of survey data</i>					
<b>Code</b>	MSc_T3_2					
<b>Part of Module</b>	Applied Statistics and Mathematics					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	6	<i>Exercises</i>	10	<i>Self-study</i>	14
<b>Lecturers</b>	PD. Dr. Sabine Güsewell					
<b>Learning outcomes and competences</b>	<p>After this course, students should be able to:</p> <ul style="list-style-type: none"> <li>- analyse survey data with regression methods and analyses of covariance using the software R</li> <li>- use alternative or robust regression methods when required by the data</li> <li>- select important explanatory variables among multiple ones</li> <li>- understand how correlations among variables or observations can affect the results of analyses</li> <li>- take these correlations into account in data analysis and in the planning of surveys</li> </ul>					
<b>Course content</b>	Multiple regression and analysis of covariance, data transformation and handling of outliers; robust regression; variable selection, problems and solutions in case of correlations among explanatory variables, planning of surveys					
<b>Teaching/learning methods</b>	Individual preparation, literature study, lectures, computer laboratories					
<b>Assessment</b>	Evaluation of assignments, written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Identical to Course 1					
<b>Prior knowledge</b>	Identical to Course 1					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Course</b>	<i>Analysis of categorical data; individual focus</i>					
<b>Code</b>	MSc_T3_3					
<b>Part of Module</b>	Applied Statistics and Mathematics					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	6	<i>Exercises</i>	10	<i>Self-study</i>	14
<b>Lecturers</b>	PD Dr. Sabine Güsewell					
<b>Learning outcomes and competences</b>	<p>After this course, all students should be able to analyse binary and categorical data and to interpret the results</p> <p>Students can subsequently choose to deepen the previous topics or to study one further procedure (e.g. randomization tests, times series, structural equations etc.)</p>					
<b>Course content</b>	<p>Tests of proportions, contingency tables, logistic regression, Poisson regression.</p> <p>Principle and examples of randomization procedures (bootstrap, permutation) – or individual focus on other procedures</p>					
<b>Teaching/learning methods</b>	Individual preparation, literature study, lectures, computer laboratories, Case study					
<b>Assessment</b>	Evaluation of assignments, written exam					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Identical to Course 1					
<b>Prior knowledge</b>	Identical to Course 1					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Module</b>	<b><i>Data management and visualisation</i></b>	
<b>Code</b>	MSc_T4	
<b>Course</b>	1. Data Structures and Data Maintenance 2. Analysis of Low – and High – Dimensional Data 3. Data Visualisation	
<b>Status</b>	Restricted option subject (6 out of 11)	
<b>ECTS Credits</b>	3	
<b>Composition of the module mark</b>	Assignment or case study (14 hrs including proposal) on a topic chosen from the course	
<b>Contact person Person responsible</b>	Thomas Ott	
<b>Address</b>	ZHAW Zürcher Hochschule für Angewandte Wissenschaften Life Sciences and Facility Management Campus Grüental, Postfach CH-8820 Wädenswil	
<b>Telephone / Email</b>	+41 58 934 56 84	thomas.ott@zhaw.ch
<b>Person involved</b>	Thomas Ott (ottt@zhaw.ch) Urs Mürset (murs@zhaw.ch) Daniel Köchli (koda@zhaw.ch) Dr. Bobby Rohrkemper (roro@zhaw.ch)	
<b>Comments</b>		

<b>Course</b>	<i>Database Structures and Data Maintenance</i>					
<b>Code</b>	MSc_T4_1					
<b>Part of Module</b>	Data Processing and Visualisation					
<b>Workload (h)</b>	<b>Total</b>	<b>15</b>				
	<i>Contact</i>	<i>7</i>	<i>Exercises</i>		<i>Self-study</i>	<i>8</i>
<b>Lecturers</b>	Prof. Dr. Urs Mürset Dr. Bobby Rohrkemper					
<b>Learning outcomes and competences</b>	Students are able to consolidate, structure and model measurement and observation data from a range of different sources in lists, tables and data bases. They understand different structures of data and the principles of data base design.					
<b>Course content</b>	<ul style="list-style-type: none"> <li>• Different structures of data</li> <li>• Principles of data base design</li> </ul> <p>This course concentrates on practical applications and is not designed as a comprehensive lecture in theoretical foundations.</p>					
<b>Teaching/learning methods</b>	In-class lectures, case studies and literature study. Exercises with MS Excel and MS Access					
<b>Assessment</b>	See module description					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	MS Excel and MS Access (current version) has to be installed on each students notebook					
<b>Prior knowledge</b>	Excel including Pivot tables, basic knowledge of Access					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Course</b>	<i>Analysis of Low – and High – Dimensional Data</i>					
<b>Code</b>	MSc_T4_2					
<b>Part of Module</b>	Data Processing and Visualisation					
<b>Workload (h)</b>	<b>Total</b>	<b>45</b>				
	<i>Contact</i>	21	<i>Exercises</i>	12	<i>Self-study</i>	12
<b>Lecturers</b>	Thomas Ott					
<b>Learning outcomes and competences</b>	Students are familiar with some state of the art models, methods and tools for the appropriate compression and analysis of data. They are able to generate new knowledge by targeted data evaluation and data mining. They are aware of different ways to critically examine and visualise low – and high – dimensional data sets.					
<b>Course content</b>	<ul style="list-style-type: none"> <li>• Descriptive statistics of low – dimensional data</li> <li>• Statistical models of high – dimensional data and dimensionality reduction</li> <li>• Selected multivariate procedures and methods of machine learning (principal Component analysis, clustering, classification techniques,....)</li> </ul> <p>This class concentrates on practical applications and does not primarily provide a comprehensive overview of theoretical foundations.</p>					
<b>Teaching/learning methods</b>	In-class lectures, case studies and exercises					
<b>Assessment</b>	See module description					
<b>Language of instruction</b>	English					
<b>Bibliography</b>						
<b>Prior knowledge</b>	<p>Basic statistics at bachelor level (descriptive statistics, two sample tests, correlation measures, etc.)</p> <p>Basic knowledge of the software R is advantageous</p>					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Course</b>	<i>Data Visualisation</i>					
<b>Code</b>	MSc_T4_3					
<b>Part of Module</b>	Data processing and Visualisation					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>	9	<i>Self-study</i>	9
<b>Lecturers</b>	Dr. Daniel Köchli					
<b>Learning outcomes and competences</b>	<p>Students</p> <ul style="list-style-type: none"> <li>• are familiar with different methods for the targeted visualisation of measurements, models and simulations (2D, 3D and 4D; Excel, GIS, CAD etc.)</li> <li>• know the potential and limitations of various visualisation models, their degree of realism (effect on target audience), and software and hardware requirements (performance problems).</li> </ul>					
<b>Course content</b>	<p>The term "extended reality" includes computer-assisted extension of perceptions of reality, which relates to all the human senses. This course is concerned first and foremost with the visual representation of data. With information technology we can process data so that the knowledge it represents is easily accessible to users.</p> <p>In contrast to virtual reality, in which the user is completely immersed in a virtual world, extended reality puts the emphasis on the presentation of additional data. A good example is the website <a href="http://www.map.search.ch">www.map.search.ch</a>, which not only presents reality in the form of aerial photographs, but also gives additional information about train connections.</p> <p>The way that data are presented is always related to a particular purpose. Accordingly, we may use simple graphics such as pie diagrams or x-y graphs, or more complex graphical renditions in two or three dimensions (navigation systems, 3D models of molecules, etc.). In the visualisation of processes or simulation results over time, 4D representations may also be used (logistics simulations, growth simulations, landscape development etc.).</p> <p>This course provides the theoretical foundations which enable students to visualise data as demanded by specific situations. This involves not only modelling reality with data, but also the exploration of the possibilities and limitations of information technology (software and hardware).</p>					
<b>Teaching/learning methods</b>	In-class lectures, case studies, excursions and literature study					
<b>Assessment</b>	See module description					
<b>Language of instruction</b>	English					
<b>Bibliography</b>						
<b>Prior knowledge</b>	<p>Completion of MScT4_1 and MScT4_2</p> <p>Basic knowledge of CAD or GIS an advantage</p>					

<b>Follow-up module(s) course(s)</b>	
<b>Comments</b>	

<b>Module</b>	<b><i>Environmental Policy and Future Models</i></b>	
<b>Code</b>	MSc_T5	
<b>Course</b>	1. Environmental Policy and Governance : from local community level to International Organization	
<b>Status</b>	Restricted option subject (6 out of 11)	
<b>ECTS Credits</b>	3	
<b>Composition of the module mark</b>	Written and oral examinations.	
<b>Contact person Person responsible</b>	Daniel Béguin	
<b>Address</b>	Haute école du paysage, d'ingénierie et d'architecture, hepia Genève/Lullier Filière gestion de la nature 150, rte de Presinge 1254 Jussy	
<b>Telephone / Email</b>	+41 22 546 68 40	daniel.beguina@hesge.ch
<b>Person involved</b>		
<b>Comments</b>		

<b>Course</b>	<i>Environmental Policy and Governance: from local community level to International Organization</i>					
<b>Code</b>	MSc_T5_1					
<b>Part of Module</b>	Environmental Policy and Future Models					
<b>Workload (h)</b>	<b>Total</b>	<b>90</b>				
	<i>Contact</i>	36	<i>Exercises</i>	14	<i>Self-study</i>	40
<b>Lecturers</b>	Yves Hausser, EIL					
<b>Learning outcomes and competences</b>	<p>To acquire and understand the basis framework of environmental Law and Governance</p> <p>To understand the juridical framework of environmental Law at different scales: from local to international level</p> <p>To understand the links between biodiversity, international trade and human rights</p> <p>Identification and use of juridical resources in a context of project management</p> <p>Ability to define legal requests and to organize collaboration with lawyers</p>					
<b>Course content</b>	<p>I Stakeholders of environmental governance</p> <p>I.1 Local communities</p> <p>I.2 Non governmental organisations</p> <p>I.3 State institutions (Cf. III)</p> <p>I.4 International institutions in a globalised context (Cf. II).</p> <p>II International institutions</p> <p>II.1 Environmental International institutions</p> <p>II.2 Environmental International conventions</p> <p>II.3 Analysis and limits of self reporting instruments.</p> <p>III. Governance and environmental legislation : the Swiss case</p> <p>III.1 Environmental legislation</p> <p>III. 2 Stakeholders of nature protection</p> <p>III. 3 «The recourse right (le droit de recours) »: a Swiss specificity?</p> <p>III.4 Swiss environmental policy outcomes</p> <p>IV. Biodiversity Resources: property, access and use</p> <p>IV.1 Biodiversity and property</p> <p>IV.2 Biodiversity and trade</p> <p>IV.3 Biodiversity and human rights</p>					
<b>Teaching/learning methods</b>	Contact, Exercises, Self-study.					
<b>Assessment</b>	Written and oral examinations.					
<b>Language of instruction</b>	English					

<b>Bibliography</b>	<p>Panorama du droit de l'environnement. Condensé du droit fédéral de l'environnement (lois, ordonnances, conventions internationales), 2005.<a href="http://www.bafu.admin.ch/php/modules/shop/files/pdf/phpZQ3k1Q.pdf">http://www.bafu.admin.ch/php/modules/shop/files/pdf/phpZQ3k1Q.pdf</a></p> <p>Beurier Jean-Pierre, Kiss Alexandre-Charles, Droit international de l'environnement, 2004.</p> <p>Bernasconi-Osterwalder Nathalie, Magraw Daniel (eds.), Environment and trade : a guide to WTO jurisprudence, 2006</p>
<b>Prior knowledge</b>	
<b>Follow-up module(s) course(s)</b>	
<b>Comments</b>	

<b>Module</b>	<b><i>Socio-cultural and Psychological Aspects of Sustainable Development</i></b>	
<b>Code</b>	MSc_T6	
<b>Course</b>	1. Socio-cultural and psychological aspects of Sustainable Development	
<b>Status</b>	Restricted option subject (6 out of 11)	
<b>ECTS Credits</b>	3	
<b>Composition of the module mark</b>	written examination	
<b>Contact person Person responsible</b>	Sandra Wilhelm Hamiti	
<b>Address</b>	ZHAW Zürcher Hochschule für Angewandte Wissenschaften Life Sciences and Facility Management Campus Grüental, Postfach CH-8820 Wädenswil	
<b>Telephone / Email</b>	+4158 934 58 68	sandra.wilhelm@zhaw.ch
<b>Person involved</b>		
<b>Comments</b>	<p>Ecosystems are increasingly affected by negative human influences. Societies are therefore requested to change course towards sustainable development and to take into account of environmental concerns. Solutions are both economically and technologically feasible. Nevertheless, environmentally friendly technologies aren't implemented successfully if people are not convinced of these means. Human beings have become a crucial factor in the sustainable development of the natural ecosystems. The greatest obstacles to resolving the threat of environmental detriment remain social and political, rather than financial or technical.</p> <p>The aim is to study person-environment relationships with an emphasis on the behavior of the individual, on the underlying cognitive and intentional processes as well as of societies in general. The goal is to utilize social psychology know-how to design interventions towards environmental consciousness and sustainability.</p>	

<b>Course</b>	<i>Socio-cultural and Psychological Aspects of Sustainable Development</i>					
<b>Code</b>	MSc_T6_1					
<b>Part of Module</b>	Socio-cultural and Psychological Aspects of Sustainable Development					
<b>Workload (h)</b>	<b>Total</b>	<b>90</b>				
	<i>Contact</i>	36	<i>Exercises</i>	14	<i>Self-study</i>	40
<b>Lecturers</b>	Sandra Wilhelm Hamiti, Further associate lecturers					
<b>Learning outcomes and competences</b>	<p>Participants know about interactions and conflicts between society and environment. They are able to recognize environmental problems as «tragedy of the commons»-situations.</p> <p>In their own field of profession, they are able to analyze such dilemma situations, to chose appropriate approaches and to develop adequate solutions for a sustainable development.</p> <p>Participants are aware of their own values and attitudes related to environment-oriented behavior.</p>					
<b>Course content</b>	<p>Sustainable development as a regulative idea</p> <p>Human behavior, values and cultural norms</p> <p>Socio-psychological dimensions of the interaction between society and environment: influential theories in social psychology</p> <p>Basic model for the explanation of human behavior</p> <p>Environmental consciousness, relationship between knowledge – attitudes – behavior</p> <p>The «commons dilemma» – a paradigm to explain human behavior concerning the use of common resources</p> <p>Changing environmental attitudes and human behavior: classification of intervention instruments and behavioral change techniques</p> <p>Educational interventions, education for sustainable development</p> <p>Current environmental problems illustrating the commons dilemma</p>					
<b>Teaching/learning methods</b>	Blended learning, supervised and individual self-study, lectures, discussions, case studies, simulation games, exercises					
<b>Assessment</b>	written examination					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Gardner, G. T. & Stern P. C. (2002): Environmental problems and human behavior. 2 <sup>nd</sup> ed. Boston, MA: Pearson Custom Publishing.					
<b>Prior knowledge</b>						
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Module</b>	<b><i>Biodiversity assessment</i></b>	
<b>Code</b>	MSc_T7	
<b>Course</b>	1. Biodiversity	
<b>Status</b>	Restricted option subject (6 out of 11)	
<b>ECTS Credits</b>	3	
<b>Composition of the module mark</b>	Written and/or oral examinations.	
<b>Contact person Person responsible</b>	Jean-Francois Rubin	
<b>Address</b>	Institut Terre-Nature-Paysage hepia Rte de Presinge 150 CH-1254 Jussy	
<b>Telephone / Email</b>	+4122 546 68 87 (h 1) +4122 546 24 64 (h 2)	jean-francois.rubin@hesge.ch
<b>Person involved</b>	Jean-Francois Rubin, Lassaad Belbahri, Beat Oertli, Patrice Prunier François Lefort	
<b>Comments</b>		

<b>Course</b>	<i>Biodiversity</i>					
<b>Code</b>	<i>MSc_T7_1</i>					
<b>Part of Module</b>	Biodiversity assessment					
<b>Workload (h)</b>	<b>Total</b>	<b>90</b>				
	<i>Contact</i>	36	<i>Exercises</i>	14	<i>Self-study</i>	40
<b>Lecturers</b>	Jean-Francois Rubin, Lassaad Belbahri, Beat Oertli, Patrice Prunier François Lefort					
<b>Learning outcomes and competences</b>	<p>The general objective of the module is to explain the concept of biodiversity, the methods for studying it, its uses and the stakes for its conservation.</p> <p>The module is of 3 ECTS credits and is divided into 3 courses of equal importance comprising each of: about 12 frontal course periods, 4 periods of work under supervision or tutorials (excursions, practical work, exercises and e-teaching) and 14 periods of individual study.</p>					
<b>Course content</b>	<p>What is biodiversity ?</p> <p>What are the creative mechanisms of biodiversity?</p> <p>How to measure and to assess the biodiversity?</p> <p>What are the main molecular markers ?</p> <p>What do we need as Genetic tools box ?</p> <p>What are the main phylogenetic concepts and trees reconstitution models ?</p> <p>What is Bioinformatics ?</p> <p>Which Softwares and facilities to use ?</p> <p>What are the human impacts that can threaten biodiversity?</p> <p>Invasive species, which dangers and threats?</p> <p>How to conserve biodiversity?</p>					
<b>Teaching/learning methods</b>	Contact, Exercises, Self-study.					
<b>Assessment</b>	Written and/or oral examinations.					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Variable according to the different lecturers.					
<b>Prior knowledge</b>						
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Module</b>	<b><i>Comparative Physiology</i></b>	
<b>Code</b>	MSc_T8	
<b>Course</b>	1. Human physiology 2. Cell physiology and therapy 3. Microorganism physiology	
<b>Status</b>	Restricted option subject (6 out of 11)	
<b>ECTS Credits</b>	3	
<b>Composition of the module mark</b>	Written examination on entire Module (each question in English)	
<b>Contact person Person responsible</b>	PD Dr. Bruno Schnyder	
<b>Address</b>	Fachhochschule HES-SO Wallis Life Technologies Route du Rawyl 47 CH-1950 Sion	
<b>Telephone / Email</b>	+4127 606 86 59	bruno.schnyder@hevs.ch
<b>Person involved</b>	PD Dr. W. Andlauer (HES-SO Sion), PD Dr. K. Eyer (HES-SO Sion), Prof. Dr. U. Graf-Hausner (ZHAW), Prof. Dr. K. Kovar (ZHAW), Prof. Dr. W. Pralong (EPFL), Prof. Dr. J. Rohrer (ZHAW) Dr. S. Schmid (HES-SO Sion), PD Dr. B. Schnyder (HES-SO Sion)	
<b>Comments</b>	<p>The principal attraction of life sciences is certainly the opportunity to discover the functioning and fascinating evolutionary adaptations of living organisms. And the current module aims to compare the physiology (study of functions) between different organisms, and orient towards applications.</p> <p>The module 'Comparative Physiology' compares functions of living organisms in different contexts covering contacts of mammalian cell-to-cell, microorganism-to-microorganism, and cell-to-microorganism. This contributes to the development of functional products in analytics, diagnostics, and therapy. The module's content integrates the majority of physiological interactions exemplified through the courses:</p> <p>MSc_T8_1 Human physiology            MSc_T8_2 Cell physiology and therapy            MSc_T8_3 Microorganism physiology</p>	

<b>Course</b>	<i>Human Physiology</i>					
<b>Code</b>	MSc_T8_1					
<b>Part of Module</b>	Comparative Physiology					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	PD Dr. W. Andlauer (HES-SO Sion), Prof. Dr. W. Pralong (EPFL), PD Dr. B. Schnyder (HES-SO Sion)					
<b>Learning outcomes and competences</b>	The participants acquire knowledge on key physiological aspects in living organisms, organs, cell systems, compared with microorganisms. On this basis, they evaluate advantages of Life Science technologies and concepts and employ them. They manage ethical and economical stand points of view.					
<b>Course content</b>	Intracellular signal transduction elicited by hormones and cytokines (Lecturer, BS) The immune cell system evoking food allergy and the development of vaccines (BS) Gastro-intestinal tract : structure, digestion and absorption (WA) Neurophysiology and repair of neuron degeneration (WP)					
<b>Teaching/learning methods</b>	A selection of documents will be handed-out, enabling comparable background knowledge among participants, prior to the contact-lectures. These will be summarised in class. Contact-period of 12 hours serves to provide the knowledge and highlights on the enlisted contents, in written and oral manners.					
<b>Assessment</b>	Written examination on entire module					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Selection of scientific articles and chapters, provided on a separate list					
<b>Prior knowledge</b>	Bachelor of Science in Life Sciences (Biotechnology, Food-technology, Molecular Technologies, Health Technologies)					
<b>Follow-up module(s) course(s)</b>	Modules covering either Biotechnology, Food-technology, Molecular Technologies, or Health Technologies					
<b>Comments</b>	The 3 courses are inter-related.					

<b>Course</b>	<i>Cell physiology and therapy</i>					
<b>Code</b>	MSc_T8_2					
<b>Part of Module</b>	Comparative Physiology					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	PD Dr. K. Eyer (HES-SO Sion), Prof. Dr. U. Graf-Hausner (ZHAW), PD Dr. B. Schnyder (HES-SO Sion)					
<b>Learning outcomes and competences</b>	The participants acquire knowledge on key physiological aspects in living organisms, organs, cell systems, compared with microorganisms. On this basis, they evaluate advantages of Life Science technologies and concepts and employ them. They manage ethical and economical stand points of view.					
<b>Course content</b>	Aspects of developmental biology (KE) Cell and tissue culture technology in three-dimensional systems (UG) Stem cell technologies in human and animal models (BS)					
<b>Teaching/learning methods</b>	A selection of documents will be handed-out, enabling comparable background knowledge among participants, prior to the contact-lectures. These will be summarised in class. Contact-period of 12 hours serves to provide the knowledge and highlights on the enlisted contents, in written and oral manners.					
<b>Assessment</b>	Written examination on entire module					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Selection of scientific articles and chapters, provided on a separate list					
<b>Prior knowledge</b>	Bachelor of Science in Life Sciences (Biotechnology, Food-technology, Molecular Technologies, Health Technologies)					
<b>Follow-up module(s) course(s)</b>	Modules covering either Biotechnology, Food-technology, Molecular Technologies, or Health Technologies					
<b>Comments</b>	The 3 courses are inter-related.					

<b>Course</b>	<i>Microorganism physiology</i>					
<b>Code</b>	MSc_T8_3					
<b>Part of Module</b>	Comparative Physiology					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	PD Dr. K. Eyer (HES-SO Sion), Prof. Dr. K. Kovar (ZHAW), Prof. Dr. J. Rohrer (ZHAW) Dr. S. Schmid (HES-SO Sion), PD Dr. B. Schnyder (HES-SO Sion)					
<b>Learning outcomes and competences</b>	The participants acquire knowledge on key physiological aspects in living organisms, organs, cell systems, compared with microorganisms. On this basis, they evaluate advantages of Life Science technologies and concepts and employ them. They manage ethical and economical stand points of view.					
<b>Course content</b>	Global regulatory mechanisms of growth (KE,SS) Physiological state of single cells (KK) Glycosylation in biotechnology and diagnostics (JR) Host-Pathogen interaction and the host sensors of toxins (BS)					
<b>Teaching/learning methods</b>	A selection of documents will be handed-out, enabling comparable background knowledge among participants, prior to the contact-lectures. These will be summarised in class. Contact-period of 12 hours serves to provide the knowledge and highlights on the enlisted contents, in written and oral manners.					
<b>Assessment</b>	Written examination on entire module					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Selection of scientific articles and chapters, provided on a separate list					
<b>Prior knowledge</b>	Bachelor of Science in Life Sciences (Biotechnology, Food-technology, Molecular Technologies, Health Technologies)					
<b>Follow-up module(s) course(s)</b>	Modules covering either Biotechnology, Food-technology, Molecular Technologies, or Health Technologies					
<b>Comments</b>	The 3 courses are inter-related.					

<b>Module</b>	<b><i>Industrial System Theory</i></b>	
<b>Code</b>	MSc_T9	
<b>Course</b>	1. Simulation and Parameter Identification 2. Modeling of Complex Systems 3. System Control	
<b>Status</b>	Restricted option subject (6 out of 11)	
<b>ECTS Credits</b>	3	
<b>Composition of the module mark</b>	Writing a scientific paper based on a project including modeling, simulation, and control of an installation and its reaction (food, biochemistry or chemical, depending of the MRU selected)	
<b>Contact person Person responsible</b>	Prof. Olivier Naef	
<b>Address</b>	Ecole d'ingénieurs et d'architectes de Fribourg Filière de chimie Bld Pérolles 80 CH-1705 Fribourg	
<b>Telephone / Email</b>	+4126 429 67 05	olivier.naef@hefr.ch
<b>Person involved</b>	Prof. Olivier Naef Prof. Thierry Chappuis	
<b>Comments</b>	This module will present technics to model and simulate food, biochemical and chemical reactions with different possibilities. Controller such as pH, oxygen, and temperature will be included. The courses are based on practical case studies.	

<b>Course</b>	<i>Simulation and Parameter Identification</i>					
<b>Code</b>	MSc_T9_1					
<b>Part of Module</b>	Industrial System Theory					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	8	<i>Exercises</i>	4	<i>Self-study</i>	18
<b>Lecturers</b>	Olivier Naef					
<b>Learning outcomes and competences</b>	<p>Able to explain the difference between Euler, Runge-Kutta, and stiff methods using constant step and variable step.</p> <p>Able to understand the parameter identification philosophy.</p> <p>Able to apply the mean root square method to the parameters identification.</p> <p>Able to use simple MATLAB® command such as “plot”, “ode”, and so on.</p> <p>Able to write a MATLAB® script.</p> <p>Able to write Model with SIMULINK®.</p>					
<b>Course content</b>	<p>Solving Differential Equation with Numerical Tools</p> <p>Software Tools (Aspen, MATLAB, and SIMULINK).</p> <p>Parameters Identification using the “Output Error Method” (non linear mean root square method).</p> <p>Using MATLAB and SIMULINK</p> <p>MATLAB for Solving Complex Model System</p> <p>SIMULINK for Solving Complex Model System</p>					
<b>Teaching/learning methods</b>	<p>Direct Teaching, theory (2x4h).</p> <p>Demonstration with a Case Study (2x2h).</p> <p>Self Study (18h), exercises with correction.</p>					
<b>Assessment</b>	See the Module Cover Sheet.					
<b>Language of instruction</b>	English (German & French).					
<b>Bibliography</b>	<ul style="list-style-type: none"> <li>• Adrian Biran &amp; Moshe Breiner. MATLAB for Engineers. Pearson Education Limited.</li> <li>• Steven Karris. Introduction to Simulink with Engineering Applications, Second Edition.</li> </ul>					
<b>Prior knowledge</b>	This module requires basis knowledge on the manner to solve simple linear differential equations					
<b>Follow-up module(s) course(s)</b>	<p>MSc_T9_2: Modeling of Complex Systems</p> <p>MSc_T9_3: System Control</p>					
<b>Comments</b>	Student without Full MATLAB® License can use the Student Version ( <a href="http://www.mathworks.com">http://www.mathworks.com</a> ) or the open source SCILAB/SCICOS software ( <a href="http://www.scilab.org">http://www.scilab.org</a> ). OCTAVE can also be used in place of MATLAB ( <a href="http://www.octave.org">http://www.octave.org</a> ).					

<b>Course</b>	<i>Modeling of Complex Systems</i>					
<b>Code</b>	MSc_T9_2					
<b>Part of Module</b>	Industrial System Theory					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	<b>8</b>	<i>Exercises</i>	<b>4</b>	<i>Self-study</i>	<b>18</b>
<b>Lecturers</b>	Thierry Chappuis (Olivier Naef).					
<b>Learning outcomes and competences</b>	<p>Able to differentiate between mathematical model and knowledge model.</p> <p>Able to differentiate between deterministic model and stochastic model.</p> <p>Able to define the working hypothesis to build knowledge model.</p> <p>Able to write balance equation.</p> <p>Able to write complementary equations necessary to solve complex system.</p>					
<b>Course content</b>	<p>Modeling Fundamentals.</p> <p>(Bio)chemical Engineering Modeling or a General Approach.</p> <p>Modeling a (Bio)chemical Reaction using Deterministic Model.</p> <p>Modeling a (Bio)chemical Reaction using Stochastic Model.</p> <p>Drug Transport through the Wall of a Cell.</p>					
<b>Teaching/learning methods</b>	<p>Direct Teaching, theory (2x4h).</p> <p>Demonstration with a Case Study (2x2h).</p> <p>Self Study (18h), exercises with correction &amp; theory.</p>					
<b>Assessment</b>	See the Module Cover Sheet.					
<b>Language of instruction</b>	English (German & French).					
<b>Bibliography</b>	<ul style="list-style-type: none"> <li>• Octave Levenspiel. Chemical Reaction Engineering. John Wiley &amp; Sons.</li> <li>• A. Kayode Coker. Modeling of Chemical Kinetics and Reactor Design. Gulf Professional Publishing.</li> <li>• George W. Roberts. Chemical Reactions and Chemical Reactors. John Wiley &amp; Sons.</li> <li>• Tanase G. Dobre and José G. Sanghez Marcano. Chemical Engineering – Modelling, Simulation and Similitude. Wiley-VCH.</li> <li>• James E. Bailey and David F. Ollis. Biochemical Engineering Fundamentals.</li> <li>• Michael L. Shuler and Fikret Kargi. Bioprocess Engineering: Basic Concepts (2nd Edition). Prentice Hall.</li> </ul>					
<b>Prior knowledge</b>	This module requires knowledge in chemical processes or biochemical processes (kinetics, thermal transfer).					

<b>Follow-up module(s) course(s)</b>	<i>MsC_T9_3</i> : System Control
<b>Comments</b>	

<b>Course</b>	<i>System Control</i>					
<b>Code</b>	MSc_T9_3					
<b>Part of Module</b>	Industrial System Theory					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	8	<i>Exercises</i>	4	<i>Self-study</i>	18
<b>Lecturers</b>	Olivier Naef					
<b>Learning outcomes and competences</b>	<p>Able to do a PID synthesis.</p> <p>Able to discuss the different regulation philosophy</p> <p>Able to create Forward and Backward regulation.</p> <p>Able to understand Auto-tuning regulation.</p> <p>Able to realize pH controller</p> <p>Able to realize O2 controller.</p>					
<b>Course content</b>	<p>PID synthesis.</p> <p>Numeric PID.</p> <p>Auto-tuning with PID.</p> <p>Fuzzi-logic controller and Neuronal controller.</p> <p>pH control</p> <p>Oxygen control</p>					
<b>Teaching/learning methods</b>	<p>Direct Teaching, theory (2x4h).</p> <p>Demonstration with a Case Study (2x2h).</p> <p>Self Study (18h), exercises with correction &amp; theory.</p>					
<b>Assessment</b>	See the Module Cover Sheet.					
<b>Language of instruction</b>	English (German & French).					
<b>Bibliography</b>	<ul style="list-style-type: none"> <li>• Gregory K. McMillan and Robert A. Cameron. Advanced pH Measurement and Control, 3rd Edition.</li> <li>• Fuzzy control of dissolved oxygen in a sequencing batch reactor pilot plant [An article from: Chemical Engineering Journal] by A. Traore, S. Grieu, S. Puig, and L.</li> <li>• Karl J. Åström and Tore Hägglund. Advanced PID Control. ISA.</li> <li>• Karl J. Astrom. Adaptive Control: Second Edition.</li> </ul>					
<b>Prior knowledge</b>	<p>This module requires basis knowledge on the manner to solve simple linear differential equations.</p> <p>This module requires basis knowledge in the Laplace transform, and in the PID regulation.</p>					
<b>Follow-up module(s) course(s)</b>						

<b>Comments</b>	Student without Full MATLAB® License can use the Student Version ( <a href="http://www.mathworks.com">http://www.mathworks.com</a> ) or the open source SCILAB/SCICOS software ( <a href="http://www.scilab.org">http://www.scilab.org</a> ). OCTAVE can also be used in place of MATLAB ( <a href="http://www.octave.org">http://www.octave.org</a> ).
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<b>Module</b>	<b><i>Active Natural Substances and Materials</i></b>	
<b>Code</b>	MSc_T10	
<b>Course</b>	1. Materials 2. Natural Resources 3. Natural Bioactive Compounds	
<b>Status</b>	Restricted option subject (6 out of 11)	
<b>ECTS Credits</b>	3	
<b>Composition of the module mark</b>		
<b>Contact person Person responsible</b>	Beat Meier	
<b>Address</b>	ZHAW Zürcher Hochschule für Angewandte Wissenschaften Life Sciences and Facility Management Campus Grüental, Postfach CH-8820 Wädenswil	
<b>Telephone / Email</b>	+4158 9345806	beat.meier@zhaw.ch
<b>Person involved</b>	Urs Baier urs.baier@zhaw.ch Sebastian Baum sebastian.baum@zhaw.ch Michel de Wild michael.dewild@fhnw.ch	
<b>Comments</b>	The module will be presented by ZHAW and FHNW.	

<b>Course</b>	<i>Materials</i>					
<b>Code</b>	MSc_T10_1					
<b>Part of Module</b>	Active Natural Substances and Materials					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	Michael de Wild					
<b>Learning outcomes and competences</b>	<p>Review over the broad spectra of materials from perspective of material sciences and in biomedical application.</p> <p>The participants are provided basic insight for a profound access into the specific field.</p>					
<b>Course content</b>	<ul style="list-style-type: none"> <li>• Classes of materials and biomaterials.</li> <li>• Requirements on materials (mechanical, physical, biological, crystallographic and chemical properties, incl. biocompatibility and sterility).</li> <li>• Metals: Mechanical properties, Corrosion, Stainless steels, cobalt alloys, titanium. Bulk properties, Surface chemistry and topography.</li> <li>• Polymers: Synthetic Polymers, Natural polymers, biodegradable Polymers. Applications.</li> <li>• Ceramic materials: Oxide ceramics, hydroxyapatite, Bioglass.</li> <li>• Destructive and non-destructive material testing.</li> </ul>					
<b>Teaching/learning methods</b>	Computer-based lecture using beamer. To support the study, the script will be distributed. Interactive computer-based practices using beamer and overhead projector, in part group work.					
<b>Assessment</b>	Written Exam, together with the other courses of this module.					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	<p>Professional article, specific reports.</p> <p>Reference books</p> <ul style="list-style-type: none"> <li>• „Medizintechnik mit biokompatiblen Werkstoffen und Verfahren“, Erich Wintermantel und Suk-Woo Ha, (2002).</li> <li>• „Werkstoffkunde“, Hans-Jürgen Bargel and Günter Schulze, (2008).</li> </ul>					
<b>Prior knowledge</b>	Basics in chemistry and physics.					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Course</b>	<i>Natural Resources</i>					
<b>Code</b>	<i>MSc_T10_2</i>					
<b>Part of Module</b>	Active Natural Substances and Materials					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	Urs Baier Sebastian Baum					
<b>Learning outcomes and competences</b>	<p>Course participants will</p> <ul style="list-style-type: none"> <li>- get to know the classification and the characteristics of lignocellulosic biomass and its by-products.</li> <li>- be able to assess the applicability and the effectiveness of physical, chemical and biological processes for their use as biomaterials and as bioenergy source.</li> <li>- be able to explain different state of the art technologies and valorisation concepts for the energetic as well as for the non-energetic use of lignocellulosic biomass.</li> <li>- gain insight into examples of natural resource based products and their applications.</li> </ul>					
<b>Course content</b>	<p>Wood and lignified biomass: Classification, characteristics and components, resources and potentials of wood and by-products.</p> <p>Direct energetic use of wood and wood residues, wood combustion technologies.</p> <p>Indirect energetic use of lignified biomass (gasification, pyrolysis, biofuels, BtL),</p> <p>Concepts, resources, technologies and products of biorefineries.</p> <p>Project study on a natural resource based product.</p>					
<b>Teaching/learning methods</b>	Contact Teaching and individual project study.					
<b>Assessment</b>	Written examination, in combination with the other courses of this module.					
<b>Language of instruction</b>	English					
<b>Bibliography</b>	Scientific Literature and papers (to be specified).					
<b>Prior knowledge</b>	Basic knowledge in Chemistry, Microbiology, Process Technology.					
<b>Follow-up module(s) course(s)</b>	None					
<b>Comments</b>						

<b>Course</b>	<i>Natural Bioactive Compounds</i>					
<b>Code</b>	MSc_T10_3					
<b>Part of Module</b>	Active Natural Substances and Materials					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	Beat Meier, Guest speakers					
<b>Learning outcomes and competences</b>	<p>Students will get an idea to several strategies in natural product research especially in preparative chromatography, biosynthesis and test systems for bioguided fractionation. They learn to focus on specific topics in the evaluation of scientific papers.</p> <p>The participants are provided basic insight for a profound access into the specific field.</p>					
<b>Course content</b>	<p>A short overview to the diversity of the natural compounds of secondary metabolism of natural organism (focus on plants) on the base of biosynthesis will be given. Techniques for the isolation and identification of such compounds will be presented as well as an overview of screening systems to test the bioactivity of natural compounds, strategies to find new lead structures and to approve the activity of herbal medicinal extracts. The evaluation of the challenge of a herbal medicinal product and the quality of scientific papers is the outcome of students self studies.</p>					
<b>Teaching/learning methods</b>	Contact teaching, individual study on biological test systems.					
<b>Assessment</b>	Separated written examination, in combination with the other courses of this module. Evaluation of the individual study.					
<b>Language of instruction</b>	German or English					
<b>Bibliography</b>	<p>Hänsel R., Sticher O: Pharmakognosie-Phyopharmazie. Springer-Verlag, Hamburg. 9. Auflage (2010).</p> <p>Crozier A., Clifford M.N., Ashihara H. (Editors): Plant Secondary Metabolites. Blackwell Publishing (2006).</p> <p>Hostettmann K., Hostettmann M., Marston A.: Preparative Chromatography Techniques. Applications in Natural Product Isolation. Springer Verlag, Hamburg (1997).</p>					
<b>Prior knowledge</b>	A basic knowledge in organic chemistry, biochemistry, physics, chromatography and pharmacology is essential to follow the topics.					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>	For basic knowledge in Biochemistry Horton et al. Principles of Biochemistry (ISBN 978-0-1319-7736-5) or (in German) Biochemie ( ISBN 978-3-8273-7312-0). www.pearson.com is recommended.					

<b>Module</b>	<b><i>Fundamentals of Nanosciences</i></b>	
<b>Code</b>	MSc_T11	
<b>Course</b>	1. Properties as function of structure and dimensions 2. Design, creation and characterization of nanostructures 3. Applied Nanotechnology	
<b>Status</b>	Restricted option subject (6 out of 11)	
<b>ECTS Credits</b>	3	
<b>Composition of the module mark</b>	average of course marks	
<b>Contact person Person responsible</b>	Christian Hinderling	
<b>Address</b>	ZHAW Zürcher Hochschule für Angewandte Wissenschaften Life Sciences and Facility Management Campus Grüental, Postfach CH-8820 Wädenswil	
<b>Telephone / Email</b>	+4158 934 55 10	christian.hinderling@zhaw.ch
<b>Person involved</b>	Prof. U. Pieves, external experts	
<b>Comments</b>		

<b>Course</b>	<i>Properties as function of structure and dimensions</i>					
<b>Code</b>	MSc_T11_1					
<b>Part of Module</b>	Fundamentals of Nanosciences					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	C. Hinderling, Prof. U. Pielele, external experts					
<b>Learning outcomes and competences</b>	Students are familiar with the central concepts in the nanosciences and recognize the chemical and physical effects of ongoing miniaturization. They know the fundamental forces that govern the interactions on the nanoscale.					
<b>Course content</b>	<p>Miniaturization; purpose, consequences and limits</p> <p>classical scaling laws and their limits</p> <p>quantum- and confinement effects</p> <p>chemical and physical consequences</p> <p>1,2, and 3 dimensional nanostructures</p> <p>Forces and interactions on the nanoscale</p> <p>basic principles in supramolecular chemistry</p> <p>Design of building blocks, examples from nature and laboratory</p> <p>The special relevance of surfaces and interfaces</p> <p>Functional structures of growing complexity:</p> <p>passive nanostructures; materials and surfaces (1st generation, particles, coatings, composites)</p> <p>active nanostructures (2nd generation)</p> <p>Nanosystems (3rd generation, examples from biochemistry)</p>					
<b>Teaching/learning methods</b>	lecture, guided self study					
<b>Assessment</b>	Final exam (written or oral) on entire module					
<b>Language of instruction</b>	English					
<b>Bibliography</b>						
<b>Prior knowledge</b>	physics and chemistry on BSc level of technical degree courses					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Course</b>	<i>Design, creation and characterization of nanostructures</i>					
<b>Code</b>	MSc_T11_2					
<b>Part of Module</b>	Fundamentals of Nanosciences					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	Prof. U. Pieves, external experts, C. Hinderling					
<b>Learning outcomes and competences</b>	<p>Characterization of nanomaterials</p> <p>Students have an overview of important chemical and topographical analytical techniques used in Nanotechnology.</p> <p>Students will have a closer introduction to selected analytical and spectroscopic methods (subject to availability)</p> <p>Students are able to work on complex questions on the properties and mechanism of action of nanomaterials by selecting and combining relevant analytical methods. They know the limits of the different methods and are able to interpret results correctly.</p> <p>Students know the important approaches involved in designing and creating nanomaterials and nanostructures. They are familiar with the principles of self-organization and the important approaches and mechanisms of structure replication.</p>					
<b>Course content</b>						
<b>Teaching/learning methods</b>						
<b>Assessment</b>	Final exam (written or oral) on entire module					
<b>Language of instruction</b>	English					
<b>Bibliography</b>						
<b>Prior knowledge</b>						
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						

<b>Course</b>	<i>Applied Nanotechnology</i>					
<b>Code</b>	MSc_T11_3					
<b>Part of Module</b>	Fundamentals of Nanosciences					
<b>Workload (h)</b>	<b>Total</b>	<b>30</b>				
	<i>Contact</i>	12	<i>Exercises</i>		<i>Self-study</i>	18
<b>Lecturers</b>	C. Hinderling, Prof. U. Pieves, external experts					
<b>Learning outcomes and competences</b>	Students know current applications of nanotechnology, with some emphasis on applications relevant in the Life Sciences. They know the governing chemical and physical principles and know selected applications in detail.					
<b>Course content</b>	<p>New materials: synthetic nanoparticles, nano-composites, nanotubes, smart materials.</p> <p>Micro- and Nanosystems (MEMS / NEMS)</p> <p>Nano-to-Bio; technical components in biological applications. BioMEMES, diagnostic tools, bioactive materials, scaffolds, drug-delivery systems.</p> <p>Bio-to-Nano; biological strategies and components in nanotechnology.</p> <p>Electronics and IT: data storage, molecular electronics</p> <p>Nano-optics.</p> <p>Energy; photo-voltaics, energy storage</p> <p>Further examples from food-science, environmental technology and agronomy</p> <p>outlook</p>					
<b>Teaching/learning methods</b>	lectures guided self study					
<b>Assessment</b>	Final exam (written or oral) on entire module					
<b>Language of instruction</b>	English					
<b>Bibliography</b>						
<b>Prior knowledge</b>	physics and chemistry on BSc level of technical degree courses					
<b>Follow-up module(s) course(s)</b>						
<b>Comments</b>						





## Contact Information of the lectures from the School of Life Sciences FHNW

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Fent	Karl	IEC	ecotoxicology	+41 61 467 45 71
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Stanimirov	Michael	IMA	signal processing, embedded systems	+41 61 467 46 93
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Wolf	Markus	IEC	waste, resources & sustainability	+41 61 467 43 51
Zehnder	Beat	ICB	chem. synth., process dvlp, sustainable dvlp.	+41 61 467 43 57

ICB Institute of Chemistry and Bioanalytics  
 IEC Institute of Ecopreneurship  
 IMA Institute of Medicinal and Analytical Technologies  
 IPT Institute of Pharmaceutical Technology

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## Contact for the Master Programme

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