Module title	**Materials Science**
Code	C1
Degree Programme	Master of Science in Life Sciences
Group	Chemistry
Workload	3 ECTS (90 student working hours: 42 contact lessons = 32 h; 58 h self-study)
Module Coordinator	**Name**: Dr. Michael de Wild **Phone**: +41 (0)61 228 56 49 **Email**: michael.dewild@fhnw.ch **Address**: FHNW, Hochschule für Life Sciences, Hofackerstrasse 30, 4132 Muttenz
Lecturers	• Dr. Michael de Wild, FHNW • Dr. Patrick Shahgaldian, FHNW
Entry requirements	Scientific background in chemistry, physics and analytical chemistry. The students need a Bachelor in Materials Sciences, Chemistry, Physics, Engineering, Biomedical Engineering or equivalent. Basic lectures on materials sciences, chemistry, physics and biomaterials are a prerequisite to follow this course.
Learning outcomes and competences	After completing the module, students will be able to: • give an overview of the broad spectra of metallic and ceramic materials from the perspective of materials science from the macroscopic to the nanoscopic scale; • explain different state-of-the-art technologies and methodologies for the analysis of materials; • illustrate the important approaches involved in designing and creating materials and nanostructures; • express the central concepts of nanosciences.
Module contents	• The solid state is discussed based on material scientific theories. • The crystallographic and electronic structure of solid materials, as well as optical, mechanical and magnetic properties are examined. • The influence of sterilization and irradiation on material properties is reviewed. • Shape Memory Alloys are discussed. • Metallographic preparation techniques, Fractography. • High-end oxide ceramics and their ability for phase-transformation toughening are discussed. • The macroscopic and microscopic structure and properties of metallic and ceramic materials are compared and state-of-the-art characterization methods are introduced. • Nanocrystalline materials are discussed. • Imperfections and their effects on material properties are highlighted. • Key physical characteristics of nanoscale materials (vs. bulk) are studied, including lotus and gecko effects. • Fabrication, functions and properties of nanomaterials of different types are discussed. • Top-down as well as bottom-up approaches are emphasized. • Several important classes of nanomaterials (e.g., nanoparticles, nanotubes, 2D material, metal-organic frameworks, mesoporous materials, advanced polymers) are studied

	• Selected applications of nanomaterials in the field of life sciences are treated. • Important aspects of the (eco)toxicity of nanomaterials are discussed.
Teaching / learning methods	Lecture and blended learning: Contact lessons • Lectures, Q&A-sessions • Group Exercises • Simulations • Demonstrations Self-study • Learning videos • Interactive simulations (https://phet.colorado.edu/en/simulations/category/new) • Individual Project Studies
Assessment of learning outcome	1. Final written exam, closed book, (100%).
Format	7-weeks
Timing of the module	Autumn semester, CW 38-44
Venue	Blended learning format. Presence sequences take place in Olten
Bibliography	Pre-reading The scripts for this module will be available on moodle timely before the module starts. Likewise, selected scientific articles and instructions for pre-work are announced on the moodle platform. Course material G. Carter, D. Paul, Materials Science and Engineering, ASM International, Materials Park, OH, 2010. ISBN 978-0-87170-399-6. E. Hornbogen, G. Eggeler, E. Werner, Werkstoffe, Aufbau und Eigenschaften von Keramik-, Metall-, Polymer- und Verbundswerkstoffen, Springer Verlag Berlin Heidelberg, 2008., ISBN 978-3-540-71857-4. W.D. Callister, D.G. Rethwisch, Materials Science and Engineering: SI Version (English), Wiley-VCH Verlag GmbH & Co KgaA, 2016. M. Köhler, W. Fritsche: Nanotechnology, 2. ed, Wiley-VCH Verlag GmbH & Co KgaA, Weinheim, 2007. ISBN 978-3-527-31871-1. J. N. Israelachvili, Intermolecular and surface forces, 3rd ed., Academic Press, San Diego, 2011. ISBN-978-0-12-391927-4. Interactive simulations (https://phet.colorado.edu/en/simulations/category/new) Selected recent scientific articles
Language	English
Links to other modules	Recommended supplementary modules: C2 “Surface Characterization” and C3 “Polymers and Applications”. Specialisation modules FHNW: “Bio-interfaces and Bio-conjugate Chemistry”, “Supramolecular Chemistry and Nanochemistry”, “Polymers and Applications”
Comments	
Last Update	06.03.2025