The English version of the curriculum for the „Master's Programme in Material and Nano Sciences“ is not legally binding and is for informational purposes only. The legal basis is regulated in the curriculum published in the Bulletin of the University of Innsbruck of 25th November 2008, issue 13, No. 81. Decision of the Curriculum Committee of the Faculty of Chemistry and Pharmacy on 16.10.2008, approved by Senate Decree on 06.11.2008.

On the basis of § 25 para. 1 no. 10 University Organisation Act 2002, BGBl. I (Federal Law Gazette) No. 120, most recently amended by Federal Law BGBl. I (Federal Law Gazette) No. 134/2008 and § 32 Section "Regulations of Study Law", republished in the University of Innsbruck Bulletin of 3 February 2006, issue 16, No. 90, most recently amended by the University of Innsbruck Bulletin of 7 May 2008, issue 42, No. 272, the following is decreed:

Curriculum for the **Master's Programme in Material and Nano Sciences** at the Faculty for Chemistry and Pharmacy of the University of Innsbruck

§ 1 Qualification profile

(1) The Master's Programme in Material and Nano Sciences forms part of the cluster of natural science studies.

(2) The Master's Programme in Material and Nano Sciences is structured on an interdisciplinary basis. With the emphasis on the areas of Design, Synthesis and Analysis of Advanced Materials, and with particular attention to nano-structured materials, the Programme is orientated to graduates of Chemistry, Pharmacy, Physics, Geo- and Atmospheric Sciences, as well as to Engineering and Environmental Engineering, and qualifies them to solve, by the latest research standards, complex problems in the interdisciplinary research and application fields of modern Material Science and thus to apply their theoretical knowledge in practice. The inclusion of Nano Science and its deep anchoring in the foundation disciplines of Chemistry and Physics complement the training of civil engineers in the area of classical working materials. A comprehensive range of intensifying subject modules widens graduates' knowledge of their subject with an eye on their desired career aims and/or future doctoral studies.

(3) The established interdisciplinary and research-based education enables graduates to work in a task-oriented way. The variety of the programme and the extra-subject skills that are developed, open to graduates a broad spectrum of career opportunities in industry, research institutes, universities and in the public services. The dominant occupational fields in all this are materials development in university and industrial research, materials analysis and quality assurance as well as the materials testing and patenting areas. The subject competencies acquired open up career paths in the chemical industry, in the semi-conductors industry, in metal production and processing firms, in light technology and optics, as well as in energy technology, sensorics and many other branches.

§ 2 Scope and length of the Programme

The Master's Programme in Material and Nano Sciences comprises 120 ECTS points equivalent to a course lasting four semesters. One ECTS point represents a workload of 25 hours.

§ 3 Admission

(1) Admission to the Master's Programme in Material and Nano Sciences depends on the successful completion of a Bachelor's Degree in an appropriate subject or of a Baccalaureat course in an appropriate subject area or of an equivalent level course in a recognised Austrian or foreign post-secondary educational institution.

(2) Successful completion of a Bachelor's Programme in Building and Environmental Engineering Sciences, Physics, Chemistry and Geo- and Atmospheric Sciences at the University of Innsbruck also count for qualification under paragraph 1.

§ 4 Teaching courses and number of participants allowed

(1) Lecture (VO): A lecture serves to introduce the methods of the subject as well as the teaching of concepts, an overview of the state of knowledge, special and current developments in the respective subjects. Lectures can include experimental presentations to illustrate subject content and to promote a better understanding of the subject. Maximum number of participants: 120

(2) Lecture-Practical (VU): The lecture/practical is a course with continuous assessment in which the theoretical parts of the lecture are closely linked with the practical parts. In the practice part the practical-professional and scientific aims of the Master's Programme are dealt with using specific exercises and their solutions. Maximum number of participants: 30

(3) Lab courses (PR): These are courses graded by continuous assessment by the supervisors responsible with the emphasis on autonomous and experimental work by the students on selected practical methods and issues. The independent experimental work of the students can also if necessary take place in groups. In such cases lab practices also promote interdisciplinary skills through teamwork. The results of the experimental work are gathered in a laboratory report. This serves to ensure standardised scientific documentation of the data and results together with the learning of documentary and presentation techniques that are interdisciplinary. Maximum number of participants: 10

(4) Proseminar (PS): A proseminar is a course graded by continuous assessment which accompanies a lecture. In a proseminar subject-specific methods are taught through an intensified treatment of relevant and current examples with considerable independent participation by the students. Maximum number of participants: 60

(5) Exercise (UE): An exercise is a course graded by continuous assessment in which the practical application of the content dealt with in the accompanying lecture is shown and in which tasks completed by the students are dealt with. Depending on the teaching aims, these tasks may be calculation tasks, constructions, plans, programming tasks, presentation and management tasks, laboratory work and also a mixture of these. Maximum number of participants: 30

(6) Course (KU): A course is graded by continuous assessment in which general skills are worked on with the active participation of students. Maximum number of participants: 60

§ 5 Procedures for the allocation of places in courses with restricted numbers of participants

(1) Selection of the students is carried out in line with the following principles:

1. Students who have prolonged their studies because of a study deferment are to be given priority.
2. Students for whom the course is mandatory.
3. Students from other subject areas

4. If the criteria in sections 1-3 do not suffice, the available places are drawn by lot.

(2) If necessary, parallel courses may be held, but only in normally course-free time.

§ 6 Name, quantity and content of the mandatory and elective modules with ECTS-points

(1) The Master's Programme in Material and Nano Sciences is divided into the following groups of modules:

1. Mandatory modules in the disciplines Inorganic Chemistry, Physical Chemistry, Mineralogy**,** Pharmaceutical Technology, Physics, Ion Physics, Engineering Sciences and Theoretical Material Science. The students are to complete successfully 12 modules (75 ECTS-AP).
2. Elective modules of subject intensification from the disciplines Inorganic Chemistry, Physical Chemistry, Mineralogy, Organic Chemistry, Pharmaceutical Technology, Physics, Ion Physics, Textile Chemistry and Textile Physics, Building and Engineering Sciences and Theoretical Material Sciences. From these 14 modules students are to select and complete successfully modules totalling 10 ECTS-AP.
3. Elective modules of general competencies. From these nine modules an appropriate number amounting to 5 ECTS-AP are to be chosen and successfully completed.
4. Mandatory module: Defence of the Master's Thesis (2,5 ECTS-AP).

(2) Mandatory modules of the disciplines Inorganic Chemistry, Physical Chemistry, Mineralogy, Pharmaceutical Technology, Physics, Ion Physics, Building and Engineering Sciences and Theoretical Material Sciences. The following 12 modules amounting to 75 ECTS-AP are to be successfully completed:

1.	**Mandatory module: Structural Working Materials**	**SST**	**ECTS-AP**
a.	**VO Mineral Raw and High Performance Materials** Glasses, ceramics, cement, concrete, composite working agents, bonding agents	3	6
b.	**UE Mineral Raw and High Performance Materials** Calculation examples to deepen knowledge of the above-mentioned groups of materials	1	1,5
	Total	**4**	**7,5**
	Aims of the Module: Students acquire knowledge of the chemical and structural qualities of important structural working materials and bonding agents.		
	Admission Requirements: none		

2.	**Mandatory Module: Phases and Phase Transitions**	**SST**	**ECTS-AP**
a.	**VO Phase Transitions** Thermodynamic description and classification of phase transitions, order parameters, critical phenomena, nucleation and growth, surface melting, glass transition, experimental methods to observe phase transitions	1	1,5
b.	**VO Phase Diagrams** Interpretation of phase diagrams from the areas of ceramics and metal-	1	1,5

	lurgy, principles of thermodynamics to calculate phase relations, thermodynamic mixing models for solid materials		
c.	**PR Experimental Studies of Phase Transitions** Determining latent heat, heat capacities, expansion coefficients, compressibilities, critical phenomena, solid-solid transitions, P-V-T-analyses of fluid inclusions, thermoanalytical methods, dilatometry, heat microscopy, high-temperature diffraction and Raman spectroscopy, high-pressure experiments and spectroscopy	2	2
	Total	**4**	**5**
	Aims of the Module: Students deepen their thermodynamic knowledge and learn about its application to materials. Understanding of kinetic processes and the theory of phase transitions. Students master the experimental methodology for characterising phase transitions.		
	Admission Requirements: none		

3.	**Mandatory Module: Group Theory**	**SST**	**ECTS-AP**
a.	**VO Group Theory** Group theory concepts, representation theory, character tables, symmetry groups, point groups, space groups, symmetry breaking, projection operator methods and applications in optical and vibration spectroscopy, electronic structure and phase transitions	2	3
b.	**PS Applications of Group Theory** Normal modes, matrix-elements and selection rules, crystal field theory, MO-theory, band theory	2	2
	Total	**4**	**5**
	Aims of the Module: Students master the symmetry analysis of problems and acquire a deeper understanding of solid state properties and spectroscopy (IR, optical spectroscopy, etc.).		
	Admission Requirements: none		

4.	**Mandatory Module: Solid State Chemistry**	**SST**	**ECTS-AP**
a.	**VO Solid State Chemistry II (Inorganic Functional Materials)** Introduction into "Inorganic functional materials" relevant to materials science with the emphasis on ion conductors, hard materials, alloys and nano-scale working materials. Next to the synthesis, the focus is particularly on the technically relevant electronic, mechanical, optical and magnetic properties of these materials	2	3
b.	**PS Solid State Chemistry II** Theoretical and practical implementation of the subject-matter of the lecture with selected examples under the aspect of "Materials Design"	1	2
	Total	**3**	**5**

	Aims of the Module: Students are familiarised with the most important methods of modern solid state chemistry and the chemistry of advanced materials. Students should be enabled to apply chemical structural principles.
	Admission Requirements: none

5.	**Mandatory Module: Tribology**	**SST**	**ECTS-AP**
a.	**VO Friction and Lubrication** Elastic and plastic deformation, classical concepts of friction: Stick and slip motion, solid-solid friction, boundary lubrication, surface melting, hydro-dynamic friction, additives, molecular, dynamic and electronic aspects	1	1,5
b.	**VO Corrosion** Electrochemical description of corrosion processes, analysis of atomic and molecular processes on interfaces, corrosion protection	1	1,5
c.	**PR Electrochemistry and Tribological Applications** Fuel cells, corrosion measuring cell, surface melting and ellipsometry, nano-friction and roughness (AFM)	2	2
	Total	**4**	**5**
	Aims of the Module: Students acquire knowledge of friction and corrosion processes on the basis of a dynamic, thermodynamic, electrochemical, kinetic and molecular description of interface processes.		
	Admission Requirements: None		

6.	**Mandatory Module: Structure of Crystalline Materials**	**SST**	**ECTS-AP**
a.	**VO Crystallographic Diffraction Methods** Theory of the structure determination of materials through diffraction methods using X-rays, neutrons and electrons	3	6
b.	**PR Lab Practice on Diffraction Methods** Methods of single crystal structure analysis and powder diffraction, inter-pretation and computer-assisted evaluation, data visualisation	2	1,5
	Total	**5**	**7,5**
	Aims of the Module: Students learn the theory and practice of diffraction methods to determine the structure of materials.		
	Admission Requirements: none		

7.	Mandatory Module: Materials Analysis	SST	ECTS-AP
a.	**VU X-Ray Fluorescence** Theoretical basis of X-ray fluorescence, construction and/measurement technology of the wavelength and energy dispersing RFA, preparation of samples and quantitative analysis for diverse materials, standardisation processes and correction methods	1	1,875
b.	**VU Raman Spectroscopy** Theoretical basis of Raman spectroscopy, functionality of a Raman spectrometer, practical work with the instrument	1	1,875
c.	**VU IR-Spectroscopy** Theoretical basis of infrared spectroscopy, functionality of the FTIR-spectrometer, identification of material classes, quantitative IR-spectroscopy	1	1,875
d.	**VU Thermoanalysis and Calorimetry** Theoretical basis and measurement principles of thermoanalytical processes like differential thermoanalysis, differential scanning calorimetry, thermogravimetry, thermomicroscopy, thermomechanical analysis as well as isothermic microcalorimetry; possible uses for various classes of materials; the practice of measurement and data evaluation	1	1,875
	Total	**4**	**7,5**
	Aims of the Module: Students acquire detailed knowledge and practical experience with modern materials analytical methods, their optimal areas and limits of use.		
	Admission Requirements: none		

8.	Mandatory Module: Elasticity Theory	SST	ECTS-AP
a.	**VO Elasticity Theory** Basics of elasticity theory (kinematic, kinetic and constitutive relations)	2	2,5
b.	**UE Elasticity Theory** Working out exercises from applied elasticity theory	1	1
c.	**PR Characterisation of Mechanical Material Properties** Measurement of material properties, Nanolab, materials test	2	1,5
d.	**VO Finite Elements I** Introduction to the displacement formulation of the finite-element method of solving problems of linear elasticity theory, planar and three-dimensional finite elements	1	1,5
e.	**UE Finite Elements I** Demonstration of the solution to practical exercises of linear elasticity theory with a finite elements software and helping students to solve such problems themselves	1	1
	Total	**7**	**7,5**

	Aims of the Module: Students master the basics of numerical mathematics and the finite-element method (FEM).
	Admission Requirements: none

9.	Mandatory Module: Surface and Interface Analysis	SST	ECTS-AP
a.	**VO Interface and Materials Analysis** Methods to determine the composition of surfaces, interfaces and layer systems: AES, XPS, depth profile analysis and adsorption spectroscopy as well as materials analysis by means of impedance spectroscopy	1	2
b.	**PR Materials Analysis II (Lab Practice on Spectroscopy in Materials Analysis and Catalysis)** Surface and depth-profile analysis with X-ray photoelectron and Auger spectroscopy, impedance spectroscopical characterisation of oxides and catalysts, adsorption spectroscopy	2	3
	Total	**3**	**5**
	Aims of the Module: Students acquire detailed knowledge and practical experience with modern surface analytical methods, their optimal areas of application and limitations.		
	Admission Requirements: none		

10.	Mandatory Module: Amorphous Materials	SST	ECTS-AP
a.	**VO Theory of Amorphous Materials** Substance types, morphological description, random-packing, random networks, fractals, percolation, physical properties, defects, testing methods	1	1,5
b.	**VO Amorphous Polymers** Physical and chemical properties of amorphous polymers, methods of characterisation, swelling, properties and reactivity of swollen polymers, gels, ways of characterising swollen polymers, rheology and form-giving, important examples of particular working materials	1	1
	Total	**2**	**2,5**
	Aims of the Module: Students are familiarised with the chemical and structural qualities of amorphous and polymeric working materials and are able to understand the theoretical concepts that describe non-crystalline solid states as well as the basics of their technical processing.		
	Admission Requirements: none		

11.	Mandatory Module: Optical and Electronic Material Properties	SST	ECTS-AP
a	**VU Electronic Structure and Material Properties** Metals, semi-conductors, superconductors, correlated systems, nano materials; transport properties	2	2,5
b.	**VU Optical Properties of Solids** Theory of the refraction index, spindle stage examination and direction-dependence of the refraction index of single crystals, connections of the refraction index with electronic and ionic polarisation as well as its dependence on frequency; colours of solids	1	3,5
c.	**PR Optical Microscopy** Basics of optical polarisation microscopy, indicatrix, optical behaviour of isotropic media as well as uniaxial and biaxial crystals	1	2
d.	**PR Transport Properties** Measurement of the electrical conductivity as dependent on the temperature for semi-conductors, metals and superconductors, determination of charge-carrier concentrations and mobilities; photo conductivity and Hallconductivity; ion conductivity and applications in sensorics	1	2
	Total	**5**	**10**
	Aims of the Module: Students learn the fundamental optical and electronic properties of various types of materials and are made familiar with new materials such as high-temperature superconductors and nano-structured materials. The students then apply their theoretical knowledge in practice and determine experimentally the afore-mentioned materials properties.		
	Admission Requirements: none		

12.	Mandatory Module: Computer-Assisted Material Science	SST	ECTS-AP
a.	**VO Introduction to Computer-Assisted Material Science** Field-of-force methods, first-principles methods to calculate electronic structures, density function theory, molecular dynamics	2	3
b.	**VO Correlated Systems** Highly-correlated systems (oxides, nano structures), multi-particle theory, numerical methods	1	1,5
c.	**PR Numerical Methods** Working with diverse codes for the numerical calculation of material properties	2	3
	Total	**5**	**7,5**
	Aims of the Module: Students acquire basic knowledge and practical experience in the use of modern numerical methods of calculating the properties of materials.		
	Admission Requirements: none		

(3) Elective modules of subject intensification from the sub-disciplines Inorganic Chemistry, Physical Chemistry, Mineralogy, Organic Chemistry, Pharmaceutical Technology, Physics, Ion Physics, Textile Chemistry and Textile Physics, Engineering Sciences and Theoretical Material Science. From these students are to choose and successfully complete modules amounting to 10 ECTS-AP:

13.	**Elective Module: Cluster and Nano Particles**	**SST**	**ECTS-AP**
a.	**VO Nano- and Cluster Physics** Introduction to cluster physics, production and properties of free and deposited clusters and nano particles	2	2,5
b.	**PR Nano and Cluster Physics** Practical experiments on supersonic jet apparatus, mass spectrometry of free cluster ions and films of deposited nano particles	4	5
	Total	**6**	**7,5**
	Aims of the Module: Students are equipped with basic theoretical and experimental knowledge of the physics of clusters and nano particles. The production and uses of clusters as working materials with new types are drawn to students' attention both theoretically in lectures and practically in experiments.		
	Admission Requirements: none		

14.	**Elective Module: Plasma and Thin Film Technology**	**SST**	**ECTS-AP**
a.	**VO Technical Applications of Plasma** Introduction to plasma physics, plasma technology and plasma diagnostics, basics of plasma chemistry, plasma processes for the synthesis of new materials	1	1,5
b.	**VO Layering, Etching, Activation of Surfaces** Plasma processes to treat surfaces and production of layers	2	2,5
c.	**PR Plasma Processes in the Production of Thin Layers** Practical experiments on plasma apparatus for the analysis, characterisation and control of plasmas and their application in layering technology	2	2,5
d.	**PR Thin Layer Technology** Calculation and production of functional thin layer systems through thermal vacuum metallizing plants	1	1
	Total	**6**	**7,5**
	Aims of the Module: Students are equipped with the basic theoretical and experimental knowledge of plasma physics, plasma diagnostics and plasma technology and learn how to use the appropriate plasma apparatus and technologies in the Material and Nano Sciences. They learn to calculate functional thin layer systems and various depositing techniques and control the properties of the products they manufacture.		
	Admission Requirements: none		

15.	Elective Module: High Pressure Synthesis And Processes	SST	ECTS-AP
a.	**VO High Pressure Materials (Experimental Petrology)** Methods to generate high pressures and temperatures, determination of elastic properties, pressure-induced phase transitions, metastable materials, pressure dependence of chemical equilibrium and reactions kinetics, high pressure synthesis of new materials	3	6
b.	**PR High Pressure Materials** Practical exercises with hydrothermal apparatuses, piston-cylinder presses, multi-anvil presses and diamond anvil cells	1	1,5
	Total	**4**	**7,5**
	Aims of the Module: Students should master high pressure methods as a synthesis method for Advanced Materials.		
	Admission Requirements: none		

16.	Elective Module: Solid State Chemistry at Extreme Temperatures and Pressures	SST	ECTS-AP
a.	**VO Solid State Chemistry for Advanced Students** Intensification of the subject area of Solid State Chemistry with reference to synthesis strategies like high temperature / high pressure syntheses, insights into modern solid state specific characterisation methods together with an introduction to current research areas and applications of solid state chemistry	1	2
b.	**PR Lab Practical Applied High Pressure Solid State Chemistry** Experimental execution of modern high pressure syntheses (multi-anvil technique) with the focus on current issues in the synthesis of new functional materials	3	3
	Total	**4**	**5**
	Aims of the Module: Students are familiarised with current research fields in modern solid state chemistry. Students acquire advanced practical competencies in the production of solid state functional materials through high temperature high pressure syntheses.		
	Admission Requirements: none		

17.	Elective Module: Finite-Elements II	SST	ECTS-AP
a.	**VO Finite-Element Methods II – Non-Linear Solidity Analyses** Load-bearing analyses of steel, concrete and armoured concrete structures with the finite elements method (non-linear numerical materials model for steel and concrete on the basis of plasticity theory and damage theory, incremental iterative solution processes)	2	2,5
b.	**UE Finite Elements Methods II–Non-Linear Solidity Analysis**	2	2,5

	Demonstration of the solution of practical exercises for non-linear solidity calculations with finite-elements programme (load-bearing calculations); helping students to find their own solutions to such questions and to interpret the numerical calculation results		
	Total	**4**	**5**
	Aims of the Module Students master the theoretical bases of the finite element method and its use for the numerical simulation of the non-linear load-bearing behaviour of two- and three-dimensional structures until failure as well as the mathematical bases and methods of risk analysis.		
	Admission Requirements: successful completion of mandatory module 8		

18.	**Elective Module: Materials Modelling**	**SST**	**ECTS-AP**
a.	**VO Materials Modelling** Physical and chemical phenomena of materials behaviour, phenomenological materials models, multi-scale models, model transitions, micro mechanics, multi-field mechanics	2	2,5
b.	**PR Materials Characterisation on Various Scales** Nanolab: Characterisation of the pore space (mercury porosity, measurement of permeability; etc.) and mechanical qualities (indentation experiments, rheometer, bending, pulling and pressurizing experiments, etc.) on various scales, sample preparation, realisation of experiments and interpreting results	2	2,5
	Total	**4**	**5**
	Aims of the Module: Students learn how to describe the behaviour of materials, acquire an understanding of the basic processes and the material qualities that emerge therefrom at the macro chemical level and practise the experimental characterisation and model-like understanding of these processes.		
	Admission Requirements: none		

19.	**Elective Module: Cement and Concrete Technology**	**SST**	**ECTS-AP**
a.	**VU Cement and Concrete Technology I** Cement, cement concrete, hydration, rock granulation, concrete additives, unset concrete, concrete formula, solid concrete, mechanical qualities, light concrete, mortar, durability, concrete test, concrete norms	2	2,5
b.	**VU Cement and Concrete Technology II** General concrete technology, HPC-high performance concrete, highly solid concrete, SCC-self-thickening concrete, production of thick and moderately thick and bulky concrete building parts, jet concrete/building with jet concrete, steel fibre concrete, subsequent concrete treatment, concrete durability, ready-mixed/fair-faced concrete, peeling, concrete damage, examples from practice	2	2,5

	Total	**4**	**5**
	Aims of the Module: Students acquire basic knowledge on the production and preparation of concrete (cement and hydro products, rock granulation and their qualities, added concrete materials, fresh and solid concrete, the chemical binding process of cement and the material qualities resulting therefrom, durability, norms and guidelines as demands of the concrete test); students are made familiar with the requirements and production of special concrete types in the building trade and they learn about new developments in concrete technology.		
	Admission Requirements: none		

20.	**Elective Module: Functional Nano Materials**	**SST**	**ECTS-AP**
a.	**VO Methods of Nano Structuring and Nano Architectures** Gel methods, self-organisation of nano materials; carbon, boron and oxide-nano structures (fullerenes, nanospheres, nanotubes); toxicological aspects of nano-structured materials	1	1,5
b.	**VO Supramolecular Chemistry and Nano Chemistry** The "Supramolecule", its internal and external organisation principles and functions, presentation of (supra)molecular examples from Lego®-Chemistry and molecular biology, uses in biological synthesis and in the construction of "functional" nano materials with current examples	1	2
c.	**VO Nano-Structured Materials and Heterogeneous Catalysis** Physical-chemical properties of nano-structured materials, application of metallic and oxidic nano particles in heterogeneous catalysis	1	1,5
	Total	**3**	**5**
	Aims of the Module: Students learn the specific properties of nano-structured materials and can handle various methods of nano-structuring as a method of materials design.		
	Admission Requirements: none		

21.	**Elective Module: Experimental Characterisation of Nano Structures**	**SST**	**ECTS-AP**
a.	**VO Scanning-Probe and Electron Microscopy** Principles and operation modes of scanning tunnelling microscopy, scanning-force microscopy, surface-potential microscopy, electric-force microscopy, friction microscopy and transmission electron microscopy	1	1,5
b.	**PR Electron and Scanning-Probe Microscopy** Characterisation of surfaces on the nano scale and with atomic resolution by use of scanning-probe methods, investigation of nano particles and layered materials with transmission electron microscopy	2	1
	Total	**3**	**2,5**
	Aims of the Module: Students acquire practical experience in modern methods of nano-structured analysis.		

	Admission Requirements: none

22.	Elective Module: Textile Chemistry and Textile Physics	SST	ECTS-AP
a.	**VO Chemistry of Textile Materials** Chemistry of natural and synthetic polymers for the production of textile fibres, surface finishing, structure and physiological qualities of textile fibres, chemical modification and functionalisation	2	2,5
b.	**VO Physical Processes and Textile Materials** Physical characterisation of textile materials and optimisation of mechanical, thermal, electric and structural qualities	2	2,5
c.	**PR Physical processes and Textile Materials** Lab practical to establish the physical-chemical and mechanical qualities of textile fibres, fabrics and complex composite materials	2	2,5
	Total	**6**	**7,5**
	Aims of the Module Students are equipped with basic theoretical and experimental knowledge of fibre polymers, structures made from them, their characterisation, modification and the necessary processing techniques.		
	Admission Requirements: none		

23.	Elective Module: Colour Measurement	SST	ECTS-AP
a.	**VO Theory of Colour Measurement** Basics of the colour space, colour coordinates, colour differences, measuring techniques, colour point, degree of whiteness, opacity, Kubelka-Munk-equation, application examples on non-transparent bodies (paint, pigments, ceramics, textile colouring, paper)	1	1,5
b.	**PR Measuring System in Colorimetry** Diffuse reflexion (Ulbricht sphere), colour coordinates calculation, colour difference calculation, determination of concentration on non-transparent bodies, UV permeability and fluorescence, metamerism and whiteness indices	1	1
	Total	**2**	**2,5**
	Aims of the Module: Students learn the methods for the description and measurement of colours and coloured materials and surfaces.		
	Admission Requirements: none		

24.	Elective Module: Mineralogy and Crystallography	SST	ECTS-AP
a.	**VO General Mineralogy and Crystallography** Symmetry aspects of physical-chemical properties of crystalline materials	2	4
b.	**VU Special Mineralogy** Selected rock-forming or economically important minerals are treated with respect to their structure and composition, their classification, their macroscopic properties, their origin and their occurrence. The theory is illustrated by the inspection of natural specimens.	2	3,5
	Total	**4**	**7,5**
	Aims of the Module: Students are made familiar with the regular features of crystalline materials, the physical-chemical properties, the genesis and occurrence of the minerals and they can determine these by means of macroscopic characteristics		
	Admission Requirements: none		

25.	Elective Module: Introduction to Solid State Chemistry	SST	ECTS-AP
a.	**VO Solid State Chemistry** Solid state reactions, thermodynamic, kinetic, diffusion, phase transitions, phase diagrams, methods of crystal growth, solid state synthesis from the gas phase, solid state structures, material science applications of solids (super-hard materials, superconductors, optical and NLO materials, micro and nano-porous materials)	2	3,5
b.	**UE Solid State Chemistry** Synthesic strategies of solid state chemistry are intensified in this course and practice-oriented examples are given	1	1,5
	Total	**3**	**5**
	Aims of the Module: Students are familiarised with the important concepts of solid state chemistry and applications in materials chemistry		
	Admission Requirements: none		

26.	Elective Module: Theoretical Methods in the Material Sciences	SST	ECTS-AP
a.	**VO Computer-Assisted Design of Materials** Methods of theoretical chemistry for the evaluation of material qualities, calculation of the relations between molecular topology, electronic structure and chemical qualities (QSEPR), use of QSEPR for the computer design of new compounds/materials	1	1
b.	**PR Methods of Calculating and Evaluating Physical-Chemical Materials Properties** Combined use of quantum mechanics and semi-classical methods to cal-	2	1,5

	culate structural, dynamic and spectroscopic properties of chemical systems; a practical exercise in the practical use of QSEPR methods and of materials design		
	Total	**3**	**2,5**
	Aims of the Module: Students acquire knowledge in the use of quantum mechanics methods, modelling processes and simulation techniques to calculate material properties of all kinds and learn the most important ways to produce quantitative/electronic structure property/relationships as a basis for the design of new chemical compounds and materials.		
	Admission Requirements: none		

(4) Elective modules of the general competencies. From these nine modules an appropriate number amounting to 5 ECTS-AP are to be chosen and successfully completed:

27.	**Elective Module: Series of Lectures on Material and Nano Sciences/GÖCh/Inorganic Colloquium/Physics Colloquium, Earth Sciences Colloquium/Colloquium of Civil Engineering**	**SST**	**ECTS-AP**
	KU Series of Lectures Attendance of the invited-lecture series organised by the research platform Advanced Materials and Nano Sciences, the Society of Austrian Chemists (GÖCh), the Inorganic Chemistry Colloquium, the Physics Colloquium, the Earth Sciences Geo-Colloquium and the Colloquium of Civil Engineering	2	2,5
	Total	**2**	**2,5**
	Aims of the Module: Through participation in the lectures students are made familiar with the current research topics of outside experts and they learn how current topics are presented and discussed at a scientific level. Contact with the invited speakers enables students to get to know the Scientific Community.		
	Admission Requirements: none		

28.	**Elective Module: Patent and Chemicals Law**	**SST**	**ECTS-AP**
	KU Law on Patents and Chemicals Inventions, protection of inventions, patents registration, patents, effects and consequences of patents, protection certificates, Austrian and European chemical law, registration, assessment and approval of chemicals	2	2,5
	Total	**2**	**2,5**
	Aims of the Module: Students acquire a basic understanding of the law on intellectual property as it affects chemists together with an overview on legal regulations of chemicals.		
	Admission Requirements: none		

29.	Elective Module: Project Management	SST	ECTS-AP
	KU Project Management Project definition, project management approaches and processes; practice-oriented tools for the planning, organisation, implementation and supervision of projects, case studies of relevance for chemistry, from the worlds of research and industry.	2	2,5
	Total	**2**	**2,5**
	Aims of the Module: Students get to know the status, methodology and success factors of modern project management and learn how to use management processes and helpful tools for their own projects. The acquired skills should enable students to undertake an active role in a project organisation.		
	Admission Requirements: none		

30.	Elective Module: Presentation Techniques and Application Strategies	SST	ECTS-AP
a.	**KU Presentation Techniques** Perception, memory, cognitive, emotional and interactional aspects of presentations, prerequisites for comprehensibility, presentation and rhetoric, opportunities and limits of various presentation techniques	1	1,5
b.	**KU Application Strategies** Perception of personal and social perception, self-presentation, human communication, credibility, dynamics of application discussions, control of stress, opportunities and limits of various application strategies	1	1
	Total	**2**	**2,5**
	Aims of the Module: Students acquire basic knowledge on the theory and practice of presentations and self presentation in the professional context, reflect on their own behaviour in these respects and increase and improve their skills in these areas.		
	Admission Requirements: none		

31.	Elective Module: Gender Studies in the Natural Sciences	SST	ECTS-AP
	KU Gender Studies in the Natural Sciences Knowledge of gender research in the natural sciences: “Women in Science“; professional and sociological aspects/ “Gender in Science”, gender aspects of the production of knowledge, product creation, consumption, uses, politics of chemical/scientific theory		2,5
	Total	**2**	**2,5**
	Aims of the Module: Consideration of gender-specific aspects in the natural sciences imparts to students knowledge of the social context of their subject. They learn to recognise attempts made at		

	various levels to analyse the connections between the natural sciences and gender relations. Their sense of responsibility for the uses and risks and of the social implications of their subject are thus strengthened.
	Admission Requirements: none

32.	**Elective Module: Computer-Assisted Data Bank Research**	**SST**	**ECTS-AP**
	KU Computer-Assisted Data Bank Research Structuring and information content of natural scientific data banks (SciFinder, Beilstein CrossFire, Science of Synthesis – Houben Weyl, esp@cenet, Cambridge Crystallographic Data Centre etc.); strategies for literature searches, search algorithms and search profiles, data management	2	2,5
	Total	**2**	**2,5**
	Aims of the Module: Students acquire practice-oriented knowledge on the content of and search for information in data banks relevant to the natural sciences.		
	Admission Requirements: none		

33.	**Elective Module: Computer-Assisted Control of Experiments**	**SST**	**ECTS-AP**
	PR Computer-Assisted Control of Experiments Basic components of A/D and D/A conversion, programming in LABVIEW	3	2,5
	Total	**3**	**2,5**
	Aims of the Module: Participants are familiarised with hard- and software (programming) for automatic data acquisition and computer control of experiments.		
	Admission Requirements: none		

34.	**Elective Module: Processing of Metals and Ceramics for Laboratory Uses**	**SST**	**ECTS-AP**
	PR Metal and Ceramics Processing for Laboratory Uses Independent work in the precision mechanics workshop	5	5
	Total	**5**	**5**
	Aims of the Module: Participants learn refined mechanical methods and skills and can independently produce their own mechanical precision parts and devices.		
	Admission Requirements: none		

35.	Elective Module: Glass Processing for Laboratory Purposes	SST	ECTS-AP
	PR Glass Processing for Laboratory Purposes Independent practice with glass-blowing and the production of glass devices needed in the laboratory	5	5
	Total	**5**	**5**
	Aims of the Module: Participants learn the methods of working with glass and how to independently produce glass devices for use in the laboratory.		
	Admission Requirements: none		

(5) Mandatory module Defense of the Master's Thesis (2,5 ECTS-AP):

36.	Mandatory Module: Defense of the Master's Thesis (Defensio)	SST	ECTS-AP
	Oral defense of the Master's Thesis in front of a Senate Examination Committee		2,5
	Total		**2,5**
	Aims of the Module: Reflection on the Master's Thesis in connection with the whole of the Master's Programme in Material and Nano Sciences. Foremost in this are theoretical understanding, methodological bases, the delivery of the results of the Master's Thesis and presentation skills.		
	Admission Requirements: Successful completion of the prescribed mandatory and elective modules and of the Master's Thesis.		

§ 7 The Master's Thesis

(1) The Master's Programme in Material and Nano Sciences includes a Master's Thesis worth 27,5 ECTS-AP. The Master's Thesis is a piece of scientific work that testifies to the student's ability to adequately deal wit a scientific topic with regard to both content and method.

(2) The topic of the Master's Thesis may be chosen from all areas of the Material and Nano Sciences, particularly from Inorganic Chemistry, Building and Engineering Sciences, Ion Physics, Mineralogy, Pharmaceutical Technology, Physics, Physical Chemistry, Textile Chemistry and Textile Physics, and Theoretical Material Sciences. Before the topic of the Master's Thesis is announced, the student must provide evidence of achieving at least 60 ECTS-AP in the mandatory and elective modules.

(3) Master's Theses are to be presented in the written and electronic forms laid down by the Director of Studies.

§ 8 Examination Regulations

(1) With the exception of the Defense of the Master's Thesis module, the other modules are successfully completed through positive participation in the relevant courses.

(2) For lectures a written or oral test is to be taken on the total content of the course whereby the course leader is to inform students of the mode of examination before the course begins.

(3) Assessment of courses with continuous assessment is based on the regular written and oral and/or practical/experimental contributions of the student; students are to be informed of the assessment criteria by the course leader before the course begins.

(4) The Master's Programme in Material and Nano Sciences is completed by the student's defense of the Master's Thesis in front of a Senate Examination Commission consisting of three persons. In a 20-minute lecture students present the results aimed at in their thesis. Defense of the Master's Thesis follows with the student answering the questions put by the members of the commission. Assessment by the Senate Examination Commission is based on the student's lecture and on the answers given to the questions posed.

§ 9 Academic Title

Students successfully completing the Master's Programme in Material and Nano Sciences are awarded the title "Master of Science", shortened to "MSc".

§ 10 Coming into force

This curriculum comes into force on 1st October 2009.

For the Curriculum Committee

Ao. Univ.-Prof. Dr. Benno Bildstein

For the Senate

Univ.-Prof. Dr. Ivo Hajnal

Appendix 1: Recommended study plan

As a result of the wide range of electives for the Master's Programme in Material and Nano Sciences, a detailed study plan with a list of courses chosen is not very useful. The time sequence for the subjects chosen is in line with the semester course offerings (winter or summer semester) and the actual choice of module is decided by the students themselves. Below is an overview plan in line with the relative workload in terms of ECTS-AP:

<table>
<tr><th>1st Semester
(Winter Semester)</th><th>2nd Semester
(Summer Semester)</th><th>3rd Semester
(Winter Semester)</th><th>4th Semester
(Summer Semester)</th></tr>
<tr><td colspan="3">Mandatory modules
(12 Modules, 75 ECTS-AP)
Inorganic Chemistry, Physical Chemistry, Mineralogy, Pharmaceutical Technology, Physic, Ion Physics, Buildings and Engineering Sciences and Theoretical Material Sciences</td><td rowspan="3">Master'sThesis
(27,5 ECTS-AP)

Defense of the Master's Thesis
(2,5 ECTS-AP)</td></tr>
<tr><td colspan="3">Elective Modules of the Subject Intensification
(14 Modules, Choice from 10 ECTS-AP)
Inorganic Chemistry, Physical Chemistry, Mineralogy, Organic Chemistry, Pharmaceutical Technology, Physics, Ion Physics, Textile Chemistry and Textile Physics, Building and Engineering Sciences and Theoretical Material Sciences</td></tr>
<tr><td colspan="3">Elective Modules of the General Competencies
(9 Modules, Choice from 5 ECTS-AP)</td></tr>
</table>