Analytical Methods I

Module title and code no	05M-MCM-1-P1 Analytical Methods I			
Representative/s	Michael Wendschuh			
Appendant courses	05M-MCM-1-P1-1	Materials Analysis I	Project Exercise	5 SWS
Workload / credit points	6 CP 180 hours / 6 CP			
Mandatory / compulsory / elective	Mandatory			
Assignment	Master of Science Materials Chemistry and Mineralogy 2012			fulltime class
Duration	1 Semester Winter term / First year of study			
Requirements for participation	Basics in chemistry and physics			
Offered	Yearly WS			
Teaching Language	Teaching language: Eng Level: C1			
Learning Outcome	- Basic analytical skills - Knowledge of application fields and limitations of various analytical methods			
Content	- Basics and principles of instrumental analytics - Spectroscopy, diffractometry and imaging techniques - Fundamentals of selected analytical methods - Sample preparation, performing of measurements and evaluation of the results - Report writing			
Exam	Module exam (combined marks): laboratory report written exam		not graded 100 %	
Literature	- Will be announced at the start of the course			

Mineralogy

Module title and code no	05M-MCM-1-P2 Mineralogy			
Representative/s	Reinhard X. Fischer			
Appendant courses	05M-MCM-1-P2-1 05M-MCM-1-P2-2	Introduction to Mineralogy Materials Resources	Lecture, Exercise Lecture, Exercise	2 SWS 2 SWS
Workload / credit points	6 CP 180 hours / 6 CP			

Mandatory / compulsory / elective	Mandatory
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Winter term / First year of study
Requirements for participation	
Offered	Yearly WS
Teaching Language	Teaching language:
Learning Outcome	- Basic knowledge of mineral science
Content	- Pure and applied mineralogy - Crystal chemistry and chemical composition of minerals - Mineralogical methods - Physical Properties of minerals and inorganic compounds - Utilisation of minerals - Systematic and descriptive mineralogy
Exam	Module exam (one mark): written exam
Literature	- Will be announced at the start of the course

Crystallography

Module title and code no	05M-MCM-1-P3 Crystallography
Representative/s	Reinhard X. Fischer
Appendant courses	05M-MCM-1-P3-1 Introduction to Crystallography Lecture 2 SWS 05M-MCM-1-P3-2 X-ray Diffraction & Rietveld Analysis Lecture 3 SWS
Workload / credit points	6 CP 180 h. Introduction to crystallography • time for lectures and excercises (2 SWS x 14 weeks) 28 h • time for preparation and post processing 38 h • time for exams and preparation 24 h X-ray diffraction & Rietveld analyis • time for lectures and excercises (3 SWS x 14 weeks) 42 h • time for preparation and post processing 30 h • time for exams and preparation 18 h
Mandatory / compulsory / elective	Mandatory This module must be attended by all students
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Winter term / First year of study

Requirements for participation	Previous knowledge in crystallography and X-ray diffraction is not required, yet a general understanding of fundamental physical and chemical concepts. The classes will start from most fundamental ideas and rapidly proceed to up-to-date topics.
Offered	Yearly WS
Teaching Language	Teaching language: English
Learning Outcome	Students will understand the specific properties of crystals and be able to describe them with crystallographic tools. X-ray diffraction methods and up-to-date methods for X-ray diffraction data analysis will be understood in detail and the students will be able to apply the latter.
Content	Fundamentals of Crystallography for all aspects of materials science - properties of crystals - crystals and periodicity - symmetry of crystals and crystal properties - crystal chemistry and physics - crystal structure models - crystal structure determination X-ray diffraction - fundamentals and methods - diffraction and scattering phenomena - diffraction and periodicity - "diffraction in direct and reciprocal space" - powder diffraction methods - methods for powder diffraction data analyses - calculation of powder diffraction patterns - Rietveld analysis of powder diffaction patterns - understanding, evaluation and application
Exam	Module exam (combined marks): written exam 80 % written report 20 %
Literature	Crystallography Putnis - Introduction to Mineral Sciences Kleber, Bautsch, Bohm - Einführung in die Kristallographie Giacovazzo et al. - Fundamentals of Crystallography X-ray diffraction: 1. Rietveld's initial papers - Rietveld (1967), Acta Cryst. 22, 151-152 - Rietveld (1969), J. Appl. Cryst. 2, 65-71. 2. Some introductory articles to the Rietveld method - Albinatti, Willis (1982), J. Appl. Cryst., 15, 361-374. - Mc Cusker et al. (1999), J. Appl. Cryst., 32, 36-50. 3. Comprehensive Rietveld book - Young (ed.) (1995), The Rietveld method, IUCr Monographs on Crystallography 5, 298 S.

Chemistry

Module title and code no	05M-MCM-1-P4 Chemistry
Representative/s	Marcus Bäumer
Appendant courses	05M-MCM-1-P4-1 Surfaces and Interfaces Lecture 1 SWS

	05M-MCM-1-P4-2	Solid State Chemistry	Lecture, Exercise	1 SWS
	05M-MCM-1-P4-3	Solid State Physics	Lecture	2 SWS
Workload / credit points	6 CP Lecture Surface and Interfaces: • Präsenzzeit (1 SWS x 14 Wochen) 14 h • Vor und Nachbereitung 30 h • Prüfungsvorbereitung 24 h Lecture Solid State Chemistry: • Präsenzzeit (1 SWS x 14 Wochen) 14 h • Vor und Nachbereitung 30 h • Prüfungsvorbereitung 24 h Lecture Solid STate Physics: • Präsenzzeit (1 SWS x 14 Wochen) 14 h • Vor und Nachbereitung 30 h • Prüfungsvorbereitung 24 h			
Mandatory / compulsory / elective	Mandatory will be given till 23.12.2011			
Assignment	Master of Science Materials Chemistry and Mineralogy 2012			fulltime class
Duration	1 Semester Winter term / First year of study			
Requirements for participation	Fundamental knowledge in chemistry and physics			
Offered	Yearly WS			
Teaching Language	Teaching language: English			
Learning Outcome	will be given till 23.12.2011			
Content	will be given till 23.12.2011			
Exam	Module exam (combined marks): written exam		100 %	
Literature	as given in the lectures			

Materials Science

Module title and code no	05M-MCM-1-P5 Materials Science			
Representative/s	Kurosch Rezwan			
Appendant courses	05M-MCM-1-P5-1	Introduction to Materials Science	Lecture, Exercise	2 SWS
	05M-MCM-1-P5-2	Phase Diagrams	Lecture, Exercise, Practical Course	2 SWS

Workload / credit points	6 CP 180 h
Mandatory / compulsory / elective	Mandatory compulsory for all students
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Winter term / First year of study
Requirements for participation	There are no specific requirements except general knowledge in science basics
Offered	Yearly WS
Teaching Language	Teaching language: English
Learning Outcome	The students will be able to understand the basic principles in materials science and they will be able to understand and to design syntheses routes derived from phase diagrams.
Content	- Fundamentals in materials science - Interpretation of phase diagrams - Crystallization paths - Melting processes - Solid solutions - Phase transformations
Exam	Module exam (one mark): written exam
Literature	F. Tamás, I. Pál: Phase Equilibria Spatial Diagrams R. Powell: Equilibrium Thermodynamics in Petrology T. Gasparik: Phase Diagrams for Geoscientists A. Putnis: Introduction to Mineral Sciences B. Predel, M. Hoch, M. Pool: Phase Diagrams and Heterogeneous Equilibria Phase Diagrams for Ceramists, Amer. Ceram. Soc. (PDC)

Analytical Methods II

Module title and code no	05M-MCM-2-P6 Analytical Methods II
Representative/s	Michael Wendschuh
Appendant courses	05M-MCM-2-P6-1 Materials Analysis II Project Exercise 5 SWS
Workload / credit points	6 CP 180 hours / 6 CP
Mandatory / compulsory / elective	Mandatory
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Summer term / First year of study

Requirements for participation	Basics and principles of instrumental analytics
Offered	Yearly SS
Teaching Language	Teaching language: Eng Level: C1
Learning Outcome	Knowledge of application fields and limitations of various analytical methods
Content	This module is a continuation of analytical methods I. It covers additional methods of instrumental analytics.
Exam	Module exam (combined marks): laboratory report not graded written exam 100 %
Literature	- Will be announced at the start of the course

Crystal Structure Analysis

Module title and code no	05M-MCM-2-W1M Crystal Structure Analysis			
Representative/s	Reinhard X. Fischer			
Appendant courses	05M-MCM-2-W1M-1 05M-MCM-2-W1M-2	Crystal Structure Analysis and Crystal Chemistry Single Crystal Diffraction	Lecture, Exercise Lecture	3 SWS 2 SWS
Workload / credit points	6 CP 180 h			
Mandatory / compulsory / elective	Compulsory elective module			
Assignment	Master of Science Materials Chemistry and Mineralogy 2012			fulltime class
Duration	1 Semester Summer term / First year of study			
Requirements for participation	The students should have a basic knowledge in geometrical crystallography, crystal chemistry, and X-ray diffraction theory			
Offered	Yearly SS			
Teaching Language	Teaching language: English			
Learning Outcome	The students will be able to determine the crystal structure of minerals and synthetic, crystalline compounds, and to understand the structure/property relationships			
Content	- Theory of single-crystal diffraction - Structure factor calculations - Thermal vibration, anisotropic displacements, eigenvalue calculation - Anomalous dispersion - Fourier syntheses - Patterson function - Direct methods			

	- Least squares theory - Structure solution and refinement using SHELX program - Crystal chemical calculations - Diffractometer operation and data collection - Absorption correction - Precession and Weißenberg methods
Exam	Module exam (combined marks): written exam 100 % Advance performance: - Protokoll zur Strukturlösung und Verfeinerung mit
Literature	G.H. Stout, L.H. Jensen: X-ray structure determination. John Wiley B.D. Cullity: Elements of X-ray diffraction.Addison-Wesley. W. Massa: Kristallstrukturbestimmung. Teubner M.J. Buerger: Kristallographie. Walter de Gruyter M.J. Buerger: Crystal-structure analysis. Krieger Publishing. C: Giacovazzo: Fundamentals of crystallography J. P. Glusker, K.N. Trueblood: Crystal structure analysis, a primer. Oxford University Press M.F.C. Ladd, R.A. Palmer: Structure determination by X-ray crystallography.Plenum Press P. Luger: Modern X-ray analysis on single crystals. Walter de Gruyter B.E. Warren: X-ray diffraction. Addison-Wesley A.J.C. Wilson: Elements of X-ray crystallography. Addison-Wesley

Physical Properties of Crystals

Module title and code no	05M-MCM-2-W2M Physical Properties of Crystals
Representative/s	Reinhard X. Fischer
Appendant courses	05M-MCM-2-W2M-1 Introduction to Crystal Physics Lecture, Exercise 2 SWS 05M-MCM-2-W2M-2 Crystal Optics Lecture, Exercise 2 SWS
Workload / credit points	6 CP 180 h. Introduction to crystal physics • time for lectures and excercises (2 SWS x 14 weeks) 28 h • time for preparation and post processing 38 h • time for exams and preparation 24 h Crystal optics • time for lectures and excercises (2 SWS x 14 weeks) 28 h • time for preparation and post processing 38 h • time for exams and preparation 24 h
Mandatory / compulsory / elective	Compulsory Elective module to cover 6 CP within profile Mineralogy.
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester

	Summer term / First year of study
Requirements for participation	Basic crystallographic understanding as taught in the compulsory module Crystallography.
Offered	Yearly SS
Teaching Language	Teaching language: English
Learning Outcome	The students will understand the scientific description of reversible physical properties in terms of tensor calculus. They will be able to perform the determination of selected properties such as piezoelectricity and refractive indices and to predict if they may be expected for a given symmetry.
Content	Crystals are anisotropic solids. They are homogeneous with respect to structure (atomic arrangement), chemical composition and physical properties. In crystal physics macroscopic properties and their determination are described in detail. The most important tool is tensor calculus which will be introduced in detail. Symmetry is of similar importance as it determines whether a crystal may exhibit specific properties, such as piezoelectricity, or not. Optical properties are widely used for phase identification in the field of geosciences and materials science. Understanding their dependance on symmetry and structure is very intriguing. Special techniques for the determination and methods for the calculation of optical properties will be presented.
Exam	Module exam (one mark): short written exams
Literature	Very close to the lecture in crystal physics: J.F. Nye (1957): Physical properties of crystals, Oxford More crystal physics text books: W. Kleber, K. Meyer, W. Schoenborn (1968): Einführung in die Kristallphysik, Berlin S. Haussühl (1983): Kristallphysik P. Paufler (1987): Physikalische Kristallographie, Verlag Chemie W.A. Wooster, A. Breton,… (1970): Experimental crystal physics, Oxford Ch. Kittel (1971): Introduction to solid state physics, N.Y. W. Voigt (1966, Nachdruck von 1910): Lehrbuch der Kristallphysik, Stuttgart

Functional Ceramics

Module title and code no	05M-MCM-2-W3M Functional Ceramics			
Representative/s	Reinhard X. Fischer			
Appendant courses	05M-MCM-2-W3M-1	Bioceramics	Lecture, Exercise	2 SWS
	05M-MCM-2-W3M-2	Modification and Characterisation of Material Surfaces for Biotechnological Applications	Lecture, Exercise	2 SWS
	5 SWS			
Workload / credit points	6 CP 180 h			
Mandatory / compulsory / elective	Compulsory elective module			
Assignment				

	Master of Science Materials Chemistry and Mineralogy 2012	fulltime class
Duration	1 Semester Summer term / First year of study	
Requirements for participation	no special knowledge required except the contents of module 05M-MCM-1-P5 Materials Science.	
Offered	Yearly SS	
Teaching Language	Teaching language: German Further language skills: English	
Learning Outcome	The students will be able to understand structure - property relationships of functional ceramics and their utilization.	
Content	Introduction to characteristic properties of functional ceramics. Introduction to the development and engineering of advanced ceramic materials for applications in the areas of biomaterials engineering, environmental engineering, energy harvesting devices and aerospace. Novel Processing and Shaping Routes Bioceramics Precursor derived Ceramics (Ceramers) Advanced Composites	
Exam	Module exam (one mark): oral exam	
Literature		

Minerals and Materials

Module title and code no	05M-MCM-2-W4M Minerals and Materials			
Representative/s	Reinhard X. Fischer			
Appendant courses	05M-MCM-2-W4M-1	Mineral Surfaces and Reactions	Lecture, Exercise	2 SWS
	05M-MCM-2-W4M-2	Thermodynamics in Mineral Sciences	Lecture, Exercise, Practical Course	3 SWS
Workload / credit points	6 CP 180 hours / 6 CP			
Mandatory / compulsory / elective	Compulsory			
Assignment	Master of Science Materials Chemistry and Mineralogy 2012			fulltime class
Duration	1 Semester Summer term / First year of study			
Requirements for participation				
Offered	Yearly SS			

Teaching Language	Teaching language:
Learning Outcome	Knowledge of processes and reactions in the production chain of inorganic materials.
Content	This module will treat minerals as raw materials and their correlations with the resulting products. In particular the role of surface properties with respect to mineral-mineral as well as mineral-fluid reactions and the thermodynamic and kinetic aspects of mineral processes are in the focus.
Exam	Module exam (one mark): written exam
Literature	- Will be announced at the start of the course

Solid State Synthesis and Characterization

Module title and code no	05M-MCM-2-W1C Solid State Synthesis and Characterization			
Representative/s	Marcus Bäumer			
Appendant courses	05M-MCM-2-W1C-1 05M-MCM-2-W1C-2	Solid State Reactions Solid State Synthesis and Characterization	Lecture Seminar, Practical Course	1 SWS 4 SWS
Workload / credit points	6 CP Solid State Reactions: • Präsenzzeit (1 SWS x 14 Wochen) 14 h • Vor und Nachbereitung 26 h • Prüfungsvorbereitung 20 h Solid State Synthesis and Characterisation: • Präsenzzeit (4 SWS x 14 Wochen) 56 h • Vor und Nachbereitung 44 h • Erstellung von Protokollen 20 h			
Mandatory / compulsory / elective	Compulsory			
Assignment	Master of Science Materials Chemistry and Mineralogy 2012			fulltime class
Duration	1 Semester Summer term / First year of study			
Requirements for participation	Fundamental knowledge of diffractions methods (X-ray, neutrons) are helpful.			
Offered	Yearly SS			
Teaching Language	Teaching language: English and/or German			
Learning Outcome	After finishing the modul the students sshould be able: • to name and use differnt kinds of solid state synthesis methods; • to do X-ray and spectroscopic phase identifications; • to validate the use of analytical methods to answer solid state specific open questions;			
Content	This modul should deeply introduce into prepartion methods and special characterisation and working techniques of solid state chemistry. Problems			

	occuring during solid state preparations (Thermodynamic, Defects, Kinetic, Metastability) together with classic and modern synthesis methods (solid-solid, phase transitions, precursor meterials, sol-gel, hydrothermal reactions etc.) will be explained and discussed. Selected examples (close to actual scientific work) of differnt synthesis methods will be practically trained and the products identified and characterized.
Exam	Module exam (combined marks): written exam 100 % protocol not graded
Literature	as given in the lecture and practical course

Structure Property Relationship

Module title and code no	05M-MCM-2-W2C Structure Property Relationship
Representative/s	Marcus Bäumer
Appendant courses	05M-MCM-2-W2C-1 Structure Property Relations Lecture 2 SWS 05M-MCM-2-W2C-2 Structure Property Relations Seminar Seminar 2 SWS
Workload / credit points	6 CP Lecture Structure Property Relations: • Präsenzzeit (2 SWS x 14 Wochen) 28 h • Vor und Nachbereitung 30 h • Prüfungsvorbereitung 24 h SeminarStructure Property Relations: • Präsenzzeit (2 SWS x 14 Wochen) 28 h • Vor und Nachbereitung 30 h • Eigener Vortrag als Studienleistung 40 h
Mandatory / compulsory / elective	Compulsory
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Summer term / First year of study
Requirements for participation	Grundkenntnisse in Festkörperchemie sind von Vorteil.
Offered	Yearly SS
Teaching Language	Teaching language: English and/or German
Learning Outcome	Passing this modul the students should be able to understand, describe and use topics of the following areas: • crystalline and non-crystalline solids • thermal expansion of solids • magnetism and magnetic structures • tensor properties of solids • to correlate structures and their properties in case studies

	• to work out structure property relations out of scientific literature and explain the relations correctly
Content	Brief Introduction to Materials, Structures and Properties 1. Historical Perspective, Crystalline and Non-crystalline Materials, Polycrystalline and Bulk Properties 2. Bond Valence Theory and State-of-the-Arts 3. Defects and Distortions Thermal Properties of Materials 4. Thermal Expansion (General Overview, Isotropic, and Anisotropic Thermal Expansion) 5. Thermal Expansion Coefficients, Anisotropic Factor, Grüneisen Function 6. Mathematical Treatment (Modeling) of Thermal Parameters 7. Low Temperature (sub-zero) Stability Magnetic Properties of Materials 8. General Overview and and Hysteresis 9. Neutrons, Magnetism and Magnetic Structures Tensor Properties of Materials 10. General Overview, Rank and Representation 11. Thermal Expansion Tensors 12. Electrical Conductivity Tensors Property Investigations and Tools 13. Case study-1 (Sodalites, X-ray diffraction, IR, NMR) 14. Case study-2 (Mullites, Neutron Diffraction, Pair Distribution Function)
Exam	Module exam (combined marks): written exam 100 % seminar talk not graded
Literature	as given in the lecture and seminar

Catalysis and Surface Chemistry

Module title and code no	05M-MCM-2-W3C Catalysis and Surface Chemistry			
Representative/s	Marcus Bäumer			
Appendant courses	05M-MCM-2-W3C-1 05M-MCM-2-W3C-2 05M-MCM-2-W3C-3	Heterogeneous Catalysis Vacuum and Cryotechnics Industry Excursion	Lecture Lecture, Exercise, Practical Course Excursion	2 SWS 2 SWS 1 SWS
Workload / credit points	6 CP 6 CP Heterogene Katalyse und Oberflächenchemie - Präsenzzeit (V 2 SWS x 14 Wochen) 28 h - Vor und Nachbereitung 42 h Vakuum- und Kryotechnik - Präsenzzeit 14 h (V 1 SWS x 14 Wochen) 14 h - Vor und Nachbereitung (V, Ü) 21 h - Durchführung und Auswertung eines Experiments an einer Ultrahochvakuum-Anlage (Plasmabehandlung von Oberflächen, Photoelektronenspektroskopie) (Blockpraktikum 3 x 8 h, Auswertung 6 h) 30 h			

	Industrieexkursion (BASF Nienburg) 7 h - Prüfungsvorbereitung 30 h Zusammen: 172 h
Mandatory / compulsory / elective	Compulsory Teilnehmerbegrenzung auf 6 Teilnehmer
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Summer term / First year of study
Requirements for participation	
Offered	Yearly SS
Teaching Language	Teaching language: Englisch Further language skills: Deutsch
Learning Outcome	The participants of the module shall gain a basic understanding of heterogeneous catalysis on different scales: from the macroscopic level (reactor) all the way down to microscopic level. They will be able to judge the complexity of the process based on the strctural features, such as pores and surface properties, and the relevant processes of transport and reaction taking place at different scales.
Content	see description of different parts of the module
Exam	Module exam (one mark): written exam Advance performance: - Laborbericht zum Versuch im Modulteil "Vakuum- und - Schr. Bericht zur Industrieexkursion
Literature	

Functional Surfaces

Module title and code no	05M-MCM-2-W4C Functional Surfaces			
Representative/s	Petra Swiderek			
Appendant courses	05M-MCM-2-W4C-1	Molecular Layers	Lecture	2 SWS
	05M-MCM-2-W4C-2	Electron induced chemical reactions	Seminar	1 SWS
	05M-MCM-2-W4C-3	Surface Modifications	Seminar, Practical Course	1 SWS
Workload / credit points	6 CP 6 CP = 180h Molecular layers: - Präsenzzeit 28 h (V, 2 SWS x 14 weeks) - Vor und Nachbereitung (V) 28 h Electron-induced reactions: - Präsenzzeit 14 h (S, 1 SWS x 14 Wochen) - Vor und Nachbereitung (S) 14 h			

	- Ausarbeitung eines Seminarbeitrags 34 h Lab course surface modification: - Präsenzzeit 14 h (P, 1 SWS) - Auswertung und Protokoll 14 h Preparation for examination: - 34 h
Mandatory / compulsory / elective	Compulsory
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Summer term / First year of study
Requirements for participation	Basic knowledge of physical chemistry is expected
Offered	Yearly SS
Teaching Language	Teaching language: Deutsch Further language skills: Englisch
Learning Outcome	After successful participation in this course students will - know important processes for preparing molecular layers on surfaces - be able to explain the physical and chemical principles behind these processes - be able to select suitable analytical methods to analyse the structure of molecular layers - be able to prepare self-assembled monolayers - be able to describe and explain applications of molecular layers on surfaces - know about the principles of electron beam methods for the modification of molecular layers and the relevance of electron-induced reactions in selected areas of research and technology.
Content	Relevance of nanoscopic molecular layers (areas of application, recent examples) Preparation of monomolecular layers (self-assembly, PVD, growth modes and their kinetics, epitaxy, Langmuir-Blodgett-layers, SAMs) Methods for investigating the structureof nanoscopic molecular layers (Overview, contact angle, ellipsometry, diffraction, optical spectroscopy, electron spectroscopy, scanning probe techniques) Surface modification and structuring (Silicon surfaces as selected example, processes for surface structuring) Electron-induced elementary processes (Mechanisms of electron-molecule interactions, excitation, electronen attachment, ionisation, subsequent reactions, kinetics of processes) Experiments on electron-induced processes (Vacuum, surface analytical techniques: TDS, RAIRS, ESD, HREELS, XPS) Relevance of electron-induced reactions (Technical applications of keV- and MeV-electrons, Irradiation with low-energy electrons, plasmas, lithography, radiation damage, atmospheric and cosmic chemistry) Modification of surfaces by electrons (Technical processes, selected examples)
Exam	Module exam (combined marks): seminar paper 75 % seminar talk 25 % internship report not graded
Literature	Will be proposed during the course.

Introduction to Technical Chemistry

Module title and code no	05M-MCM-2-W5C Introduction to Technical Chemistry
Representative/s	Marcus Bäumer
Appendant courses	05M-MCM-2-W5C-1 Technical Reaction Processes — Lecture, Exercise, Practical Course — 5 SWS
Workload / credit points	6 CP 6 CP Techn. Reaktionsführung: - Präsenzzeit (2 SWS x 14 Wochen) 28 h - Vor und Nachbereitung 54 h Praktikum - Durchführung der Versuche (3 x 8 h) 24 h - Auswertung + Protokollerstellung 24 h Seminar - Präsenzzeit (0.5 SWS) 7 h - Vorbereitung Vortrag 20 h Prüfungsvorbereitung 20 h Zusammen: 177 h
Mandatory / compulsory / elective	Elective
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 — fulltime class
Duration	1 Semester Summer term / First year of study
Requirements for participation	
Offered	Yearly SS
Teaching Language	Teaching language: Englisch Further language skills: Deutsch
Learning Outcome	After attending the module, the participants shall... - judge the differences between different reactor types used in the lab and in industry - predict the residence time spectrum of different reactor types - estimate when a special reactor type is better suited than another one
Content	The module will cover the following topics: - Chemical reactions: thermodynamics - Yields and reactor design: continous and discontinous reactor types, industrial reactors, estimation of costs - Macro kinetics: ideal and real reactors, residence time spectrum, dispersion model
Exam	Module exam (one mark): written exam Advance performance:

	- Praktikumsprotokolle
Literature	

General Studies

Module title and code no	05M-MCM-3-P7 General Studies
Representative/s	Reinhard X. Fischer
Appendant courses	05M-MCM-3-P7-1 General Studies Compulsory Course Lecture 2 SWS 05M-MCM-3-P7-2 Programming Lecture, Exercise 2 SWS
Workload / credit points	6 CP 180 h
Mandatory / compulsory / elective	Mandatory compulsory for all students
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Winter term / Second year of study
Requirements for participation	There are no prerequesits except general knowledge in the handling of computers
Offered	Yearly WS
Teaching Language	Teaching language: English
Learning Outcome	The students will obtain some additional competences complementary to their science study, e.g., in the field of business studies, additional languages, cultural studies. Further on, the students will be able to write complex computer programs
Content	- special topics in selected areas - programming of mathematical algorithms - user interface programming - graphics programming
Exam	Module exam (combined marks): assignment 100 % Advance performance: - Erfolgreiche Teilnahme an General Studies Veransta
Literature	

Petrology and Isotope Geochemistry

Module title and code no	05M-MCM-3-W5M Petrology and Isotope Geochemistry
Representative/s	Wolfgang Bach, Simone Kasemann
Appendant	

courses	05M-MCM-3-W5M-1	Mineral Deposits and Isotope Geochemistry	Lecture, Exercise, Practical Course	3 SWS
	05M-MCM-3-W5M-2	Phase Equilibria - Principles, Applications and Computations	Lecture, Exercise	2 SWS
Workload / credit points	6 CP 6CP = 180 hours 45 hours of course work for class 05M-MAR-2-C12-1, including lectures and lab exercises 30 hours of course work for class 05M-MAR-2-C12-2 60 hours of home work for class 05M-MAR-2-C12-1 45 hours of home work for class 05M-MAR-2-C12-2			
Mandatory / compulsory / elective	Compulsory			
Assignment	Master of Science Materials Chemistry and Mineralogy 2012			fulltime class
Duration	1 Semester Winter term / Second year of study			
Requirements for participation				
Offered	Yearly WS			
Teaching Language	Teaching language: English			
Learning Outcome	Applying principles of geochemistry and petrology to problems in material sciences. Understanding the process of isotopic analysis and the principles of isotope ratios as tracer. Using phase equilibria calculations in assessing phase relations in varied materials.			
Content	Principles of isotopes as tracers for the origin and fate of materials. Conducting thermodynamic calculations in order to assess the origin and state of materials.			
Exam	Module exam (combined marks): assignment 60 % assignment 40 %			
Literature				

Technical Ceramics

Module title and code no	05M-MCM-3-W6M Technical Ceramics			
Representative/s	Michael Wendschuh, Kurosch Rezwan			
Appendant courses	05M-MCM-3-W6M-1	Ceramics lab course	Exercise	2 SWS
	05M-MCM-3-W6M-2	Ceramic Nanotechnology	Lecture	3 SWS
Workload / credit points	6 CP 180 h			
Mandatory /	Mandatory			

compulsory / elective	elective modul
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Winter term / Second year of study
Requirements for participation	No special knowledge required except the contents of module 05M-MCM-1-P5 Materials Science
Offered	Yearly WS
Teaching Language	Teaching language: German Further language skills: English
Learning Outcome	The students will be able to understand structure - property relationships of technical ceramics and their utilization.
Content	Introduction to characteristic properties of technical ceramics and their development, engineering, and utilization.
Exam	Module exam (one mark): oral exam
Literature	

Special Topics in Materials Science

Module title and code no	05M-MCM-3-W7M Special Topics in Materials Science
Representative/s	Reinhard X. Fischer
Appendant courses	05M-MCM-3-W7M-1 Nanoparticles and Nanotechnology Lecture, Exercise 2 SWS 05M-MCM-3-W7M-2 Zeolites, Catalysts and Ion Exchange Lecture, Exercise 2 SWS
Workload / credit points	6 CP 180 h. Lectures and excercises • lecture and excercises time (4 SWS x 14 weeks) 56 h • time for preparation and post processing 84 h • time for exams and preparation 40 h
Mandatory / compulsory / elective	Mandatory Elective module to cover 6 CP within profile Mineralogy.
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Winter term / Second year of study
Requirements for participation	
Offered	Yearly WS
Teaching Language	Teaching language: English

Learning Outcome	Students will be able to understand processes involved in the production of advanced materials and thea will be able to produce them with up-to-date techniques such as flame spray pyrolysis.
Content	Advanced and up-to-date methods and concepts in materials science. Most recent techniques such as flame spray pyrolysis will be presented in theory and practice.
Exam	Module exam (one mark): written exam
Literature	To be announced within the class.

Building Materials

Module title and code no	05M-MCM-3-W8M Building Materials			
Representative/s	Jörg Kropp			
Appendant courses	05M-MCM-3-W8M-1	Building Materials Analysis & Characterizations	Lecture, Exercise	2 SWS
	05M-MCM-3-W8M-2	Binders and Ceramic Building Materials	Lecture	1 SWS
	05M-MCM-3-W8M-3	Corrosion of Materials	Lecture	1 SWS
Workload / credit points	6 CP 180 hours / 6 CP			
Mandatory / compulsory / elective	Compulsory			
Assignment	Master of Science Materials Chemistry and Mineralogy 2012			fulltime class
Duration	1 Semester Winter term / Second year of study			
Requirements for participation				
Offered	Yearly WS			
Teaching Language	Teaching language:			
Learning Outcome	- Fundamental knowledge of building materials and building material analytics			
Content	Inorganic building materials like mortar, cement or brick stones belong to the oldest materials of the cultural history and are in use until today. Nowadays they are complemented with high performance materials like fibre reinforced concrete or special ceramics. Subjects of the module are the production, properties, processing, recycling and disposal of important building materials as well as specific methods for their evaluation and analytics.			
Exam	Module exam (one mark): written exam			
Literature	- Will be announced at the start of the course			

Research Module Mineralogy I

Module title and code no	05M-MCM-3-W9M Research Module Mineralogy I

Representative/s	Reinhard X. Fischer
Appendant courses	05M-MCM-3-W9M-1 Research Module Mineralogy Project 10 SWS Exercise 10 SWS
Workload / credit points	12 CP 360 h
Mandatory / compulsory / elective	Compulsory elective module
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Winter term / Second year of study
Requirements for participation	The students should have a fundamental knowledge in mineralogy and crystallography and they should be well trained in analytical methods, especially X-ray diffraction methods
Offered	Yearly WS
Teaching Language	Teaching language: English
Learning Outcome	Organization of a self-designed research project
Content	The research project typically consists of the synthesis of inorganic materials or the preparation and modification of natural minerals and their characterization.
Exam	Module exam (combined marks): laboratory report 100 % seminar talk not graded
Literature	none

Research Module Chemistry I

Module title and code no	05M-MCM-2-W6C Research Module Chemistry I
Representative/s	Thorsten Gesing
Appendant courses	05M-MCM-3-W6C-1 Research Module Chemistry I Project 10 SWS Exercise
Workload / credit points	12 CP 360 h
Mandatory / compulsory / elective	Compulsory elective module
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Winter term / Second year of study

Requirements for participation	The students should have a fundamental knowledge in materials chemistry and they should be well trained in analytical methods (Different than Research Modul Chemisry II)
Offered	Yearly WS
Teaching Language	Teaching language: English
Learning Outcome	Organization of a self-designed research project
Content	The research project typically consists of the synthesis of inorganic materials in crystalline or nano-crystalline form and their characterization.
Exam	Module exam (combined marks): laboratory report 100 % seminar talk not graded
Literature	

Research Module Chemistry II

Module title and code no	05M-MCM-3-W7C Research Module Chemistry II
Representative/s	Marcus Bäumer
Appendant courses	05M-MCM-3-W7C-1 Research Module Chemistry II Project 10 SWS Exercise 10 SWS
Workload / credit points	12 CP 360 h
Mandatory / compulsory / elective	Compulsory elective module
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Winter term / Second year of study
Requirements for participation	The students should have a fundamental knowledge in materials chemistry and they should be well trained in analytical methods (Different than Research Modul Chemisry I)
Offered	Yearly WS
Teaching Language	Teaching language: English
Learning Outcome	Organization of a self-designed research project
Content	The research project typically consists of the synthesis of inorganic materials in crystalline or nano-crystalline form and their characterization.
Exam	Module exam (combined marks): laboratory report 100 % seminar talk not graded

Literature	

Master Thesis

Module title and code no	05M-MCM-4-M Master Thesis
Representative/s	Reinhard X. Fischer
Appendant courses	05M-MCM-4-M-1 Master Thesis Thesis 22 SWS weeks 22 we SWS
Workload / credit points	30 CP ca. 900 h / 30 CP equivalent to ca 22 weeks fulltime
Mandatory / compulsory / elective	Mandatory
Assignment	Master of Science Materials Chemistry and Mineralogy 2012 fulltime class
Duration	1 Semester Summer term / Second year of study
Requirements for participation	Application of knowledge and skills obtained in master program
Offered	Yearly SS
Teaching Language	Teaching language: English
Learning Outcome	Students will be able to prepare and realize an independent scientific project including literature research, sample preparation and characterization, data processing and interpretation, and finally the performance of the written essay. Students will have the ability to present and defend their results.
Content	After the second semester, students are encouraged to start developing ideas for their master thesis, usually in close cooperation with one of the research groups in mineralogy and chemistry department or cooperating groups in materials science. During the research projects in the third semester, the topic of the thesis work will be defined clearly. The forth semester is dedicated to thesis work. Supervised by a lecturer each student will perform an independent scientific study and prepare a written essay. Students will have a time period of 22 weeks for the realization of their thesis work. Such thesis work may be a laboratory experiment or a project outside the university, e.g. in collaboration with industry. Students will deliver a copy of their thesis to the main examiner (usually the supervisor) and one co-examiner; three copies have to be submitted to the examining office. Examiners have a period of four weeks for their evaluation and grading of the thesis. In a final colloquium, the student has to present and defend his or her thesis. The duration of the colloquium will be 45 to 60 minutes. For successful completion of the Master thesis and the colloquium students earn 30 CP. A failed Master thesis may be repeated once only.
Exam	Module exam (one mark): master thesis
Literature	