Amtliche Bekanntmachungen der TU Bergakademie Freiberg

Nr. 19, Heft 2 vom 22. September 2011

Modulhandbuch

für den

Internationalen

Masterstudiengang Geoscience

INHALTSVERZEICHNIS

Anpassung von Modulbeschreibungen

Zur Anpassung an geänderte Bedingungen können folgende Bestandteile der Modulbeschreibungen vom Modulverantwortlichen mit Zustimmung des Dekans geändert werden:

1. „Code/ Dates“
2. „Responsible“
3. „Lecturer(s)“
4. „Institute(s)“
5. „Competencies“
6. „Content“, sofern sie über die notwendige Beschreibung des Prüfungsgegenstandes hinausgehen
7. „Literature“
8. „Pre-requisites“, sofern hier nur Empfehlungen enthalten sind (also nicht zwingend erfüllt sein müssen)
9. „Applicability“
10. „Workload“

Die geänderten Modulbeschreibungen sind zu Semesterbeginn durch Aushang bekannt zu machen.

Code/ Dates	ANGEOPH.BA.Nr. 486	Version: 16.08.2010	Start: WT 2010/11
Name	Applied Geophysics		
Responsible	**Surname** Spitzer **First name** Klaus **AcademicTitle** Prof. Dr.		
Lecturer(s)	**Surname** Buske **First name** Stefan **AcademicTitle** Dr.		
Institute(s)	Institute for Geophysics		
Duration	1 Semester		
Competencies	The aim of this course is an introduction to the most commonly applied geophysical exploration methods (gravimetry, magnetics, geoelectrics, electromagnetics, georadar, refraction and reflection seismics, borehole geophysics, etc.).		
Content	Targets of geophysical exploration, theory/method/corrections/applications/case-studies/ of gravimetry/magnetics/geoelectrics/EM/georadar/ seismics/borehole-geophysics.		
Literature	Telford, et al, 1978, Applied Geophysics, University of Cambridge Press, Sheriff & Geldart, Exploration Seismology, U. of Cambridge Press.		
Types of Teaching	Lecture (2 SWS), Exercise (1 SWS)		
Pre-requisites	Physics for natural sciences I, Higher mathematics for engineers I		
Applicability	Bachelor Applied Informatics and Industrial Engineering, Master Geosciences, Applied Informatics and Network Computing, Diploma Geotechnics and mining, Mine-Surveying and Applied Geodesy.		
Frequency	Start at winter semester		
Requirements for Credit Points	Exams consist of a written examination (90 min) test and successfully completed course exercises.		
Credit Points	4		
Grade	Mark = arithmetic mean of written examination and summary mark for course exercises.		
Workload	120 h = 45 h attendance time and 75 h self study (self study comprises preparation time for lectures, exercises and exams)		

Code/ Dates	ATMOSGAS.MA.Nr.3032	Version: 11.02.2010	Start: ST 2010
Name	Atmospheric Chemistry – Gases and Aerosols (Atmosphärenchemie – Gase und Aerosole)		
Responsible	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr. **Surname** Zimmermann **First name** Frank **Academic title** Prof. Dr.		
Institute(s)	Institute of Mineralogy		
Duration	1 semester		
Competencies	Current knowledge and understanding on atmospheric chemistry and anthropogenic air pollution helps active participants to work in this field and to understand the interaction of atmospheric gases and aerosols with ecosystems and the global change issues. It qualifies for leading roles in science and practical applications.		
Contents	Extended knowledge on gas phase and aerosol chemistry in the planetary boundary layer and on ecosystem fluxes (matter and energy fluxes), encompassing their practical determination by eddy-correlation at the TUBAF research site Oberbärenburg (OBB, eastern Erzgebirge). Feedback mechanisms between atmospheric chemistry and the climate system. Special questions on anthropogenic air pollution. Next to physics and chemistry of air pollutants, measuring methods, dispersion models, pollution control and emission reduction measures are discussed with the respective risks of air pollutants. **Practical training**: A wide range of methods and applications is being experienced (training at partner locations). Air quality monitoring and meteorology (State Networks), global reference station and quality assurance (DWD), as well as complex research infrastructures (e.g., TUBAF-station OBB, IfT Leipzig) are part of the program.		
Literature	Recent publications from refereed journals; **Bouwman AF (ed; 1999)** Approaches to scaling of trace gas fluxes in ecosystems. Developments in atmospheric sciences 24: 362 p.; **Brasseur GP, Prinn RG, Pszenny AAP (eds; 2003)** Atmospheric chemistry in a changing world. Springer, 300 p.; **Seinfeld JH, Pandis SN (2005)** Atmospheric Chemistry and Physics (from air pollution to climate change), Wiley 1203 p.; **Finlayson Pitts BJ, Pitts JN Jr (1986)** Atmospheric Chemistry. Fundamentals and experimental techniques. Wiley Interscience, 1098 p.; **Slanina S (ed; 1997)** Biosphere-atmosphere exchange of pollutants and trace substances. Springer, 528 p.; **Vallero D (2007)** Fundamentals of air pollution. Elsevier 936 p.; **Complex practical training**: **Heard DE (ed, 2006)** Analytical techniques for Atmospheric Measurements. Blackwell; **Strangeways I (2000)** Measuring the natural environment. Cambridge Univ. Press, 365 p.; Recent publications from refereed journals		
Types of Teaching	seminaristic lectures and exercise (4 + 2 SWS); Complex practical training = exercise (5 days, 3 SWS respectively)		
Pre-requisites	B.Sc. in Geoecology or related. Sufficient knowledge of the English language.		
Applicability	Recommended for M.Sc. course in Geoecology (focal area Atmosphere and Climate) as well as seriously interested students form related areas		
Frequency	Every summer term		
Requirements for Credit Points	Successful participation is demonstrated by active seminar contributions and a meaningful professional report on the complex practical training.		
Credit Points	9		
Grade	The module grade is calculated from the seminar contributions (2/3) and		

	the final written report on the practical training course (1/3)
Workload	Total time expenditure (270 h): 135 h attendance and 135 h preparation and learning time (home studies) as well as writing the report. Time expenditure for the complex practical training (90 h): 45 h attendance and 50 h preparation and learning time, as well as writing the report.

Code/ Dates	ATMOS.BA:Nr.674	Status: 11.02.2010	Start: ST 2010
Name	Atmospheric Research (Atmosphärenforschung)		
Responsible	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr. **Surname** Zimmermann **First name** Frank **Academic title** Dr.		
Institute(s)	Institute of Mineralogy		
Duration	1 semester (summer).		
Competencies	Successful participants will master the basics of atmospheric chemistry and physics. These build up on the module METHYDR.bas Nr. 182 (physics), and introduces tropospheric chemistry (see content). This module lays the foundations for more demanding work in atmospheric sciences.		
Contents	Composition of the troposphere; Sources, transport and sinks of trace gases; Relevant tropospheric trace gases; Tropospheric aerosols; Air pollution; Tropospheric cycles; Chemistry of the stratosphere; Cloud and precipitation chemistry; Field and experimental methods in atmospheric chemistry		
Literature	**Brimblecombe P (1996)** Air composition and chemistry. 2nd ed. Cambridge; 253 p.; **Graedel TE, Crutzen PJ (1994)** Chemie der Atmosphäre. Spektrum; 511 S.; **Heard DE (ed, 2006)** Analytical techniques for Atmospheric measurements. Blackwell; **Hewitt CN, Jackson AV (eds, 2009)** Atmospheric science for environmental scientist. Wiley-Blackwell, 300 pp.; **Hobbs PV (2000)** Introduction to Atmospheric Chemistry, Cambridge		
Types of Teaching	2 SWS lecture, 2 SWS exercise, 1 SWS field training (5 days)		
Pre-requisites	Successful participation in the module METHYDR.bas Nr. 182 Meteorologie, Klimatologie, Hydrologie or similar (recommended).		
Applicability	Basis for ongoing and more sophisticated work in atmospheric and climate science, e.g., in Geoecology (Earth System Science)		
Frequency	Once a year, summer semester		
Requirements for Credit Points	The module exam consists of a written exam (KA) of 90 minutes, a written homework (AP 1) and a report on the field training (AP 2).		
Credit Points	6		
Grade	The module note is calculated as a weighted mean of the note fort he written exam (weight 2), plus the average of the notes for the homework and the field training report (weight 1 each)		
Workload	The work load is 180 h, consisting of 75 h presence time and 105 h autonomous studies. The latter comprises preparatory work and repetitions of lecture and exercise content, and exam preparations		

Code/ Dates	ATMOSCL.MA Nr.3031	Version: 11.02.2010	Start: WT 2010/11
Name	Atmospheric Research – Climate (Atmosphärenforschung – Klima)		
Responsible	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Hänsel **First name** Stephanie **Academic title** Dr. **Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr. **Surname** Zimmermann **First name** Frank **Academic title** Dr.		
Institute(s)	Institute of Mineralogy		
Duration	1 term (semester)		
Competencies	Participants receive up-to-date information on climate change issues (global and regional, mainly physical and chemical aspects), on mitigation and adaptation, and on data analysis (observed and modelled climate data, model and scenario comparison, handling of uncertainties. Statistical methods and their application in atmospheric research with standard and specialized statistics software are being introduced and exercised. Participants learn about a spectrum of statistical applications in atmospheric physics and chemistry (climate research). Successful participants will understand the ongoing discussion on global climate change-related issues and be able to classify and apply scientific arguments.		
Contents	Regression and correlation analysis, time series analysis, trend estimates, extreme value statistics and the visualisation of data. In the exercises, applications are shown and practised in MS Excel, SPSS, and StatGraphics.		
Literature	**Oliver JE (ed; 2005)** Encyclopaedia of World Climatology. Springer; 854 p.; **Storch H von, Zwiers FW (2002)** Statistical Analysis in Climate Research. Cambridge Univ Press, 484 p.; **IPCC reports**; **Bonan G (2002)** Ecological climatology. Concept and applications. Cambridge Univ Press, 678 p.; **Wilks DS (2006)** Statistical methods in atmospheric science. Elsevier, 627 p.; **Thiebaux H (1994)** Statistical Data Analysis for Ocean and Atmospheric Sciences. Elsevier, 247 p.; **Schönwiese CD (2000)** Praktische Statistik. 4. Aufl. Bornträger, 302 S.; **Stoyan D et al. (1997)** Umweltstatistik. Teubner; 348 S.		
Types of Teaching	Seminaristic lecture (2 SWS) and exercise (1 SWS) on climatology; Lecture (1 SWS) and exercise (2 SWS) on statistics		
Pre-requisites	B.Sc. in Geoecology (or related successful B.Sc. degree). Sufficient experience with English.		
Applicability	For M.Sc. studies' focusing in Geoecology (Atmosphere and Climate) and students focusing on related areas		
Frequency	Every winter term		
Requirements for Credit Points	Successful participation is demonstrated by individual contributions (student papers) and a written exam. In the statistics section, successful participation is demonstrated by active participation in the exercises (e.g., homework)		
Credit Points	7		
Grade	The final grade for the module is being calculated in equal proportions from the participant's performance in the exercises, the student paper, and the written final exam of 90 minutes.		
Workload	Total time expenditure 210 h. Expenditure in climatology is 120 h, consisting of 45 h attendance time and 75 h individual (home) studies. The latter involves learning of lecture material and the exercises, as well		

	as working on the student paper. Time expenditure in statistics (90 h) consists of 45 h attendance time and 45 h of preparation and learning time, as well as writing a student paper.

Code/ Dates	ATMOSBIO.MA.Nr.3205	Version: 08.07.2010	Start: ST 2011
Name	Biosphere Atmosphere Interaction		
Responsible	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr. **Surname** Zimmermann **First name** Frank **Academic title** Dr.		
Institute(s)	Institute for Mineralogy (IÖZ)		
Duration	1 semester		
Competencies	Current knowledge and understanding on atmospheric chemistry and anthropogenic air pollution helps active participants to work in this field and to understand the interaction of atmospheric gases and aerosols with ecosystems and the global change issues. It qualifies for leading roles in science and practical applications.		
Contents	Extended knowledge on gas phase and aerosol chemistry in the planetary boundary layer and on ecosystem fluxes (matter and energy fluxes). Feedback mechanisms between atmospheric chemistry and the climate system. Special questions on anthropogenic air pollution. Next to physics and chemistry of air pollutants, measuring methods, dispersion models, pollution control and emission reduction measures are discussed with the respective risks of air pollutants.		
Literature	Recent publications from refereed journals; **Bouwman AF (ed; 1999)** Approaches to scaling of trace gas fluxes in ecosystems. Developments in atmospheric sciences 24: 362 p.; **Brasseur GP, Prinn RG, Pszenny AAP (eds; 2003)** Atmospheric chemistry in a changing world. Springer, 300 p.; **Seinfeld JH Pandis SN (2005)** Atmospheric Chemistry and Physics (from air pollution to climate change), Wiley 1203 p.; **Finlayson Pitts BJ, Pitts JN Jr (1986)** Atmospheric Chemistry. Fundamentals and experimental techniques. Wiley Interscience, 1098 p.; **Slanina S (ed; 1997)** Biosphere-atmosphere exchange of pollutants and trace substances. Springer, 528 p.; **Vallero D (2007)** Fundamentals of air pollution. Elsevier 936 p.; **Complex practical training**: **Heard DE (ed, 2006)** Analytical techniques for Atmospheric Measurements. Blackwell; **Strangeways I (2000)** Measuring the natural environment. Cambridge Univ. Press, 365 p.; Recent publications from refereed journals		
Types of Teaching	seminaristic lectures and exercise (4 + 2 SWS); Complex practical training = exercise (5 days, 3 SWS respectively)		
Pre-requisites	B.Sc. in Geoecology or related. Sufficient knowledge of the English language.		
Applicability	Recommended for the International M.Sc. course in Geoscience (focal area Atmosphere and Climate) and interested students form related areas		
Frequency	Every summer term		
Requirements for Credit Points	Successful participation is demonstrated by active seminar contributions		
Credit Points	6		
Grade	The module grade is calculated from the seminar contributions		
Workload	Total time expenditure (180 h): 90 h attendance and 90 h preparation and learning time (home studies) as well as writing the student papers.		

Code/ Dates	UWGEOCH .MA.Nr. 2065	Version: 18.05.2011	Start: ST 2011
Name	Environmental Geochemistry – Elements (Umweltgeochemie)		
Responsible	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr.		
Institute(s)	Institute for Mineralogy		
Module duration	1 term (semester)		
Competencies	Students learn to access, discern and judge natural and anthropogenic processes in most environmental compartments, related sources, sinks, retention processes and cycles.		
Content	Natural and anthropogenic components and processes in all parts of the geosphere and their interaction with the ecosphere are in focus. The presentation of element sources and sinks delivers an understanding for Environmental Geochemistry, and thus, the basis for the evaluation of related processes and measures. A 2-day excursion demonstrates some of the lecture content.		
Literature	Eby GN (2004) Principles of environmental geochemistry, Thomson-Brooks/Cole; Matschullat, Tobschall, Voigt (Hrsg, 1997) Geochemie und Umwelt, Springer; Sherwood Lollar B (ed; 2004) Environmental geochemistry. In Holland HD, Turekian KK (ser eds) Treatise on geochemistry 9, Pergamon Press		
Types of Teaching	Lecture Environmental Geochemistry 2 SWS, seminar Environmental Geochemistry 2 SWS, excursion 1 SWS (2 days)		
Prerequisites	Basic (geo)chemical knowledge (from B.Sc.) is needed. Successful participation in Geochemistry modules on the B.Sc. level.		
Applicability	Master courses: Geoecology, Geosciences or related		
Frequency	Every summer term (recommended for first term in Geoecology)		
Requirements for Credit Points	Module exam consists of a written exam of 90 minutes and an alternative performance (student paper).		
Credit Points	5 credit points (CP)		
Grade	The module grade is being calculated from the weighted average of the written exam grade(s) (weight 2) and the rating of the seminar performance (student paper, weight 1).		
Workload	Total time expenditure (150 h): composed of 75 h attendance plus 75 h independent studies. The latter comprises literature evaluation, home study, and preparation for the exam(s).		

Code/ Dates	ENVGEOL.MA.Nr.3207	Version: 16.8.2010	Start: WT 2010/11
Name	Environmental Geology		
Responsible	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Institute(s)	Institut for Geology		
Duration	1 semester		
Competencies	Students will pick up basic information about environmental problems on earth and learn to discuss and evaluate aspects and arguments with respect to environmental problems.		
Contents	Geohazards including earthquakes, volcanoes, floods, extraterrestrial impacts, etc.), impact of chlorinated hydrocarbons on soil, water and air, air pollution and consequences, natural radioactivity, mining and mining rehabilitation, landfills and waste deposits, nuclear waste deposits, artificial irrigation, climate change and geological archives for past climate fluctuations, alternative energy resources		
Literature	Montgomery (2003): Environmental Geology		
Types of Teaching	Lecture and seminar (2/2/0)		
Pre-requisites	Basic knowledge in science including geosciences		
Applicability	Master Geosciences		
Frequency	Once within an academic year in the winter term		
Requirements for Credit Points	Written examination (90 minutes), Active participating in seminar (PVL) and oral talk of 15 minutes (AP1)		
Credit Points	4		
Grade	The overall grade is calculated as the arithmetic average of the grades of the written exams and the oral talk		
Workload	The total time is 120 h (60 h are spent in class, remaining 60 h are spent on preparation and self study)		

Code/ Dates	GEOGEL.MA.Nr.2021	Version: 12.07.2010	Start: WT 2010/11
Name	Field Exercise		
Responsible	**Surname** Stanek **First name Klaus Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Stanek **First name** Klaus **Academic title** Prof. Dr. **Surname** Ratschbacher **First name** Lothar **Academic title** Prof. Dr. **Surname** Kroner **First name** Uwe **Academic title** Dr. **Surname** Gloaguen **First name** Richard **Academic title** Dr. **Surname** Schulz **First name** Bernhard **Academic title** Prof. Dr. **Surname** Tichomirowa **First name** Marion **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Duration	1 Semester		
Competencies	Analyzing orogenic deformation in the field.		
Contents	Interdisciplinary data acquisition (e.g. in the fields of structural geology, sedimentology, petrology, remote sensing, paleontology, geomorphology) in the field in the framework of ongoing projects in orogenic belts.		
Literature	Publications in international journals Depending on the orogenic belt and work focus		
Types of Teaching	Fieldwork (8 SWS) with applications of various methods in tectonics, literature and remote sensing preparation, sampling, field report preparation.		
Pre-requisites	Bachelor-level field exercises		
Applicability	Master Geosciences		
Frequency	Yearly, depending on the field projects of the lecturers.		
Requirements for Credit Points	Meaningful professional written report on the complex practical training (AP)		
Credit Points	5		
Grade	The grade results from the written report.		
Workload	The total time is 150 h (120 h are spent in class, remaining 30 h are spent on preparation and self study).		

Code/ Dates	MISOCHR.MA.Nr.2037	Verion: 12.07.2010	Start: WT 2010/11
Name	Geochronology and Isotope Geochemistry		
Responsible	**Surname** Tichomirowa **First name** Marion **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Tichomirowa **First name** Marion **Academic title** Prof. Dr. **Surname** Jonckheere **First name** Raymond **Academic title** Dr. **Surname** Pfänder **First name** Jörg **Academic title** Dr. **Surname** Ratschbacher **First name** Lothar **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Duration	2 Semester		
Competencies	Acquisation of theoretical and practical skills in geo-thermochronology and isotope geochemical analysis		
Contents	Variable, for example: geo-themochronological techniques (in particular: U-Pb, Ar-Ar, Rb-Sr, particle track), application of geo-thermochronology and isotopic geochemical analysis for the understanding of the evolution of young orogenic belts.		
Literature	Publications in international journals; Faure (1986): Principles of Isotope Geology; Stosch (1999): Einführung in die Isotopengeochemie; Dickin (2005): Radiogenic Isotope Geology.		
Types of Teaching	Variable proportions of lectures, exercises and seminars		
Pre-requisites	Bachelor course in structural geology		
Applicability	Master programs in Geoscience		
Frequency	Yearly		
Requirements for Credit Points	Prerequisites: participation in exercises and seminars. written exam (KA) of 90 minutes		
Credit Points	9		
Grade	The grade results from the written exam		
Workload	The total time is 270 h (60h are spent in class, remaining 210 h are spent on exercises, seminars, preparation and self study).		

Code/ Dates	MKOMMU2.MA.Nr.2018	Version: 17.08.2009	Start: ST 2010
Name	Geo-scientific communication II		
Responsible	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr. **Surname** Ratschbacher **First name** Lothar **Academic title** Prof. Dr. **Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr. **Surname** Stumm **First name** Andreas **Academic title** Dr.		
Institute(s)	Institute for Geology, University Library		
Duration	1 Semester		
Competencies	The course intends to give students the knowledge and the ability to perform scientific database research and documentation as well as scientific writing, designing a scientific poster and presenting results in an oral talk.		
Content	Detailed database research, data mining, data management including raw data, scientific writing, rhetoric, and poster compilation. Major goals are learning and applying strategies of scientific enquiries using different techniques and digital sources, navigating reference management systems and compilation of bibliographies. Database concepts, publication strategies, citation of publications, Digital Object Identifier (DOI®) System, techniques for primary data publication incl. Meta data concepts are contents as well. Finally rhetoric and promoting results by means of scientific posters are content of the class. Seminar: working on a scientific topic for a defined time, writing a 10 pages paper and presenting the results in an oral presentation.		
Literature	Poetzsch, E. (2002). Information Retrieval: Einführung - Potsdam, Verl. für Berlin-Brandenburg. ; Horatschek & Schubert (1998). Richtlinie für die Verfasser geowissenschaftlicher Veröffentlichungen.		
Types of Teaching	Lectures and tutorials, seminar (2 SWS)		
Pre-requisites	Geo-scientific knowledge		
Applicability	Master course: Geowissenschaft, Geoökologie, Groundwater Management, Geosciences		
Frequency	Once within an academic year in the summer term.		
Requirements for Credit Points	Active participating in the lectures and seminar (PVL), oral talk of 15 minutes (AP1), scientific manuscript (10 pages) according to the guidline o the course (AP2).		
Credit Points	5		
Grades	The overall grade is calculated as the arithmetic average of the grades of the talk (weight 1) and the paper (weight 2).		
Workload	The total time is 150 h (30 h are spent in class, remaining 120 h are spent on preparation and self study).		

Code/ Dates	MGWCHE1.MA.Nr.2025	Version: 28.09.2009	Start: WT 2009/10
Name	Groundwater Chemistry I		
Responsible	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Duration	1 Semester		
Competencies	The student is widening his chemical know how in the field of hydrochemical aspects in particular with respect to groundwater. He will be able to solve basic but as well complex water quality problems by means of geochemical modeling on his own.		
Content	**Lecture groundwater chemistry:** basis of thermodynamics (ionic strength, calculating activity, saturation index), water as universal solvent, solution and precipitation of minerals, redox reactions, ion exchange, sorption, solubility of gases in water, balance between lime and carbonic acid. Basis of the chemistry of the elements Silicium, Aluminum, Sodium, Potassium, Carbon, Calcium, Magnesium, Halogens, Sulfur, Iron, Manganese, Nitrogen, Phosphorus, and the following trace elements: Pb, Cd, As, Hg, Zn, Cu, Ni, Cr, Mo, Co, Se in groundwater. Radioactivity, Uranium and gases in groundwater, microbiology and organic constituents in water. Practical training: chemical thermodynamics by means of PHREEQC, complex formation, species distribution, saturation index, mixing of waters, balance between lime and carbonic acid, gases in water, weathering of rocks, evaporation, reaction pass modeling.		
Literature	MERKEL & PLANER-FRIEDRICH (2002): Groundwater Geochemistry – A Practical Guide to Modeling of Natural and Contaminated Aquatic Systems, Springer. LANGMUIR (1997): Aqueous environmental geochemistry, Prentice Hall. APPELO & POSTMA (1993): Geochemistry, groundwater and pollution, Balkema. MERKEL & SPERLING (1996 & 1998): DVWK-Schriften 111 & 117, Hydrogeochemische Stoffsysteme I & II, Wirtschaft, Verlagsges. Gas und Wasser GmbH		
Types of Teaching	Lectures (2 SWS) and tutorials (2 SWS)		
Pre-requisites	Basic knowledge of chemistry and hydrogeology		
Applicability	Master Geowissenschaften, Geoökologie, Angewandte Naturwissenschaft, Groundwater Management, Geoscience		
Frequency	Once within an academic year in the winter term .		
Requirements for Credit Points	Written exam (duration 90 minutes). Report for 7 exercises with PHREEQC (AP1). web-based quiz along the lecture (AP2).		
Credit points	4		
Grades	The overall grade is calculated as the arithmetic average of the grades of the written exam (weight 2), grades for the 7 reports (weight 1) and grades for the web-based quiz (weight 1)		
Workload	The total time is 120 h (60 h are spent in class, remaining 60 h are spent on preparation and self study)		

Code/ Dates	MGWCHE2.MA.Nr.2026	Version: 28.09.09	Start: ST 2010
Name	Groundwater Chemistry II		
Responsible	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr. **Surname** Kummer **First name** Nicolai - Alexeji **Academic title** Dr. **Surname** Weise **First name** S. **Academic title** Dr.		
Institute(s)	Institute for Geology, Zentrum für Umweltforschung, Halle-Leipzig		
Duration	1 Semester		
Competencies	Student will gain confidence and experience in sampling, sample treatment, sample storage as well as measuring field parameters and basic and advanced analytical techniques for ground water investigations and with respect to environmental isotopes in water.		
Content	Lecture groundwater chemistry (sampling and analytical techniques) combined with laboratory exercises: sampling (DIN/ISO and low flow sampling), impact of construction material of monitoring well, filtration and stabilization in the field, reading field parameters (pH, eH, temperature, EC, O_2). Determination of limit of detection and limit of quantification. Using photometry for different species (e.g. Fe(II), Fe(III), NO_2, NO_3, NH_4), titration to determine balance between lime and carbonic acid and Ks and Kb in comparison to the determination of TIC. Ion selective electrodes (activity versus concentration), Ion chromatography for anions and cations, HPLC for inorganic and organic compounds (evaluation of chromatograms), ICP-MS and coupling IC with ICP-MS, GC with FID, ECD, NPD, PID, MS. Elisa and toxicity tests. Lecture isotope hydrology: stable (H, O, C, N, S, and Sr) and radioactive isotopes (H, C, Sr, Cs, Ra, U, J, Rn, Ar, Kr, Cl) in aquatic systems.		
Literature	http://www.ile.tu-freiberg.de/ile2: ebook Grundwassermanagement, Kap. Monitoring. Schwedt (1996): Taschenatlas der Analytik, WILEY-VCH; Sigg & Stumm (1994): Aquatische Chemie, Teubner Verlag; Stumm & Morgan (1996): Aquatic Chemistry. John, Wiley & Sons; Otto (2000): Analytische Chemie, VCH, CLARK & FRITZ (1997): Environmental Isotopes in Hydrogeology, Lewis Publishers.		
Types of Teaching	Lecture (1 SWS) and exercise (3 SWS) and lecture (2 SWS)		
Pre-requisites	Basic knowledge in chemistry, water chemistry, and physics		
Applicability	Master Geowissenschaften, Geoökologie, Angewandte Naturwissenschaft, Groundwater Management, Geoscience		
Frequency	Once within an academic year in the summer term		
Requirements for Credit Points	Written exams (duration each 90 minutes) for both lectures and reports on lab exercises.		
Credit Points	6		
Grades	The overall grade is calculated as the arithmetic average of the grades of the two written exams (each weight 1) and the lab reports (AP, weight 2)		
Workload	The total time is 180 h (90 h are spent in class, remaining 90 h are spent on preparation and self study)		

Code/ Dates	MGWMAN.MA.Nr.2027	Version: 17.08.2009	Start: WT 2009/10
Name	Groundwater-Management		
Responsible	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Duration	1 Semester		
Competencies	Student will gain confidence and experience in navigation GIS software and applying his geo-scientific knowledge by means of GIS. Furthermore he will learn how to develop a project, calculate costs, writing tenders and quotes, and manage a project with respect to costs, time, and project goals.		
Content	Practical project management is a lecture with home works addressing aspects like designing contracts, billing and accounting, HOAI (Scale of Fees for Services by Architects and Engineers), tender, VOL, VOB, engineering contracts, project- management, development and controlling. Short course GIS Applications in Hydrogeology: Display and edit of raster, vector and CAD objects as well as handling of databases. Determination of subsurface and groundwater catchments based on a DTM. Utilization of slope, aspect, and shading. Groundwater exploration by means of remote sensing, compilation of land use maps. Raster-based calculation of evapotranspiration and groundwater recharge. Creating and managing well head protection zones for potable water withdrawal.		
Literature	HOAI 2009-Text Edition, Honorarordnung für Architekten und Ingenieure vom 18. August 2009/ Official Scale of Fees for Services by Architects and Engineers, Vieweg, ISBN: 978-3-8348-0984-1 Standardleistungsbuch für das Bauwesen (1985): Anwenderhandbuch. Beuth Verlag GmbH. Martin Brook (2004): Estimating and Tendering for Construction Work. 3rd edition, Elsevier Drury (1993): Image interpretation in geology		
Types of Teaching	Lecture (1 SWS) with home works, short course (4 days)		
Pre-requisites	Basic knowledge Hydrogeology and GIS		
Applicability	Master Geowissenschaften, Geoscience, Groundwater Management		
Frequency	Once within an academic year in the winter term		
Requirements for Credit Points	AP1: 7 reports AP2: compiling an digital atlas with concent form the GIS class		
Credit Points	3		
Grades	The overall grade is calculated as the arithmetic average of the grades of AP1 and AP2.		
Workload	The total time is 90 h (40 h are spent in class, remaining 50 h are spent on preparation and self study)		

Code/ Dates	MHYGEO2 .MA.Nr. 2029	Version: 17.08.2009	Start: WT 2009/10
Name	Hydrogeology II		
Responsible	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Duration	1 Semester		
Competencies	The student will be able to solve practically relevant hydrogeological problems. He will be able to select appropriate techniques for both investigation and data evaluation. In particular he will gain knowledge with respect to all issues concerning groundwater protection.		
Content	1. Lecture Hydrogeology II: practically relevant hydrogeological tasks and techniques such as hydrogeological mapping, prognosis of water demand, geophysical exploration and measuring techniques, drilling of wells, well development and well rehabilitation, hydrogeological field measurements, pumping-test (design, performance, evaluation), parameter determination in the lab, natural/artificial tracers, groundwater chemistry (sensors, sampling, conservation, analytical techniques) . Paleohydrogeology, perma-frost, fresh-saltwater interface at coastal sites, geothermal systems and geothermal energy, engineering and mining hydrogeology, examples from regional hydrogeology 2. Practical exercises II: working with hydrogeological maps, groundwater recharge, saltwater intrusion, geodetic leveling, GPS, DGPS, water sampling, well design, well construction, and well rehabilitation, pumping test performance and evaluation (steady state and transient), diffusion and dispersion. 3. Lecture groundwater protection: Legal regulations, designing and controlling well head protection zones according to W 101, restrictions in protection zones. General groundwater protection, soil protection law, UVP-law (environmental assessment studies), European water frame work, calculating ground water vulnerability, groundwater information systems 4. Groundwater protection seminar and practical training: designing a well head protection zone, presenting a talk and a paper		
Literature	Fetter (1993): Applied Hydrogeology. Domenico & Schwartz (1996): Physical and Chemical Hydrogeology. Driscoll (1997): Groundwater and Wells. DWGW-Richtlinie W101		
Types of Teaching	Lecture (3 SWS) with practical training and seminar (2 SWS)		
Pre-requisites	Basic knowledge in Applied Geosciences		
Applicability	Bachelor Geoecology, Master Geowissenschaften, Master Geoscience, Master Groundwater Management		
Frequency	Once within an academic year in the winter term		
Requirements for Credit Points	Written exam (duration 90 minutes). AP 1: Report from practical training AP 2: Report of well head protection zone, Talk (10 min) and paper (6 pages)		
Credit Points	7		
Grades	The overall grade is calculated as the arithmetic average of the grades of the written exam (weigh 2), AP1 (weigh 1) and AP2 (weigh 2).		
Workload	The total time is 210 h (75 h are spent in class, remaining 135 h are spent on preparation and self study)		

Code/ Dates	MHYGEO3.MA.Nr.2030	Version: 17.08.2009	Start: ST 2009
Name	Hydrogeology III		
Responsible	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Duration	1 Semester		
Competencies	Student gains profound knowledge in karsthydrogeology and karst research. Furthermore his skills with respect to handling of data, multiple statistical evaluation will be enhanced to enable him solving hydrogeological problems on his own. Additional his team competencies and time management skills will be enforced.		
Content	Lecture karst hydrogeology: hydrogeological relevant karts features, rocks prone to karstification, karst indicators, karst processes (mixing corrosion, kinetics), modeling karstification, flow and transport in karst systems, storage, tracer, contaminations, protection, karst water exploration and exploitation, regional examples of different karst systems. Short course integrated data evaluation: data mining, handling and evaluation (database principles, t-test, anova, parameter free tests, correlation- and regression analysis, Factor and cluster-analysis, time series analysis, geo-statistics. Hydrogeological field exercises: working on a defined task with different techniques (sampling, measurements, data evaluation by means of statistics, GIS, models). Writing a report and presenting the results.		
Literature	Zötl (1974) Karsthydrogeologie, Springer. Dreybrodt (1988) Processes in Karst Systems Physics, Chemistry and Geology, Springer; Allg. Lehrbücher zur Statistik, Datenbankmanagement.		
Types of Teaching	Lecture (1 SWS), short course (4 days), field work (8 days)		
Pre-requisites	Basic skill in Hydrogeology, statistics, and data management.		
Applicability	Master Geowissenschaften, Groundwater Management, Geoscience		
Frequency	Once within an academic year in the summer term		
Requirements for Credit Points	Written examination (90 min) AP1: ca. 6 reports from short course AP2: ca. 20 pages report from field work		
Credit points	4		
Grades	The overall grade is calculated as the arithmetic average of the grades of the cluster: written exam (weight 1), AP1 (weight 1) and AP2 (weight 2)		
Workload	The total time is 120 h (45 h are spent in class, remaining 55 h are spent on field work, preparation and self study)		

Code/ Dates	MHYGEO4.MA.Nr.2031	Version: 11.08.2009	Start: WT 2009/10
Name	Hydrogeology IV		
Responsible	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Duration	1 Semester		
Competencies	Modeling of aquatic systems including flow, transport and chemical reactions. The student will be able to analyze a given situation, to choose an appropriate algorithm and software package to solve the given problem. Additional he will gain skill concerning geophysical methods that are important for groundwater issues.		
Content	Lecture Hydrogeological modeling : Basics of flow and transport modeling (analytical and numerical solutions, FDM, FEM, AEM), boundary conditions, numerical stability criteria, density driven flow, fracture flow, multi-phase flow, reactive transport modeling, impact of stress on pore volume, balancing and plausibility test, sensitivity analysis. Hydrogeological seminar: actually relevant research projects, literature research and presenting a talk. Practical exercise groundwater modeling: conceptual model, importing a map, discretization, defining boundary conditions and properties, calibration, wells and monitoring wells, particle tracking, modeling a contamination. 2d and 3d Model, simple transport modeling example Practical exercise reactive transport modeling: kinetically modeling within PHREEQC, 1d reactive transport for the unsaturated and saturated zone taking into account dilution and dual porosity.		
Literature	Kinzelbach & Rausch (1995): Grundwassermodellierung - eine Einführung m. Übungen. Bornträger Verlag. Anderson & Woessner (1992): Applied Groundwater modeling - Simulation of flow and advective transport, Acad. Press. Merkel, B & Planer-Friedrich B. (2005): Groundwater Geochemistry - A Practical Guide to Modeling of Natural and Contaminated Aquatic Systems. Edited by Nordstrom, Springer		
Types of Teaching	Lecture (2 SWS), 2 practical computer training courses (2x2 SWS), seminar (2 SWS)		
Pre-requisites	Basic knowledge hydrogeology, water chemistry and geophysics		
Applicability	Master Geowissenschaften, Geoinformatik und Geophysik, Geoökologie, Groundwater Management, Geoscience		
Frequency	Once within an academic year in the winter term .		
Requirements for Credit Points	Written examination (90 min) AP1: oral talk (10) minutes in the seminar AP2: reports from gw-flow course AP3. reports form reactive transport course		
Credit points	9		
Grades	The overall grade is calculated as the arithmetic average of the grades of the written exam, AP1, AP2, and AP3		
Workload	The total time is 270 h (120 h are spent in class, remaining 150 h are spent on field work, preparation and self study)		

Code/ Dates	HYPED .MA.Nr. 3051	Version: 08.07.2010	Start: ST 2011
Name	Hydropedology		
Responsible	**Surname** Schmidt **First name** Jürgen **Academic title** Prof. Dr. **Surname** Dunger **First name** Volkmar **Academic title** PD Dr.		
Lecturer(s)	**Surname** Schmidt **First name** Jürgen **Academic title** Prof. Dr. **Surname** Dunger **First name** Volkmar **Academic title** PD Dr. **Surname** Michael **First name** Anne **Academic title** Dr.		
Institute(s)	Institute of Geology		
Duration	1 term (semester)		
Competencies	Participants will learn to understand the substantial processes of soil water and channel hydraulics and to apply this knowledge to practical problems of the soil and water conservation. Participants will gain practical experiences in pedological and hydraulic methods in order to parameterize and apply hydrological and soil erosion models. Finally the students should be able to tquantify erosion processes and flood formation in small catchments.		
Contents	Hydraulic and sediment transport processes in streams, ice formation in rivers, flood formation and flood protection, usage of statistical and deterministic methods for flood estimation, hydrologic flood design, low water flow, hydrological aspects in dam reservoir management, physics of infiltration and surface runoff, fundamentals of soil erosion (detachment) and particle transport modelling, methods of soil and water conservation.		
Literature	ABRAHAMS, A. J. & PARSONS, A. D.: Overland Flow - Hydraulics and Erosion Mechanics, London; Schmidt, J. 2000: Soil Erosion. Application of Physically Based Models, Berlin; Richter, G. 2001: Bodenerosion. Analyse und Bilanzeines Umweltproblems. Darmstadt; Dyck, S. u.a. (1980): Angewandte Hydrologie, Teil 2., Berlin; Maidment, D. R. (1992): Handbook of Hydrology, New York; Maniak, U. (2005): Hydrologie und Wasserwirtschaft, 5. Auflage, Berlin, Heidelberg		
Types of Teaching	Lectures (3 SWS) with exercises (5 SWS), complex practical training in hydraulic and discharge modelling (3 SWS)		
Pre-requisites	Basic knowledge in pedology, meteorology and hydrology		
Applicability	Master programmes Geosciences, Geoecology		
Frequency	Every summer term		
Requirements for Credit Points	Written exam (duration: 90 minutes), reports for experimental (AP 1) and computer based practical work in hydraulic and discharge modelling (AP 2)		
Credit Points	12		
Grade	The module mark is calculated as arithmetic mean of the marks for the written exam, and 2 reports (for experimental work and for computer work) (AP)		
Workload	The work load is 360 h, consisting of 165 h presence time, 195 h autonomous studies. The autonomous studies involve learning of lecture material and the exercises, as well as preparing the reports.		

Code/ Dates	QUAGEO.MA.Nr. 3223	Version: 04.05.2011	Start: ST 2012
Name	Introduction to Quaternary geology		
Responsible	**Surname** Breitkreuz **First name** Christoph **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Breitkreuz **First name** Christoph **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Duration	1 Semester		
Competencies	Students will gain knowledge and the ability to understand the basic processes and techniques in the field of Quaternary Geology, and in particular in the field of paleoclimatic variation.		
Contents	Proxies for paleoclimatic variation in the last 2.5 Million years; chronostratigraphic and other tools for stratigraphic correlation of the Quaternary; important archives: lake- and marine sediments, ice cores; glacial and periglacial processes and glacial sedimentology		
Literature	Ehlers, J. (1995): Quaternary and glacial geology.- Wiley & Son, New York, 578S. Elias, S.A. (Ed.)(2007): Encyclopedia of Quaternary science.- Elsevier, 4 volumes, 3365 pp.		
Types of Teaching	Lectures (2 SWS), one day field trip		
Pre-requisites	GRUNGEO.BA.Nr. 031, GGEONEB.BA.Nr. 124 or equivalent moduls		
Applicability	BA, MA, PhD project		
Frequency	Once a year in summer term		
Requirements for Credit Points	A written test of 90 minutes The successful participation in the field trip is a prerequisite (PVL)		
Credit Points	3 credit points.		
Grade	The grade results from the grade for the written test.		
Workload	The total time budgeted for the cluster is set at 90 hours, of which 40 hours are spent in class and during the field trip. The remaining 50 hours are spent on selfstudy. Self-studies include assignments, preparation and wrapping up of lectures as well as preparation of examinations.		

Code/ Dates	MTGMAN .Ma.Nr. 3204	Version: 17.7.2010	Start: WT 2010/11
Name	Master´s Thesis Geoscience		
Responsible	**Surname** Merkel **First name** Broder **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr. **Surname** Merkel **First name** Broder **Academic title** Prof. Dr. **Surname** Ratschbacher **First name** Lothar **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Duration	1 Semester		
Competencies	Student gains profound knowledge about writing a scientific report respectively a scientific paper Furthermore he will enforce his skills with respect to creating and handling of scientific data, statistical evaluation including geo-statistics and multiple statistics, and application of analytical and /or numerical models. He will gain competence in solving geoscientific problems on his own. Additional his team competencies and time management skills will be improved. In general he will be able to use geological prior information and utilize it to geoscientific problems		
Contents	Depending on the specialization chosen and the topic of the research the master thesis will address a certain problem. The scientific investigation might be focused on field and/or lab work.		
Literature	Yvonne N. Bui (2009) How to write a masters´s thesis, SAGE		
Types of Teaching	Advice according to request		
Pre-requisites	According to regulations in the examination regulations		
Applicability	Master Geoscience		
Frequency	Arbitrary		
Requirements for Credit Points	Written thesis (monography or draft for a scientific paper) Public defence with discussion		
Credit Points	30		
Grade	The overall grade is calculated as the arithmetic average of the grades of the thesis (weight 2) and the oral defense (weight 1)		
Workload	6 months		

Code/ Dates	METHYDR.BA.Nr.182	Version: 11.02.2010	Start: WT 2008/09
Name	Meteorology, Climatology, Hydrology		
Responsible	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Matschullat **First name** Jörg **Academic title** Prof. Dr. **Surname** Dunger **First name** Volkmar **Academic title** PD Dr. **Surname** Zimmermann **First name** Frank **Academic title** Dr.		
Institute(s)	Institute fot Geology and Institute for Mineralogy		
Duration	1 semester (summer)		
Competencies	Successful participants know the basics of Meteorology and Climatology as well as Hydrology. They learnt to understand the most important parameters and processes and to interpret related results. The links between the partial modules is a prerequisite for any application of models and the understanding of more complex and advanced tasks in Atmospheric and Climate Science and in Hydrology.		
Contents	Atmospheric dynamics, radiation budget, global energy balance, meteorological parameters, global, regional, local climates and their dynamics, paleoclimatology, climate change. Hydrological cycle and water budgets, precipitation formation, heavy rain and design depth of precipitation, snow accumulation and ablation, evapotranspiration determination and calculation, discharge formation, concentration and dynamics.		
Literature	**Barry RG, Chorley RJ (2003)** Atmosphere, weather and climate. 8th ed. Routledge; **Dyck S, Peschke G (1995)** Grundlagen der Hydrologie. 3. Aufl. Verlag für Bauwesen, Berlin; **Emeis S (2000)** Meteorologie in Stichworten. Hirt Verlag; **Hupfer P, Kuttler W (2005)** Witterung und Klima. 11. Aufl. Teubner Verlag; **Kraus H (2004)** Die Atmosphäre der Erde. 3. Aufl. Springer Verlag; **Maidment, DR (1992)** Handbook of Hydrology. McGraw-Hill; **Maniak U (2005)** Hydrologie und Wasserwirtschaft. Eine Einführung für Ingenieure. 5. Aufl. Springer-Verlag; **Schönwiese CD (2008)** Klimatologie. 3. Aufl. Ulmer Verlag; **Zmarsly E, Kuttler W, Pethe H (2007)** Meteorologisch-klimatologisches Grundwissen. Eine Einführung mit Übungen, Aufgaben und Lösungen. 3. Aufl. Ulmer Verlag		
Types of Teaching	4 SWS lectures, 2 SWS exercise, alternating Met-Hydr		
Pre-requisites	Basic knowledge in Mathematics and Physics		
Applicability	Precondition for further in-depth studies in these fields and any specialization in Atmospheric and Climate Research as well as Hydrology, e.g., in M.Sc. Geoecology		
Frequency	Once a year, summer semester		
Requirements for Credit Points	The module examination consists of a written test (KA) of 90 minutes		
Credit Points	6		
Grade	The module note derives from the weighted average of the written exam note		
Workload	Work load is 180 h, consisting of 90 h presence time and 90 h autonomous studies. The latter comprises preparatory work and repetitions of the lectures and exercises and exam preparations		

Code/ Dates	MOLECOL .MA.Nr. 3042	Version: 25.09.2009	Start: WT 2009/10
Name	Molecular Ecology of Microorganisms		
Responsible	**Surname** Schlömann **First Name** Michael **Academic Title** Prof. Dr.		
Lecturer(s)	**Surname** Schlömann **First Name** Michael **Academic Title** Prof. Dr. **Surname** Mühling **First Name** Martin **Academic Title** Dr.		
Institute(s)	Institute for Biological Sciences		
Duration	1 Semester		
Competencies	The students will obtain insight into various molecular techniques to analyse microbial communities. They will understand the advantages and limitations of specific techniques. In the lab course they will obtain experience with some of the techniques. In a seminar the students will gain experience with current literature and with reporting about it to other participants.		
Contents	Molecular methods for the identification of isolated bacteria. Fluorescence *in situ* hybridisation (FISH), catalyzed reporter deposition FISH (CARD-FISH), membrane hybridization, sequencing of clone banks with PCR products, amplified ribosomal DNA restriction analysis (ARDRA), restriction fragment length polymorphisms (TRFLP), temperature and denaturing gradient gel electrophoresis (TGGE, DGGE), single strand conformation polymorphism (SSCP), real-time PCR.		
Literature	W. Reineke & M. Schlömann Umweltmikrobiologie, Spektrum Akademischer Verlag; A. M. Osborn & C. J. Smith: Molecular Microbial Ecology, Taylor and Francis; Kowalchuk, de Bruijn, Head, Akkermans, van Elsas: Molecular Microbial Ecology Manual, Springer		
Types of Teaching	lecture (1 SWS), seminar (1 SWS), lab course (1 SWS)		
Pre-requisites	Bachelor-degree in chemistry, applied science, geoecology, biology, process engineering or in another area of science or engineering. Knowledge and experiences from a Microbiological biochemical lab course.		
Applicability	Master Programmes applied science and geoecology		
Frequency	Yearly in winter semester		
Requirements for Credit Points	PVL: Accepted protocols for lab course. Acceptable oral presentation in the seminar. Written exam over 90 min.		
Credit Points	4		
Grade	The grade results from the written exam.		
Workload	The module needs 120 h of time, of which 45 h are needed to participate in lectures, seminars and lab courses, while 75 h are needed for self study. The latter comprises preparation and repetition of lecture material, the preparation of a presentation in the seminar, the preparation for the lab course, the writing of protocols on the experiments, and the preparation for the oral exam.		

Code/ Dates	MPETMET.MA.Nr.2057	Version: 12.07.2010	Start: WT 2010/11
Name	Petrology of Metamorphic Rocks		
Responsible	**Surname** Schulz **First name** Bernhard **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Schulz **First name** Bernhard **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Duration	1 Semester		
Competencies	Acquisation of theoretical and practical skills in the analysis of pressure-temperature-deformation paths in metamorphic rocks		
Contents	Variable, for example: microanalytical analysis of metamorphic rocks and geo-thermobarometry, case studies in orogenic belts		
Literature	Spear (1993) Metamorphic phase equilibria and pressure-temperature-time paths. Bucher & Frey (1994) Genesis of metamorphic rocks. Cemic (1988) Thermodynamik in der Mineralogie. Kretz (1994) Metamorphic crystallization. Will (1998) Phase equilibria in metamorphic rocks: thermodynamic background and petrological applications. Shelley (1992) Igneous and metamorphic rocks under the microscope. Passchier & Trouw (2001) Microtectonics.		
Types of Teaching	lectures, exercises and seminars (1/5/0 K 1 day)		
Pre-requisites	Bachelor course in structural geology		
Applicability	Master programs in Geoscience		
Frequency	Yearly		
Requirements for Credit Points	Prerequisite: : participation in the seminars Written exam (KA) of 90 minutes		
Credit Points	6		
Grade	The grade results from the written exam.		
Workload	The total time is 180 h (100 h are spent in class, remaining 80 h are spent on preparation and self study).		

Code/ Dates	GEOFER .MA.Nr.013	Version: 12.07.2010	Start: WT 2010/11
Name	Remote Sensing		
Responsible	**Surname** Gloaguen **First name** Richard **Academic title** Dr.		
Lecturer(s)	**Surname** Gloaguen **First name** Richard **Academic title** Dr. Ratschbacher Lothar Prof. Dr.		
Institute(s)	Institute for Geology		
Module Duration	1 Semester		
Competencies	Acquisation of theoretical and practical skills in remote sensing with a focus on the analysis of surface processes		
Content	Variable, for example: Remote sensing applications to Geoscience with a focus on the analysis of tectonics and tectonic geomorphology in active orogenic belts.		
literature	Publications in international journals; W.G. Rees, Physical principles of remote sensing, Cambridge University Press, 2001; D.W. Burbank and R.S. Anderson, Tectonic geomorphology, 2001.		
Types of teaching	Variable proportions of lectures, exercises and seminars		
Prerequisites for participation	Bachelor course in remote sensing		
Applicability	Master programs in Geoscience		
Frequency	Yearly		
Requirements for awarding credit points	written exam of 90 minutes, presentation		
Credit points	6		
Grade	The overall grade is calculated as the arithmetic average of the grades of the written exams (weight1) and the average grade of the presentation (weight 1).		
Work load	The total time is 180 h (60 h are spent in class, remaining 120 h are spent on exercises, seminars, preparation and self study)		

Code/ Dates	MPLATTE.MA.Nr. 2058	Version: 12.07.2010	Start: WT 2010/11
Name	Research Seminar: Plate Tectonics and Orogenic Processes		
Responsible	**Surname** Ratschbacher **First name** Lothar **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Ratschbacher **First name** Lothar **Academic title** Prof. Dr. **Surname** Kroner **First name** Uwe **Academic title** Dr. **Surname** Stanek **First name** Klaus **Academic title** Prof. Dr. **Surname** Gloaguen **First name** Richard **Academic title** Dr. **Surname** Jonckheere **First name** Raymond **Academic title** Dr. **Surname** Pfänder **First name** Jörg **Academic title** Dr.		
Institute(s)	Institute for Geology		
Duration	2 Semester		
Competencies	Acquisation of skills in understanding and interpreting research literature, defining problems in teconics and devising own research strategies		
Contents	Variable: focus on orogeny in Central Asia, analysis of the scientific approaches for the understanding of orogeny in natural laboratories, review of techniques of orogenic analysis (from fieldwork to pressure-temperature-deforamtion-time interpretations).		
Literature	Publications in international journals		
Types of Teaching	Lectures, exercises and seminars (1/1/4).		
Pre-requisites	Bachelor course in structural geology		
Applicability	Master programs in Geoscience		
Frequency	Yearly		
Requirements for Credit Points	Prerequisite: active participation in the seminar		
Credit Points	6		
Grade	Grades result from the contribution of the student to the seminar (talk, discussion, report)		
Workload	The total time is 180 h (90 h are spent in class, remaining 90 h are spent on self study)		

Code/ Dates	MTEKTO .MA.Nr. 046	Version: 12.07.2010	Start: WT 2010/11
Name	Rheology, Lattice Preferred Orientation, Microtectonics		
Responsible	**Surname** Ratschbacher **First name** Lothar **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Ratschbacher **First name** Lothar **Academic title** Prof. Dr. **Surname** Kroner **First name** Uwe **Academic title** Dr. **Surname** Schaeben **First name** Helmut **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Module Duration	2 Semester		
Competencies	Acquisition of theoretical background in rheological analysis in the Geosciences, practical skills in analysis of microstructures and crystallographic preferred orientation in tectonites, temperature-deformation paths and kinematics from microstructures.		
Content	Variable, for example: rheological principles in rocks and minerals, microstructural analysis in tectonites, kinematic analysis from microstructures, rheology of major rock-forming minerals, lattice preferred orientation of rock-forming minerals.		
Literature	Publications in international journals; Passchier & Trouw (2006) Microtectonics; Ranalli (1995) Rheology of the Earth; Twiss & Moores (2006) Structural Geology.		
Learning methods	Variable proportions of lectures, exercises and seminars.		
Prerequisites for participation	Bachelor course in structural geology		
Applicability	Master programs in Geoscience		
Frequency	Yearly		
Requirements for awarding credit points	Prerequisite: participation in the seminars and exercises written exam (KA) of 90 minutes		
Credit points	5		
Grade	Grades are based on the written exams		
Workload	The total time is 150 h (60 h are spent in class, remaining 90 h are spent on exercises, seminars, preparation and self study)		

Code/ Dates	MUFSAN.MA.Nr. 2066	Version: 26.6.2010	Start: WT 2010/11
Name	Soil and groundwater remediation; innovative methods		
Responsible	**Surname** Geistlinger **First name** Helmut **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Geistlinger **First name** Helmut **Academic title** Prof. Dr.		
Institute(s)	UFZ Halle Leipzig		
Duration	2 semester		
Competencies	The student improves his competences with respect to risk analysis of contaminates sites, getting acquainted with innovative techniques for active and passive treatment of the subsurface and monitoring of contaminants. He will be able to run basic physical-chemical models, to understand those processes in the unsaturated and saturated zone that are controlling clean up procedures.		
Contents	Innovative technologies: in situ sorptive and reactive treatment walls, surfactant-enhanced aquifer remediation, volatilization and air sparging, chemical, electrochemical, and biochemical remediation processes, monitored natural attenuation and nano technologies. Computer models for prognosis and control of rehabilitation methods.		
Literature	Smith and Burns, Physicochemical Groundwater Remediation Chapelle, Groundwater-Microbiology and Geochemistry Domenico and Schwartz, Physical and Chemical Hydrogeology		
Types of Teaching	Lecture and practical exercises		
Pre-requisites	Basic knowledge of hydrogeology and hydrochemistry		
Applicability	Master Geosciences, Master Geowissenschaften		
Frequency	Once within an academic year		
Requirements for Credit Points	Written examination (90 minutes) and 6 reports (AP)		
Credit Points	5		
Grade	The overall grade is calculated as the arithmetic average of the grades of the written exams (weight 2) and the average grade of the reports (weight 1).		
Workload	The total time is 150 h (45 h are spent in class, remaining 105 h are spent on preparation and self study)		

Code/ Dates	STRUGEO.MA.Nr.3204	Version: 12.07.2010	Start: WT 2010/11
Name	Structural Geology, Tectonic Geomorphology, Neotectonics		
Responsible	**Surname** Ratschbacher **First name** Lothar **Academic title** Prof. Dr.		
Lecturer(s)	**Surname** Ratschbacher **First name** Lothar **Academic title** Prof. Dr. **Surname** Gloaguen **First name** Richard **Academic title** Dr. **Surname** Kroner **First name** Uwe **Academic title** Dr. **Surname** Stanek **First name** Klaus **Academic title** Prof. Dr.		
Institute(s)	Institute for Geology		
Duration	3 Semester		
Competencies	Acquisation of theoretical and practical skills in tectonic analysis of Mesozoic-Cenozoic and in particular active orogenic belts. Mastering techniques and interpretations in structural geology, geo-thermochronology, remote sensing, tectonic geomorphology, surface processes and paleoseismology. Teaching, exercises and seminars are focused on active orogenic belts in Central Asia.		
Contents	Variable, for example: geometrical analysis of structures, balanced cross-sections, paleostress analysis, vorticity analysis, geomorphological markers, non-radiometric and radiometric dating techniques, active deformation structures and their geomorphological expression, analysis of paleoearthquakes, drainage and river profile analysis, steady-state and non-steady-state landscapes.		
Literature	Publications in international journals; Twiss & Moores (2006) Structural Geology; Pollard & Fletscher (2005) Fundamentals of Structural Geology; Ramsay & Huber (1983, 1987) and Ramsay & Lisle (2002) Techniques of Modern Structural Geology; Woodward et al. (1989) Balanced Geological Cross-Sections; Burbank & Andersen (2001) Tectonic Geomorphology; McCalpin (1996) Paleoseismology; Yeats et al. (1997) The Geology of Earthquakes; Keller, & Pinter (1996) Active Tectonics.		
Types of Teaching	Lectures, exercises and seminars (5/2/4).		
Pre-requisites	Bachelor in Geosciences that included structural geology.		
Applicability	Master programs in Geoscience		
Frequency	Yearly		
Requirements for Credit Points	Grading of the module is based on a written exam (KA) of 90 minutes and participation in the seminars		
Credit Points	11		
Grade	The grade results from the written exams.		
Workload	The total time budgeted for the cluster is set at 330 hours, of which 165 hours are spent in class and the remaining 165 hours are spent on self-study.		

Freiberg, den 13. September 2011

gez.: Prof. Dr.-Ing. Bernd Meyer

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