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Data:	EBAM. MA. Nr. 3697 / Examination number: 30713	Version: 14.03.2019	Start Year: SoSe 2020
Module Name:	**Introduction to Bayesian Analysis with R**		
(English):			
Responsible:	Gerhards, Christian / Prof. Dr.		
Lecturer(s):	Tolosana-Delgado, Raimon / PD Dr.		
Institute(s):	Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	The students will be familiarized with Bayesian methods and acquire the ability to apply these methods to geoscientific problems, using R.		
Contents:	- Bayes Theorem, Bayesian inversion, Bayesian trees - Probability models, conjugate distributions, discrete solutions - Markov Chain Monte Carlo methods: Gibbs sampling and Metropolis-Hastings		
Literature:	- Bolstad, William M., Curran, James Michael (2017) Introduction to Bayesian statistics, Wiley, ISBN: 978-1-118-59316-5 - Marin, Jean-Michel, Robert, Christian P. (2007) Bayesian core : a practical approach to computational Bayesian statistics, Springer, ISBN: 9780387389790		
Types of Teaching:	S1 (SS): Practical Application (2 SWS)		
Pre-requisites:	**Recommendations:** Data Analysis and Statistics, Multivariate Statistics and Geostatistics, basic knowledge of R		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Programming project and project documentation		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Programming project and project documentation [w: 1]		
Workload:	The workload is 90h. It is the result of 30h attendance and 60h self-studies. The latter comprises preparation for and follow-up of the lectures as well as the preparation of the programming project and project documentation.		

Data:	MWDTP. MA. Nr. 3634 / Examination number: 31728	Version: 04.07.2018	Start Year: WiSe 2018
Module Name:	**Mine Water II – Dewatering, Technical Devices, Projects**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr. Hoth, Nils / Dr.		
Lecturer(s):	Hoth, Nils / Dr.		
Institute(s):	Institute of Mining and Special Civil Engineering		
Duration:	1 Semester(s)		
Competencies:	The students will gain knowledge about inflowing waters to open cast, open pits. They are able to deal with water balances and to characterise the status of slope stabilities in relation to pore pressures. They have an understanding how the dewatering system (pumps etc.) has to be chosen in relation to the site specific situation. Furthermore they are able to build up a site specific strategy to investigate, characterise, trace the inflowing waters to open pits or underground mines hydrogeochemically.		
Contents:	Lecture: - Water balances of open casts - Dewatering aspects under consideration of pit development - Pore pressures and slope stability and slope failures - Examples of water handling systems at different mine sites - Detailed explanation of investigation strategies/ results of different projects - Water inflow balances for test sites - how to deal with data shortage - Operational cost differences related to dewatering systems - Open pit or underground mine inflow systems - hydrogeochemical investigations (trace metals, REE, isotopes, Tracers ...) Exercises: - Calculate surface run-off - Water related problems - influence to mining operation/ Impact to operational costs - Open Pit under extreme climate - groundwater and surface water inflow - Rough dewatering estimation by easy analytical solutions		
Literature:	Beale & Read (2013) Evaluating water in pit slope stability Herth $ Arndts (1995) Theorie und Praxis der Grundwasserabsenkung		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Mine Water I – Formation and Treatment, 2018-07-04		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min] PVL: Exercises and homework PVL have to be satisfied before the examination.		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies. (75 h are spent on preparation for the classes, homework and		

	with self study)

Data:	ATPF MA. Nr. 3698 / Examination number: 30714	Version: 07.10.2019	Start Year: WiSe 2020
Module Name:	**Advanced Theory of Potential Fields**		
(English):	Advanced Theory of Potential Fields		
Responsible:	Gerhards, Christian / Prof. Dr.		
Lecturer(s):	Gerhards, Christian / Prof. Dr.		
Institute(s):	Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	The students will be able to understand the mathematical aspects of geophysical potential fields methods as they occur, e.g., in gravimetry and geomagnetism. They will be able to apply and interpret specific approximation and inversion methods for such problems.		
Contents:	- Approximation methods on the sphere; in particular, spherical harmonics and wavelets/multiscale methods - ill-posedness of inverse geophysical potential field problems - specific examples from gravimetry and geomagnetism Depending on the audience, the lecture can also be held in German.		
Literature:	Blakely, R.J., 1995, Potential Theory in Gravity and Magnetic Applications, Cambridge University Press Freeden, W., Schreiner, M., 2009, (Spherical) Functions of Mathematical Geosciences - A Scalar, Vectorial, and Tensorial Setup, Springer Freeden, W., Gerhards, C., 2012, Geomathematically Oriented Potential Theory, Taylor & Francis Michel, V., 2013, Lectures on Constructive Approximation - Fourier, Spline, and Wavelet Methods on the Real Line, the Sphere, and the Ball, Birkhaeuser		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Theory of Potential Fields, introductory lecture on (partial) differential and integral equations		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	POTTH MA Nr. 3695 / Examination number: 32903	Version: 05.02.2021	Start Year: WiSe 2020
Module Name:	**Theory of Potential Methods**		
(English):			
Responsible:	Börner, Ralph-Uwe / Dr.		
Lecturer(s):			
Institute(s):	Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	The students understand the fundamental theory of potential methods, implement gravity and geomagnetic applications, and are able to establish the link between theory and practice.		
Contents:	The lecture on potential theory provides an introduction to potential fields arising, e.g., in gravity, magnetics and resistivity methods. Departing from a basic understanding of the potential of a point source, elaborated density distributions are introduced. Potential distributions caused by non-trivial two- and three-dimensional sources are studied. An extensive introduction to spherical harmonics will be provided with a focus on Earth's magnetic field. The theory of boundary value problems will be studied on the basis of the Poisson problem arising in DC resistivity applications. During the exercises the students are instructed to implement Julia and MATLAB routines to solve numerical simulation problems.		
Literature:	Blakely: Potential Theory in Gravity & Magnetic Applications		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises (1 SWS)		
Pre-requisites:			
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP [30 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	BODBEWB. BA. Nr. 646 / Examination number: 30119	Version: 05.12.2018	Start Year: SoSe 2020
Module Name:	**Special Topics Geokinematics**		
(English):			
Responsible:	Benndorf, Jörg / Prof. Dr.-Ing.		
Lecturer(s):	Benndorf, Jörg / Prof. Dr.-Ing. John, André / Dr.-Ing.		
Institute(s):	Institute for Mine Surveying and Geodesy		
Duration:	1 Semester(s)		
Competencies:	After successful completion of the course, students are able to: • solve topical problems related to predicting and monitoring mining induced ground movements, • utilize methods of inverse modelling to estimate parameters of prediction models based on monitoring data and • apply methods of machine learning to analyse highly dimensional data and identify relations between independent and dependent variables.		
Contents:	• review of methods for predicting mining induced ground movements on topical examples • applied inverse modelling and geostatistics for parameter estimation in the context of ground movement prediction • introduction to supervised and unsupervised learning (Machine Learning) in the context of resource extraction monitoring and prediction • case studies of machine learning in the context of mining induced ground movement modelling and exploration • case studies for ground movement prediction and parameter estimation		
Literature:	Kratzsch, Helmut: Bergschadenkunde. 4. Aufl., 2004, 873 S., ISBN 3-00-001661-9; Whittaker, B.N., Reddish D.J.: Subsidence. -Occurrence, Prediction and Control, 1989, 528 S., ISBN 0-444-87274-4; Kanevski, M., Timonin, V., & Pozdnukhov, A. (2009). Machine learning for spatial environmental data: theory, applications, and software. EPFL press Dzegniuk, B., Fenk, J., Pielok, J. : Analyse und Prognose von Boden und Gebirgsbewegungen im Flözbergbau. 1987,105 S., ISBN 0071-9390; Journals: Markscheidewesen, Geotechnik, Mathematical Geosciences, Computer and Geosciences, Journal of Mining Sciences		
Types of Teaching:	S1 (SS): Special Topics Geokinematics - Lectures / Lectures (2 SWS) S1 (SS): Special Topics Geokinematics - Practical work in groups / Practical Application (2 SWS)		
Pre-requisites:	**Recommendations:** Höhere Mathematik für Ingenieure 1, 2015-03-12 Höhere Mathematik für Ingenieure 2, 2015-03-12 Allgemeine Grundlagen der Bergschadenlehre, 2017-01-24 Datenanalyse/Statistik, 2011-07-27 Geomodelling – Geostatistics for Natural Resource Modelling, 2018-12-05 Ausgleichungsrechnung, 2017-12-21		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP: Oral examination [20 to 30 min]		

	PVL: Set of assignments PVL have to be satisfied before the examination.
Credit Points:	4
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP: Oral examination [w: 2] PVL: Set of assignments [w: 1]
Workload:	The workload is 120h. It consists of 60h presence time (lectures and practical), and 60 hours independent work including group work, practical, self-study and preparation for examination

Data:	ATMOSGAS. MA. Nr. 3032 / Examination number: 31024	Version: 08.05.2019	Start Year: SoSe 2010
Module Name:	**Atmospheric Gases and Aerosols**		
(English):			
Responsible:	Matschullat, Jörg / Prof. Dr.		
Lecturer(s):	Matschullat, Jörg / Prof. Dr. Zimmermann, Frank / Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
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:	S1 (SS): Seminaristic lecture / Lectures (4 SWS) S1 (SS): Exercises (2 SWS) S1 (SS): Block course / Practical Application (5 d)		
Pre-requisites:	**Recommendations:** B.Sc. in Geoecology or related. Sufficient knowledge of the English language.		
Frequency:	yearly in the summer semester		
Requirements for Credit	For the award of credit points it is necessary to pass the module exam.		

Points:	The module exam contains: AP: Active seminar contributions AP: Written report on the practical training course
Credit Points:	9
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Active seminar contributions [w: 2] AP: Written report on the practical training course [w: 1]
Workload:	The workload is 270h. It is the result of 130h attendance and 140h self-studies. The latter is spend on preparation and learning time (home studies) as well as writing the reports.

Data:	HYCHEMP. MA Nr. 3548 / Examination number: 30257	Version: 01.10.2019	Start Year: WiSe 2020
Module Name:	**Hydrochemical-Analytical Lab Course**		
(English):			
Responsible:	Scheytt, Traugott / Prof. Dr.		
Lecturer(s):	Scheytt, Traugott / Prof. Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	The students learn the concepts of water analysis through hand-on laboratory work. Water constituents are determined by Ion Chromatography (IC), TOC, Fluorescence and Photometry. The aim is to learn through analytical approach, including calibration, determining detection limit, limit of quantitation and measurement errors.		
Contents:	The students will build and carry out laboratory tests for the determination of sorption (batch experiments), cation exchange capacity and mass transfer (laboratory column tests). The students will use analytical measuring devices, in particular ICP-MS, Ion Chromatography, TOC-Analyzer, spectral fluorometer, photometer, fluorescence spectrometer to analyze water constituents.		
Literature:	Stumm, W. & Morgan, J.J. (1996): Aquatic Chemistry – Chemical Equilibria and Rates in Natural Waters.- Wiley & Sons.		
Types of Teaching:	S1 (WS): Seminar (1 SWS) S1 (WS): Practical Application (3 SWS)		
Pre-requisites:	**Mandatory:** Introduction to Hydrogeology, 2019-10-01 Hydrogeochemistry, 2019-10-01		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP*: Preparation and presentation of an oral talks in English. [10 min] AP*: Preparation of a report on the experiment results. * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP*: Preparation and presentation of an oral talks in English. [w: 1] AP*: Preparation of a report on the experiment results. [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Workload:	The workload is 150h. It is the result of 60h attendance and 90h self-studies.		

Data:	IIA. MA. Nr. 3704 / Examination number: 31103	Version: 23.01.2020	Start Year: SoSe 2021
Module Name:	**Introduction to Instrumental Analysis**		
(English):			
Responsible:	Pleßow, Alexander / Dr.		
Lecturer(s):	Pleßow, Alexander / Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	Background knowledge on instrumental chemical analysis essential for clients is being generated. Successful participants are aware of weaknesses and strengths of commonly applied analytical methods, know about the main sources of analytical errors, can deal with sampling challenges, communicate with analysts on a professional level, and assess the reliability of analytical results.		
Contents:	Analytical process, method overview; sampling, representativeness and homogeneity of samples, sample preparation and stabilisation; sample splitting and reduction; contamination, analyte losses; error categories, normal distribution, detection limits, measurement range, reference materials, traceability, quality control, data assessment.		
Literature:	Kellner R, Mermet J-M, Otto M, Valcarcel M, Widmer HM (eds; 2004) Analytical Chemistry – A modern approach to analytical science. 2. ed. Wiley-VCH; Stoeppler M (ed; 1997) Sampling and sample preparation – Practical guide for analytical chemists. Springer; Conklin AR jr (2004) Field sampling – Principles and practices in environmental analysis. Marcel Dekker; Gill R (1997) Modern Analytical Chemistry – An introduction to quantitative chemical analysis for earth, environmental and material scientists. Pearson Education		
Types of Teaching:	S1 (SS): Lectures (1 SWS) S1 (SS): Seminar (1 SWS) S1 (SS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Students are required to come with fundamentals from the modules "Higher mathematics", "General, inorganic and organic chemistry", "Analytical chemistry", "Physics", and "Fundamentals of geosciences".		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [60 min] PVL: At least 80% active and successful participation in seminar and exercise units PVL have to be satisfied before the examination.		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies. The latter comprises the home study and the exam preparation.		

Data:	MISOCHR. MA. Nr. 2037 / Examination number: 35103	Version: 25.11.2019	Start Year: WiSe 2020
Module Name:	**Geochronology and Isotope Geochemistry**		
(English):			
Responsible:	Tichomirowa, Marion / Prof. Dr.		
Lecturer(s):	Tichomirowa, Marion / Prof. Dr. Käßner, Alexandra / Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	At the end of the module students are able: • to tell and classify key applications of stable isotopes of the light elements (C, H, O, S, non-traditional stable isotope for geochemistry) as well as to evaluate new results of research • to tell and classify methods of Geochronology (Ar-Ar, Rb-Sr, Sm-Nd, Lu-Hf, U-Pb, fission tracks) as well as to evaluate new results of research • to explain important steps of these methods for Geochronology • to use relevant terms in English. Die Studierenden sind nach Ablauf des Moduls in der Lage: • die wichtigsten Anwendungsmöglichkeiten leichter stabiler Isotope (C, H, O, S, nicht-traditionelle Isotope) zu benennen, zu klassifizieren und moderne Forschungsergebnisse zu evaluieren, • geochronologische Methoden (Ar-Ar, Rb-Sr, Sm-Nd, Lu-Hf, U-Pb, Spaltspuren) zu benennen, zu klassifizieren und Forschungsergebnisse moderner Studien zu analysieren, • die wichtigsten praktischen Schritte dieser Methoden darzulegen, • wichtiges englisches Fachvokabular anzuwenden.		
Contents:	• isotope geochemistry of the stable isotopes of the light elements (C, H, O, S, non-traditional stable isotopes for geochemistry) and their application in geology • methods of geochronology (Ar-Ar, Rb-Sr, Sm-Nd, Lu-Hf, U-Pb, fission tracks) and their application for determining different geological processes • development of isotopically different terrestrial reservoirs (asthenosphere, lithosphere, earth's crust) • analysis and interpretation of geochemical and geochronological data • Isotopengeochemie leichter stabiler Isotope (C, H, O, S, nicht-tradiotionelle) und deren Anwendung in der Geologie. Geochronologische Methoden (K-Ar, Ar-Ar, Rb-Sr, Sm-Nd, U-Pb, Lu-Hf, Spaltspuren) und deren Anwendung zur Datierung unterschiedlicher geologischer Prozesse • Entwicklung unterschiedlicher terrestrischer Isotopenreservoirs (Astenosphäre, Lithosphäre, Kruste) • Auswertung und Interpretation von isotopengeochemischen und geochronologischen Daten		

Literature:	Hoefs (2018): Stable Isotope Geochemistry. Springer White (2015): Isotope Geochemistry. Faure and Mensing (2005): Isotopes, Principlesand Applications. Wiley and Sons Stosch (1999): Einführung in die Isotopengeochemie. Dickin (2005): Radiogenic Isotope Geology. Cambridge University Press. Geyh (2005): Handbuch der physikalischen und chemischen Altersbestimmung.
Types of Teaching:	S1 (WS): Lectures (3 SWS) S1 (WS): Practical Application (1 SWS)
Pre-requisites:	
Frequency:	yearly in the winter semester
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA* [90 min] AP: Presentation [10 to 20 min] AP: Exercise * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Credit Points:	4
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA* [w: 4] AP: Presentation [w: 1] AP: Exercise [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Workload:	The workload is 120h. It is the result of 60h attendance and 60h self-studies. The self-studies consists of preparation for the lectures and the practical time, preparation of the exercise and preparation for examination.

Data:	MARKLAG. BA. Nr. 648 / Examination number: 30117	Version: 05.12.2018	Start Year: SoSe 2020
Module Name:	**Geomatics for Resource and Reserve Management**		
(English):			
Responsible:	Benndorf, Jörg / Prof. Dr.-Ing.		
Lecturer(s):	Benndorf, Jörg / Prof. Dr.-Ing.		
Institute(s):	Institute for Mine Surveying and Geodesy		
Duration:	1 Semester(s)		
Competencies:	After successful completion of the course, students are able to create case specific work flows and apply methods that support a safe, economical end environmental responsible exploitation of mineral deposits. The particular focus of this module is on: - exploration of the resource and geo-mechanical aspects including tectonics, - evaluation of mineral resources and reserves according international standards, - monitoring of operational accessible reserves (in-pit reserves), - grade control and reconciliation, - operational production and safety monitoring and - aspects related to optimization of mine design.		
Contents:	• methods and phases of resource exploration • resource/reserve estimation and international standards for reporting • operational production and safety monitoring • grade control and reconciliation • tectonic structures and its visualization in mine maps (folding structures and discontinuities) • geotechnical design aspects • applied operations resource for optimized mine design		
Literature:	Eisbacher, G.H.: Einführung in die Tektonik. Ferdinand Enke Verlag Stuttgart; Klassifikation von Lagerstätten. GDMB-Hefte, GDMB-Clausthal-Zellerfeld; Michaely, H., Blasgude H.G.: Rissmusteratlas- Bergmännisches Risswerk. FABERG-Normenausschuss Bergbau im DIN Deutsches Institut für Normung e.V. Domschke, W., Drexl, A., Klein, R., Scholl, A. (2015) Einführung in das Operations Research. Springer, Berlin.		
Types of Teaching:	S1 (SS): Geomatics for Resource and Reserve Management - Lectures / Lectures (2 SWS) S1 (SS): Geomatics for Resource and Reserve Management - Exercises and practical work in groups / Practical Application (2 SWS)		
Pre-requisites:	**Recommendations:** Risstechnik, CAD und Geodatenbanken, 2017-11-14		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP [30 min] PVL: Excursion report, set of assignments incl. presentation PVL have to be satisfied before the examination.		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP [w: 1]		
Workload:	The workload is 180h. It consists of 60h presence time (lectures and		

	underground surveying practical), and 120 hours independent work including group work, practical, self-study and preparation for examination.

Data:	GSC. MA. Nr. 3630 / Examination number: 31724	Version: 04.07.2018	Start Year: SoSe 2019
Module Name:	**Geo-scientific Communication**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr. Hoth, Nils / Dr.		
Lecturer(s):	Jacob, Mark / Dr. Hoth, Nils / Dr.		
Institute(s):	International Centre/ Languages Institute of Mining and Special Civil Engineering		
Duration:	1 Semester(s)		
Competencies:	The course intends to give students the knowledge and the ability to perform scientific database research. Furthermore they will be able to structure and document their scientific work and results. Also they learn more about scientific writing (of a paper), as well as to present and defence their results (oral talk). This is very important before writing their MSc-thesis.		
Contents:	- dealing with scientific literature - Detailed database research, - citation of publications, - aspects about writing technical or review papers - structure your practical work in relation to the Master thesis (deal with sub-aspects) - Main ideas how to structure the written MSc-thesis in comparison to technical reports - dealing with the resources of the university library - search papers, therefore searching strategies Oral communication (language of describing graphs, charts and diagrams) Argumentation line of talks Written communication - Language to link points and ideas, language of comparing and contrasting Major goals are learning and applying strategies of transporting scientific informations using different techniques and analogue and digital sources. AP main work working on a scientific topic for a defined time, prepare a paper (around 12 pages) in relation to a ground water, mine water or mining/ geoscience based topic. Students have to present their topic, argumentation line and basic literature (2 to 5 scientific papers) in before they start to write the paper. Afterwards, when they have handed in the paper, they have to give a presentation/ defence talk about this topic/ paper.		
Literature:	Cargill, M. [2013] : 2013 Writing scientific research articles and internal material		
Types of Teaching:	S1 (SS): Lectures (1 SWS) S1 (SS): Exercises (2 d)		
Pre-requisites:	**Recommendations:** basics in hydrogeology, groundwater chemistry and mine water		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP*: writing a scientific research paper AP*: presentation and defence of the paper		

	* In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Credit Points:	4
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP*: writing a scientific research paper [w: 2] AP*: presentation and defence of the paper [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Workload:	The workload is 120h. It is the result of 31h attendance and 89h self-studies. (89 h are spent on preparation of the paper and preparing the presentation as well as self study).

Data:	SUSPCM. MA. Nr. 084 / Examination number: 60216	Version: 01.01.2014	Start Year: WiSe 2014
Module Name:	**Project and Contract Management**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr. Bongaerts, Jan C. / Prof. Dr.		
Lecturer(s):	Bongaerts, Jan C. / Prof. Dr.		
Institute(s):	Professor of Environmental & Resource Management Institute of Mining and Special Civil Engineering		
Duration:	1 Semester(s)		
Competencies:	The objectives of the module are to convey principal elements of project and contract management. Project Management: The student will be able to identify, analyze and structure the issues involved in a large scale environmental remediation project. On the basis of this skill, the student will be in a position to set up, organise, and control a project and its components including the procurement of outside services. He/she will be capable of managing the tendering of contracts, identifying critical paths, setting up financial controlling, initiating technical controlling as well as establishing quality assurance and control. Contract Management: The student will be able to identify the various types of contracts required to manage large scale environmental remediation projects. In particular, he/she will be in a position to compile information required to generate contracts, formulate draft contracts, expedite the execution of contracts, and to establish the organizational structures to facilitate the storage and retrieval of crucial information by project personnel. Presentation of small group projects and case studies forms an essential part of the module in order to train communication skills.		
Contents:	Project management is a set of principles, practices, and techniques applied to lead project teams and control project schedule, cost, and performance risks. The basic elements are • Project integration including the establishment of life cycle phases ending in milestones, producing a set of project documents and preparing a project management plan, • Project scope definition including the definition of requirements, breaking down the work into single components, establishing cost and schedule baselines, • Time management using automated scheduling systems, conducting critical path analysis, • Cost management covering the preparation of cost estimates, tracking costs at the work package level, • Quality management by defining goals and stating methods toachieve quality assurance, implementing quality measurement and continuous quality improvement, • Risk management composed of risk analysis and implementing measures for risk avoidance and mitigation • Human Resources management entailing the establishment of clear goals, maintaining channels of communication, and instruments to resolve conflicts, • Communications, including internal project team communication and external public relations, • Procurement.		

	Contract management covers aspects that are part of project management such as Procurement. Although contract management is an integral part of project management it deserves particular attention due to its legal implication during the execution of a project and the potential to preserve knowledge in spite of long-term staff attrition. Therefore, it is focused on further by discussing • Life Cycle of contracts, contract types, e.g. expert opinions, services, supplies and contract structures • Parties involved in designing contracts • Contract elements, e.g. risks, occupational health and safety, conflicts of interest, ownership and tights to the use of intellectual property, dispute resolution, regulatory controls) • Contract negotiations and elements of contract administration • Cost and price analysis The subjects will be presented using summary texts, graphs, software demonstration and case studies. Students shall participate in the presentation to solicit ideas as well as individual situations experienced and integrate these in the structured presentation. Where appropriate, real-life situations will be simulated.
Literature:	Johanna Rothman, Successful Project Management, The Pragmatic Programmers, 2007; Tom de Marco: The Deadline: A Novel About Project Management, B & T Publishing, 1997
Types of Teaching:	S1 (WS): Lectures (6 d) S1 (WS): Seminar (9 d)
Pre-requisites:	**Recommendations:** No previous knowledge of management is required.
Frequency:	yearly in the winter semester
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [120 min] PVL: Presentation of results of practical training PVL have to be satisfied before the examination.
Credit Points:	6
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]
Workload:	The workload is 180h. It is the result of 120h attendance and 60h self-studies.

Data:	SeStra MA. / Examination number: 32605	Version: 06.04.2018	Start Year: WiSe 2016
Module Name:	**Seismic Sequence Stratigraphy**		
(English):	Seismic Sequence Stratigraphy		
Responsible:	Buske, Stefan / Prof. Dr.		
Lecturer(s):	Fischer, Klaus		
Institute(s):	Wintershall Holding GmbH Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	The course objective is to communicate sequence stratigraphic principles and demonstrate their relevance to seismic interpretation. The basic workflow will be presented for seismic stratigraphic interpretation and basin evolution analysis, using case histories and field examples worldwide. Based on seismic examples and some "hands on" interpretation exercises from different geological settings, attendees learn how to identify different depositional environments from seismic data, predict facies and gross lithological units (reservoir and seal pairs), estimate paleo water depths, and evaluate subsidence trends and baselevel changes.		
Contents:	Course Outline: • Introduction • Principles of sequence stratigraphy, sequence stratigraphic models • Principles of seismic stratigraphy, recognition of seismic sequence boundaries and other surfaces of importance, delineation of systems tracts, sea-level variations • Seismic facies analysis: reflection geometries and other seismic facies characteristics with a detailed description of geological facies models and their use for lithology / depositional environment prediction • 3D visualisation and attribute analysis • Illustration of standard workflows for seismic reservoir characterisation The examination prerequisite is a project which will be processed in groups of 2 or 3 students with the software Petrel. Before the beginning of the project, students will receive a short Petrel introduction (around 4 hours). At the end of the course, a written examination will take place.		
Literature:			
Types of Teaching:	S1 (WS): Intensive course (including Petrel introduction and project work) / Lectures (5 d)		
Pre-requisites:			
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min]		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 90h. It is the result of 40h attendance and 50h self-studies.		

Data:	HYEX. MA Nr. 3546 / Examination number: 30253	Version: 16.10.2019	Start Year: SoSe 2021
Module Name:	**Hydrogeology Field Trip**		
(English):			
Responsible:	Scheytt, Traugott / Prof. Dr.		
Lecturer(s):	Dunger, Volkmar / PD Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	Upon successful completion of this course, students will be able to determine how different issues in water management are addressed, how different facilities work and how they are managed. The students will have hands-on experience on technical concepts and insight into practical examples of hydrogeology and water management in Saxony.		
Contents:	This field trip presents over a period of 5 days, different topics related to hydrogeology, hydrology and water management. The sites visited are located in Saxony and beyond, in order to present a wide range of geology and hydrogeology applications. At all sites relevant data and aspects are presented and discussed.		
Literature:			
Types of Teaching:	S1 (SS): Blockkurs: 5d in der vorlesungsfreien Zeit (5-day excursion in the time between terms) / Excursion (3 SWS)		
Pre-requisites:	**Recommendations:** Introduction to Hydrogeology, 2019-10-01 Hydrogeological Seminar, 2018-11-06 Hydrogeochemistry, 2019-10-01		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Students have to prepare a well-written and carefully prepared report on the visited stations of the field trip.		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Students have to prepare a well-written and carefully prepared report on the visited stations of the field trip. [w: 1]		
Workload:	The workload is 90h. It is the result of 45h attendance and 45h self-studies.		

Data:	RESEM. Ma. / Examination number: 30414	Version: 10.12.2019	Start Year: SoSe 2021
Module Name:	**Research Seminar: Tectonics /Geo-Thermochronology**		
(English):			
Responsible:	Ratschbacher, Lothar / Prof. Dr.		
Lecturer(s):	Kroner, Uwe / PD Dr. Jonckheere, Raymond / Dr. Pfänder, Jörg / PD Dr. Schneider, Susanne / Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	Acquisition of skills in understanding and interpreting research literature, defining problems in tectonics/geo-thermochronology, and devising own research strategies.		
Contents:	Variable: Discussion of the scientific approaches for the understanding of orogeny in natural laboratories with a focus on the active India-Asia collision; review of the techniques of orogenic analysis (from fieldwork to pressure- temperature-deformation-time interpretations); review of geo/thermochronologic methods and their application in tectonic studies; seminars on recent case studies by the course participants and external researchers		
Literature:	Publications in international journals		
Types of Teaching:	S1 (SS): RESEM / Lectures (1 SWS) S1 (SS): RESEM / Seminar (1 SWS)		
Pre-requisites:			
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Active participation in the seminar, oral presentation of a research topic [45 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Active participation in the seminar, oral presentation of a research topic [w: 1]		
Workload:	The workload is 120h. It is the result of 30h attendance and 90h self-studies. The total time is 120 h (60 h are spent in class, remaining 60 h are spent on self-study)		

Data:	ARSG. MA. Nr. 2013 / Examination number: 30115	Version: 05.12.2018	Start Year: WiSe 2019
Module Name:	**Applied Remote Sensing in Geosciences**		
(English):			
Responsible:	Benndorf, Jörg / Prof. Dr.-Ing.		
Lecturer(s):	John, André / Dr.-Ing.		
Institute(s):	Institute for Mine Surveying and Geodesy		
Duration:	1 Semester(s)		
Competencies:	After successful completion of the course students will be able to apply methods of remote sensing in the context of analysis of spatio-temporal processes in geosciences. This includes in particular, • the ability to choose suitable sensor technology based on knowledge about available sensors and related physical principles • processing of remote sensing data using typical software • application of multi-variate statistical methods to infer relevant information from sensor data, relevant to specific case studies • application of spatial modelling techniques for prediction of attributes at not samples location or times. integration of before mentioned aspects in an efficient work flow.		
Contents:	This module covers the introduction to and working on selected applications of remote sensing in geosciences by the means of selected case studies. Topics covered include • review of theoretical foundation of remote sensing • data acquisition techniques (terestrial , airborne, spaceborne) • spatio-temporal analysis of data • geoscientific background related to the case studies. Practical exercises will be conducted applying multi-spectral and radar data for change detection of ground properties and ground deformations. Students will conduct individual project assignments and present their results.		
Literature:	Richards and Jia, Remote Sensing Digital Image Analysis, Springer Schowengerdt, Remote Sensing: Models and Methods for Image Processing, Academic Press		
Types of Teaching:	S1 (WS): Applied Remote Sensing in Geosciences / Lectures (1 SWS) S1 (WS): Applied Remote Sensing in Geosciences / Practical Application (3 SWS)		
Pre-requisites:	**Recommendations:** Datenanalyse/Statistik, 2011-07-27 Grundlagen der Geowissenschaften für Nebenhörer, 2014-02-03 Grundlagen der Geofernerkundung, 2017-12-19		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Project assignment and presentation		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Project assignment and presentation [w: 1]		
Workload:	The workload is 180h. It consists of 60h supervised lecture and practical		

	time and 120h independent work including group work, practical, self-study and preparation for examination.

Data:	NUMINVGPY. MA Nr. 2988 / Examination number: 31515	Version: 12.02.2021	Start Year: SoSe 2020
Module Name:	**Inverse Problems in Geophysics**		
(English):			
Responsible:	Spitzer, Klaus / Prof. Dr.		
Lecturer(s):	Spitzer, Klaus / Prof. Dr.		
Institute(s):	Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	The students are introduced to fundamental problem-solving strategies in geophysics based on solving the forward and inverse problem. In this course we focus on the inverse problem. The students will understand how inverse problems are formulated and acquire the ability to develop and program them independently.		
Contents:	Inversion techniques are of fundamental importance in geophysics because they aim at reconstructing material parameter models from observed field data. Linear (e.g., magnetics, gravimetry) and nonlinear inverse problems (e.g., geoelectrics, electromagnetics) are addressed as well as regularization strategies and the influence of the eigenvalue spectrum on the solution. Resolution and error analyses, Gauss-Newton, Newton, and Quasi-Newton approaches are presented. The subject is deepend by computer exercises and programming simple problems in Matlab.		
Literature:	Menke: Discrete Inverse Theory, Borchers: Parameter Estimation and Inverse Problems, articles from geophysical journals		
Types of Teaching:	S1 (SS): Lectures (2 SWS) S1 (SS): Exercises (2 SWS)		
Pre-requisites:	**Recommendations:** Knowledge in Experimental and Theoretical Physics, Mathematics, Numerics, Partial Differential Equations, and Geophysics		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Solution of Exercises		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Solution of Exercises [w: 1]		
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies.		

Data:	BCCNG. MA. Nr. 3700 / Examination number: 31026	Version: 25.09.2019	Start Year: WiSe 2019
Module Name:	**Basics of Climate Change for Non-Geoecologists**		
(English):			
Responsible:	Matschullat, Jörg / Prof. Dr.		
Lecturer(s):	Matschullat, Jörg / Prof. Dr. Zimmermann, Frank / Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	**Specific aims**: Successful students can: • Understand physical and chemical basics of the climate systems with important feedback mechanisms. • Evaluate the key drivers of climate variability on various temporal and spatial scales. • Use palaeoclimatological knowledge and apply this to current and future climate development. • Judge insecurities related to climate observations and projections and apply this understanding to evaluate climate mitigation and adaptation strategies. • Deal with challenges derived from extreme weather and climate events. • Critically reflect and evaluate media reports on climate change and results from scientific studies. **Additional competencies**: • Compile scientific results and present them in front of experts. • Discuss pro's and con's in climate-change related debates and moderate scientific discussions.		
Contents:	**Climate Change**: Participants receive up-to-date information on climate change issues (global and regional, mainly physical and chemical aspects), on mitigation and adaptation, on model and scenario comparison, and on handling of uncertainties.		
Literature:	Burroughs (2007) Climate change – a multidisciplinary approach Dessler (2011) Introduction to modern climate change Dessler & Parson (2010) The science and politics of global climate change Neelin (2010) Climate change and climate modelling Richardson, Steffen, Liverman (2011) Climate change: global risks, challenges and decisions Hulme (2009) Why we disagree about climate change: understanding controversy, inaction and opportunity		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Seminar (1 SWS)		
Pre-requisites:	**Recommendations:** B.Sc. in Geoecology (or related successful B.Sc. degree). Sufficient experience with English.		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min]		

	AP: Performance in the exercises and student paper
Credit Points:	5
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1] AP: Performance in the exercises and student paper [w: 2]
Workload:	The workload is 150h. It is the result of 45h attendance and 105h self-studies. The latter involves learning of lecture material and the exercises, as well as working on the student paper.

Data:	MABGY MA Nr. 3701 / Examination number: 32904	Version: 16.03.2021	Start Year: SoSe 2020
Module Name:	**Borehole Geophysics and Formation Evaluation**		
(English):	Borehole Geophysics and Formation Evaluation		
Responsible:	Börner, Jana / Dr.		
Lecturer(s):	Börner, Jana / Dr.		
Institute(s):	Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	Verständnis der wichtigsten geophysikalischen Bohrlochmessverfahren, Anwendung der Verfahren zur Ableitung von Lithologie und Gesteinskennwerten, Fähigkeit zur eigenständigen Auswertung und integrierter Interpretation von Bohrlochmessdaten (formation evaluation), Fähigkeit zur fachspezifischen Kommunikation auf Englisch Knowledge of the most important geophysical logging methods, application of the methods for the derivation of lithology and rock characteristics, ability for processing and integrated evaluation of multiple logging data (formation evaluation), ability for subject-specific communication in English		
Contents:	Die Vorlesungen und Übungen vermitteln grundlegende Kenntnisse zur Aufnahme, Bearbeitung und Interpretation von geophysikalischen Bohrlochmessungen. Neben Sonden zur Bestimmung der Bohrlochgeometrie liegt der Schwerpunkt auf den elektrischen, radioaktiven und akustischen Bohrlochmessverfahren. Dabei werden elementare physikalische und petrophysikalische Grundlagen, der apparative Sondenaufbau und die Datenerfassung erläutert. Ausgehend von einfachen Gesteinsmodellen wird die Ableitung von Lagerstättenparametern (Porosität, Permeabilität, Sättigungsverhältnisse) aus den physikalischen Kennwerten diskutiert. In den Übungen werden Datenprozessing und kombinierte Auswerte- und Interpretationstechniken für bohrlochgeophysikalische Daten aus verschiedenen Anwendungsbereichen erlernt und selbstständig angewendet. The lectures and exercises provide basic knowledge about the acquisition, processing and interpretation of borehole geophysical data. Besides borehole probes to determine borehole geometry, the focus is on electrical, radioactive and acoustic logging methods. Fundamental physical and petrophysical knowledge, equipment design and data acquisition techniques are explained. Starting from simple rock models, the derivation of reservoir characteristics (porosity, permeability, saturation) from physical parameters is discussed. In the exercises, data processing and combined evaluation and interpretation techniques for borehole geophysical data from various areas of application are learned and applied independently.		
Literature:	Keys: A practical guide to borehole geophysics in environmental investigations; Jorden & Campbell: Well Logging 1 & 2; Schön, Fricke: Praktische Bohrlochgeophysik		
Types of Teaching:	S1 (SS): Lecture borehole geophysics / Lectures (2 SWS) S1 (SS): Exercise borehole geophysics / Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Einführung in die Geophysik, 2019-05-17		
Frequency:	yearly in the summer semester		

Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA* [90 min] AP*: Exercise reports * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Credit Points:	6
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA* [w: 1] AP*: Exercise reports [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Workload:	The workload is 180h. It is the result of 45h attendance and 135h self-studies.

Data:	GWCGWMB. MA. Nr. 3628 / Examination number: 31722	Version: 04.07.2018	Start Year: WiSe 2018
Module Name:	**Ground Water Chemistry for GW-Management - Basics**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr. Hoth, Nils / Dr.		
Lecturer(s):	Hoth, Nils / Dr.		
Institute(s):	Institute of Mining and Special Civil Engineering		
Duration:	1 Semester(s)		
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 understand and solve basic as well as more complex water quality problems. He gains an understanding of basic practical lab work for analysis.		
Contents:	- water as universal solvent - drinking water standards / disease aspects - basics of thermodynamics in relation to Ground waters (ionic strength, activity versus concentration, saturation index) - species interactions, solubility of gases in water - redox reactions - stability diagrams - solution/ precipitation of mineral phases – equilibria to the fluid phase - hydrochemical milieu measurements (background) - Acidity, alkalinity - Kb,Ks values - and titration in general - Carbonic acid - Carbonate phases interaction - Ground Water Sampling (hydraulic and chemical criteria) - Field handling of Water Samples (Filtration, Conservation)		
Literature:	APPELO & POSTMA (1996) or (2005): Geochemistry, groundwater and pollution, Balkema.		
Types of Teaching:	S1 (WS): Basics of GW chemistry / Lectures (2 SWS) S1 (WS): practical lab courses - Basic hydrochemical lab work, basics of titration, photometry etc. / Practical Application (2 SWS)		
Pre-requisites:	**Recommendations:** Basic knowledge of chemistry and hydrogeology		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA*: written exam to GW-chemistry [90 min] AP*: reports of lab practical work * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA*: written exam to GW-chemistry [w: 2] AP*: reports of lab practical work [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies. (120 h are spent on preparation, writing the lab course reports and self study)		

Data:	THEM. Ma. / Examination number: 35602	Version: 05.02.2021	Start Year: SoSe
Module Name:	**Theory of Electromagnetic Methods**		
(English):			
Responsible:	Börner, Ralph-Uwe / Dr.		
Lecturer(s):	Börner, Ralph-Uwe / Dr.		
Institute(s):	Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	The students get an introduction to the theory of electromagnetic methods with the emphasis on geophysical applications. They acquire the skills and capabilities to understand the theoretical principles of geoelectromagnetic applications and are able to establish the link between theory and practice.		
Contents:	The lecture on the theory of electromagnetic methods provides the necessary expertise which enables the students to interpret data obtained by geoelectromagnetic applications operating in the frequency and time domain. On the basis of Maxwell's equations, the students first learn to formulate the mathematical problem of the electromagnetic plane-wave and dipole induction in full-space and over a stratified ground using a vector potential approach. Further, the students acquire the basic knowledge of integral transforms and their numerical implementation to evaluate Hankel integrals typically arising in dipole induction applications. During the practical exercises the students implement numerical routines in Julia or MATLAB to solve simple simulation problems.		
Literature:	Nabighian: Electromagnetic Methods in Applied Geophysics, Vol. 1		
Types of Teaching:	S1 (SS): Lectures (2 SWS) S1 (SS): Exercises (1 SWS)		
Pre-requisites:			
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP [30 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	SDG. MA. / Examination number: 31730	Version: 17.06.2021	Start Year: SoSe 2021
Module Name:	**Introduction to Sustainable Development Goal 12**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr.		
Lecturer(s):	Drebenstedt, Carsten / Prof. Dr. Bongaerts, Jan C. / Prof. Dr.		
Institute(s):	Institute of Mining and Special Civil Engineering Professor of Environmental & Resource Management		
Duration:	1 Semester(s)		
Competencies:	On completion of the course students shall be able to explain the Sustainable Development Goals of the United Nations (UN) with special emphasis on SDG12 “Responsible Consumption and Production” (RCP). They have an understanding about the different research and development approaches which contribute to the goal. They learn innovative solutions for current issues in society and industry and challenges for of entrepreneurship in practical responsible consumption and production and they are able to explain, analyse and value the solutions for current issues. The course is suitable as an introduction to the subject of RCP and is thus intended to be accessible to students of all study backgrounds.		
Contents:	Introduction of SDGs with special emphasis on responsible consumption and production Lectures by guest lecturers (experts from 7 European Universities) on the following topics: European Union Culture and relevance of RCP, Sustainable Resource Economics, Sociology of sustainable business and consumption and the Circular Economy with case studies including waste management, material science, recycling, mining, and energy technologies		
Literature:	UNESCO Sustainable Development Goals (https://en.unesco.org/sustainabledevelopmentgoals), further literature will be recommended by each lecturer		
Types of Teaching:	S1 (SS): Lecture Series on SDG12 Topics / Lectures (2 SWS) S1 (SS): Introduction to term paper and scientific writing / Seminar (1 SWS) S1 (SS): Preparing a term paper - selfstudy with the compilation of an academic paper (10-pages) pp 30h / project		
Pre-requisites:	**Recommendations:** Good knowledge of English (understanding of the lectures, writing skills)		
Frequency:	each semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Term paper KA: Written Exam [60 to 90 min] PVL: Active participation in class (at least 80%) PVL have to be satisfied before the examination.		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Term paper [w: 1] KA: Written Exam [w: 1]		
Workload:	The workload is 150h. It is the result of 45h attendance and 105h self-studies.		

Data:	RCPSO.MA / Examination number: 31731	Version: 11.06.2021	Start Year: SoSe 2021
Module Name:	**European Summer School on Responsible Consumption and Production (UniQuESt)**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr.		
Lecturer(s):	Drebenstedt, Carsten / Prof. Dr.		
Institute(s):	Institute of Mining and Special Civil Engineering		
Duration:	2 Month(s)		
Competencies:	After completion of the course students have acquired a deep level of expertise in the respective academic field(s) of “Responsible Consumption and Production”. Furthermore, through interactive concepts students will have attained a set of transferable skills with reference to key competencies for sustainability such as critical thinking and integrated problem-solving.		
Contents:	Basic concepts of the EURECA-PRO universities and their philosophy, the history, concepts and cultural values of Europethe Sustainable Development Goals and Circular Material Flows as well as Innovation & Social Entrepreneurship with lectures of the EURECA-PRO Universities (Montanuniversität Leoben, Universidad de Léon, Polytechneio Kritis, Universitatea din Petrosani, Politechnika Slaska, Hochschule Mittweida), from Industry and stakeholders		
Literature:	UN Sustainable Development Goals (https://en.unesco.org/sustainabledevelopmentgoals), further literature will be recommended in Summer School		
Types of Teaching:	S1 (SS): Online language lessons before the start of the presence week, Lectures at presence week / Lectures (4 d) S1 (SS): Project Work in international Groups, presentation and report / project (5 d) S1 (SS): Companies and research institutes / Excursion (1 d)		
Pre-requisites:			
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP: two presentations (individual and group) AP: Report on the results of the assignment No grades, only successful completion or submission of the report.		
Credit Points:	3		
Grade:	The examination results are not rated. The credits are given when the exams are passed successfully.		
Workload:	The workload is 90h. It is the result of 80h attendance and 10h self-studies.		

Data:	SCGEO. MA Nr. 3696 / Examination number: 30250	Version: 04.12.2019	Start Year: WiSe 2020
Module Name:	**Scientific Communication in Geoscience**		
(English):	Scientific Communication in Geoscience		
Responsible:	Scheytt, Traugott / Prof. Dr.		
Lecturer(s):	Matschullat, Jörg / Prof. Dr. Ratschbacher, Lothar / Prof. Dr. Scheytt, Traugott / Prof. Dr. Gerhards, Christian / Prof. Dr.		
Institute(s):	Institute of Mineralogy Institute of Geology Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	Upon successful completion of this course, students will have demonstrated the ability to effectively communicate scientific topics in visual and oral forms in different fields of geosciences. Further learning outcomes are the ability to engage in technical discussions on different geoscientific aspects.		
Contents:	The course will address various topics in geoscience. Students will make one oral and a poster presentation based on their choice of topics presented. These presentations will be evaluated by the class and the instructor for scientific content and clarity of expression (including use of audio-visuals). Fundamentals of oral and poster presentation will be discussed. Oral presentation and poster are presented in English.		
Literature:	• Russey W E, Ebel H F, Bliefert C (2006). How to write a successful science thesis. Weinheim: Wiley-VCH verlaf GMBH • Laws A (2007) Presentations: Presentation skills, presentation language, evaluation checklists. Oxford: Summertown • Davis M, Davis K J, Dunagan M (2012). Scientific papers and presentations. Academic press.		
Types of Teaching:	S1 (WS): Annually in the winter term / Seminar (1 SWS)		
Pre-requisites:			
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Preparation and presentation [20 min] of a poster in English		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Preparation and presentation [20 min] of a poster in English [w: 1]		
Workload:	The workload is 90h. It is the result of 15h attendance and 75h self-studies.		

Data:	FTMGWM. MA. Nr. 3635 / Examination number: 31729	Version: 04.07.2018	Start Year: WiSe 2018
Module Name:	**Hydrogeological Flow and Transport Modelling for GW-Management**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr. Hoth, Nils / Dr.		
Lecturer(s):	Berrios Amador, Danilo Hoth, Nils / Dr. Shao, Haibing / Junior-Prof.		
Institute(s):	International Centre/ Languages Institute of Mining and Special Civil Engineering Institute of Geotechnics		
Duration:	1 Semester(s)		
Competencies:	Modelling of flow, transport and chemical reactions for ground water systems. The student will be able to analyse a given situation, to choose an appropriate algorithm and software package to solve a given task. He is able to interpret complex results of the different models in relation to the practical, site related questions.		
Contents:	- Basics of hydogeological flow modelling - numerical (FDM, FEM) and analytical solutions - Importance of the conceptual model - Boundary conditions, local grid refinements - Parameterisation aspects - Basics of non-reactive transport modelling - Transport modelling of organic contaminants - application of knowledge from GW-chemistry (use of isotherme concepts) - Boundary conditions for transport equation, stability criteria for numerical solution techniques - Reactive transport modelling - 1D with PHREEQC - concept, basic understanding (with mineral phase interactions and cation exchange) - Conceptual understanding for the modelling of column flow/ transport experiments - Short introduction to Multiphase flow and density driven flow Practical exercises: computer- training block courses in relation to FDM Modelling - MODFLOW FEM- Modelling 1D-reactive transport with PHREEQC		
Literature:	Rausch et al. (2005): Solute transport modelling Domenico & Schwartz (1998): Physical and Chemical Hydrogeology. APPELO & POSTMA (2005): Geochemistry, groundwater and pollution		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): computer exercises / Exercises (2 SWS)		
Pre-requisites:	**Recommendations:** Hydrogeology for GW-Management - Basics and Advanced		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA* [90 min] AP*: Exercises - homework computer courses * In modules requiring more than one exam, this exam has to be passed		

	or completed with at least "ausreichend" (4,0), respectively.
Credit Points:	6
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA* [w: 2] AP*: Exercises - homework computer courses [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies. (120 h are spent on preparation, to prepare reports and homework in relation to the exercises and self study)

Data:	ATMOS. BA. Nr. 674 / Examination number: 31016	Version: 08.05.2019	Start Year: SoSe 2010
Module Name:	**Introduction to Atmospheric Research**		
(English):			
Responsible:	Matschullat, Jörg / Prof. Dr.		
Lecturer(s):	Matschullat, Jörg / Prof. Dr. Zimmermann, Frank / Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
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:	S1 (SS): Lectures (2 SWS) S1 (SS): Exercises (2 SWS) S1 (SS): Field training / Practical Application (1 d)		
Pre-requisites:	**Recommendations:** Introduction to Meteorology and Climatology, 2016-08-23		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min] AP: Report on the field training AP: Written homework		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 2] AP: Report on the field training [w: 1] AP: Written homework [w: 1]		
Workload:	The workload is 180h. It is the result of 68h attendance and 112h self-studies. The latter comprises preparatory work and repetitions of lecture and exercise content, and exam preparations.		

Data:	MPLATTE. MA. Nr. 2058 / Examination number: -	Version: 12.07.2014	Start Year: WiSe 2014
Module Name:	**Research Seminar: Plate Tectonics and Orogenic Processes**		
(English):			
Responsible:	Ratschbacher, Lothar / Prof. Dr.		
Lecturer(s):	Stanek, Klaus / Prof. Dr. Kroner, Uwe / PD Dr. Jonckheere, Raymond / Dr. Pfänder, Jörg / PD Dr. Ratschbacher, Lothar / Prof. Dr. Schneider, Susanne / Dr.		
Institute(s):	Institute of Geology		
Duration:	2 Semester(s)		
Competencies:	Understanding and interpreting of research literature, defining problems in tectonics, and developing own research strategies. Focus is variable: defined by the research projects and interests of the working group.		
Contents:	Analysis of orogeny		
Literature:	Publications in international journals		
Types of Teaching:	S1 (WS): Lectures (1 SWS) S1 (WS): Exercises (1 SWS) S2 (SS): Lectures (1 SWS) S2 (SS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Bachelor Geoscience		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Active participation in the seminars		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Active participation in the seminars [w: 1]		
Workload:	The workload is 150h. It is the result of 60h attendance and 90h self-studies.		

Data:	DEFAN / Examination number: 30415	Version: 06.10.2019	Start Year: WiSe 2020
Module Name:	**Deformation Analysis**		
(English):			
Responsible:	Ratschbacher, Lothar / Prof. Dr.		
Lecturer(s):	Kroner, Uwe / PD Dr. Schneider, Susanne / Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	Understanding of key techniques of structural analysis. Familiarization and critical analysis of the recent structural geology research literature.		
Contents:	Paleostress, strain, vorticity, and balanced cross-section analysis and variable topics in the research literature.		
Literature:	Publications in international journals; Twiss & Moores (2006) Structural Geology; Ramsay & Huber (1983, 1987) and Ramsay & Lisle (2002) Techniques of Modern Structural Geology; Woodward et al. (1989) Balanced Geological Cross-Sections		
Types of Teaching:	S1 (WS): Deformation analysis / Lectures (2 SWS) S1 (WS): Balanced cross section construction / Exercises (1 SWS) S1 (WS): Deformation analysis / Seminar (1 SWS)		
Pre-requisites:			
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP/KA (KA if 5 students or more) [MP minimum 30 min / KA 90 min]		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP/KA [w: 1]		
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies. The time required is 95 hours (30 hours attendance time and 65 hours self-study, i.e. preparation of exercises, seminars, and exams).		

Data:	GEOMON. BA. 128 / Examination number: 33002	Version: 05.12.2018	Start Year: WiSe 2019
Module Name:	**Geomonitoring**		
(English):			
Responsible:	Benndorf, Jörg / Prof. Dr.-Ing.		
Lecturer(s):	Benndorf, Jörg / Prof. Dr.-Ing. John, André / Dr.-Ing.		
Institute(s):	Institute for Mine Surveying and Geodesy		
Duration:	1 Semester(s)		
Competencies:	Students are able to build on their knowledge about geodetic and geotechnical measurement methods on the one hand and their understanding about the geogenic/ antropogenic process to monitor on the other hand to generate reliable and effective monitoring concepts for spatial, temporal and spatio-temporal processes. Students are able to critically analyze monitoring concepts and interpret monitoring results.		
Contents:	The lecture introduces to applications and to the methodological approach of geomonitoring. Starting on the basis of measurement and data acquisition techniques it discusses monitoring design aspects and statistical and model based inference strategies. The aim is to infer an understanding of geo-processes and their relevant spatio-temporal dynamics, including change detection. Topical application in the context of resource extraction impact- and environmental impact monitoring on different scales in time and space will be discussed and analyzed.		
Literature:	Kavanagh, B.F. (2002): Geomatics. Pearson Education, Upper Saddle River; Jain, R. (2015). Environmental Impact of Mining and Mineral Processing: Management, Monitoring, and Auditing Strategies. Butterworth-Heinemann. Fischer-Stabel, P. (2005): Umweltinformationssysteme. Wichmann, Heidelberg. de Gruijter, J., Brus, D.J., Bierkens, M.F.P., Knotters, M.(2006). Sampling for Natural Resources. Springer.		
Types of Teaching:	S1 (WS): Geomonitoring - Lecture / Lectures (2 SWS) S1 (WS): Geomonitoring - Practical exercises / Practical Application (2 SWS)		
Pre-requisites:	**Recommendations:** Geomodellierung, 2018-01-11 Grundlagen der Geoinformationssysteme, 2014-06-16 Allgemeine Grundlagen der Vermessungs- und Instrumententechnik, 2015-06-01 Ingenieurgeodäsie, 2017-09-13 Grundlagen der Geofernerkundung, 2017-12-19 Ingenieurvermessung		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP [30 min] PVL: Project report PVL have to be satisfied before the examination.		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w):		

	MP [w: 1]
Workload:	The workload is 150h. It consists of 60h supervised lecture and practical time and 90h independent work including group work, practical, self-study and preparation for examination.

Data:	CONT. MA Nr. 3669 / Examination number: 30258	Version: 11.10.2019	Start Year: WiSe 2021
Module Name:	**Contaminant Transport in Groundwater**		
(English):			
Responsible:	Scheytt, Traugott / Prof. Dr.		
Lecturer(s):	Scheytt, Traugott / Prof. Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	Learning goals are to: • Recognize the importance of groundwater flow on contaminant transport • Use knowledge of groundwater flow to predict advective and dispersive transport – travel times, concentrations and breakthrough curves • Identify key unknowns required to determine flow directions and rates and therefore advective component of transport • Properly identify both flow and transport boundary conditions from observations and information collected at a real -world site. • Distinguish between spreading, dispersion and dilution		
Contents:	Course topics include: • Introduction to groundwater contamination problems • Organic and inorganic contaminants • Overview of aqueous phase transport processes • Mathematical models of for plume migration • Analytical solutions for plume migration • Transport of reactive contaminants • Dissolution and migration of immiscible contaminants • Determination of transport parameters • Detection monitoring programs		
Literature:	Domenico, P.A.& Schwartz, F.W. (1998): Physical and Chemical Hydrogeology.- Wiley & Sons		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Introduction to Hydrogeology, 2019-10-01 Hydrogeochemistry, 2019-10-01		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA: Midterm exam [90 min] KA: Final exam [90 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA: Midterm exam [w: 1] KA: Final exam [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	NUMSIMGPY. MA Nr. 2988 / Examination number: 31516	Version: 12.02.2021	Start Year: WiSe 2019
Module Name:	**Numerical Simulation Methods in Geophysics**		
(English):			
Responsible:	Spitzer, Klaus / Prof. Dr.		
Lecturer(s):	Spitzer, Klaus / Prof. Dr.		
Institute(s):	Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	The students are introduced to fundamental problem-solving strategies in geophysics based on numerical simulation and the solution of the inverse problem. In this course they will understand how computer simulation methods work and acquire the ability to develop and program them independently.		
Contents:	The lecture Numerical Simulation Methods in Geophysics deals with the development of numerical computer simulation techniques on the basis of finite differences. The discretization is mainly discussed using a simple elliptic partial differential equation (PDE) valid for DC geoelectrics. Parabolic PDEs (transient electromagnetics and magnetotellurics) are also treated to address a wider range of geophysical applications. The subject is deepened by computer exercises and programming simple problems in Matlab.		
Literature:	Mostly articles from geophysical journals		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises (2 SWS)		
Pre-requisites:	**Recommendations:** Knowledge in Experimental Physics, Theoretical Physics, Mathematics, Numerics, Partial Differential Equations, and Geophysics		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Solution of Exercises		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Solution of Exercises [w: 1]		
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies.		

Data:	METHYDR. BA. Nr. 182 / Examination number: 31012	Version: 23.08.2016	Start Year: WiSe 2016
Module Name:	**Introduction to Meteorology and Climatology**		
(English):			
Responsible:	Matschullat, Jörg / Prof. Dr.		
Lecturer(s):	Matschullat, Jörg / Prof. Dr. Zimmermann, Frank / Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	Successful participants know the basics of Meteorology and Climatology. Understanding the most important parameters and processes and being able to interpret related results.		
Contents:	Atmospheric dynamics, radiation budget, global energy balance, meteorological parameters, global, regional, local climates and their dynamics, paleoclimatology, climate change.		
Literature:	**Barry RG, Chorley RJ (2003)** Atmosphere, weather and climate. 8th ed. Routledge; **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; **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:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises (2 SWS)		
Pre-requisites:	**Recommendations:** Höhere Mathematik I für naturwissenschaftliche Studiengänge, 2014-06-01 Höhere Mathematik II für naturwissenschaftliche Studiengänge, 2014-06-01 Physik für Naturwissenschaftler I, 2012-05-10 Physik für Naturwissenschaftler II, 2012-05-10		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 120h. It is the result of 60h attendance and 60h self-studies. The latter comprises preparatory work and repetitions of the lectures and exercises and exam preparations.		

Data:	QUAGEO. MA. Nr. 3223 / Examination number: 30308	Version: 15.07.2014	Start Year: SoSe 2012
Module Name:	**Introduction to Quaternary Geology**		
(English):			
Responsible:	Meinhold, Guido / Prof. Dr.		
Lecturer(s):	Meinhold, Guido / Prof. Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
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:	S1 (SS): Lectures (2 SWS) S1 (SS): Field trip / Practical Application (1 d)		
Pre-requisites:	**Recommendations:** Grundlagen der Geowissenschaften für Nebenhörer, 2014-02-03 Grundlagen der Geowissenschaften I, 2014-09-10 Principles of Geoscience (Secondary Subject) or equivalent moduls; for example one of the both above		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min] PVL: Successful participation in the field trip PVL have to be satisfied before the examination.		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 90h. It is the result of 38h attendance and 52h self-studies. Self-studies include assignments, preparation and wrapping up of lectures as well as preparation of examinations.		

Data:	AHYGEO. MA. Nr. 2029 / Examination number: 30251	Version: 01.10.2019	Start Year: WiSe 2019
Module Name:	**Introduction to Hydrogeology**		
(English):			
Responsible:	Scheytt, Traugott / Prof. Dr.		
Lecturer(s):	Scheytt, Traugott / Prof. Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	Upon successful completion of the course, students will have demonstrated the ability to describe groundwater within the hydrologic cylce, and define the controls of water quantity and distribution at the earths's surface. The will be able to identify the basic principles governing the flow of water in the subsurface and the interaction of water in different geological media.		
Contents:	This course provides an introduction to hydrogeology. Course topics include the hydrologic cycle, flow through the unsaturated zone, principles of groundwater flow, properties of aquifers, and an introduction to analytical methods. These analytical solutions include calculations on simple groundwater flow situations in confined and unconfined aquifers, determination of flow at the salt water / fresh water interface, and aspects on quantification of water for dewatering of construction sites and infiltration into the aquifer. Characterization of flow nets and practical applications will be discussed and demonstrated.		
Literature:	Fetter, C.W. (2001): Applied hydrogeology. Prentice-Hall, 598 p.		
Types of Teaching:	S1 (WS): Hydrogeologie - in the winter semester / Lectures (2 SWS) S1 (WS): Hydrogeologie - in the winter semester / Exercises (1 SWS) The order of the module semesters is flexible.		
Pre-requisites:			
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA: Midterm exam [90 min] KA: Final exam [90 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA: Midterm exam [w: 1] KA: Final exam [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	HYPRO. MA Nr. 3547 / Examination number: 30254	Version: 07.10.2019	Start Year: SoSe 2021
Module Name:	**Hydrogeological Project**		
(English):			
Responsible:	Scheytt, Traugott / Prof. Dr.		
Lecturer(s):	Scheytt, Traugott / Prof. Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	This project allows students to learn basic numerical modelling tools within the framework of a larger project so that they can directly apply the modelling tools. It also gives the students experience in managing data and results for a real-world project, and it gives them experience with technical writing.		
Contents:	A semester-long hydrogeological project (groundwater resource assessment) which consists of a field trip to gather relevant field data (groundwater levels, samples) at the beginning. Afterwards, numerical groundwater flow model FEFLOW will be introduced as well as further software used in hydrogeology for processing of field data. The software packages include GeODIN database software, GEBAH for determining the origin and genesis of groundwater, and the thermodynamic equilibrium modeling program PHREEQC. All these tools will be applied for modelling and interpretation of the field data and for the preparation of a report.		
Literature:	Manuals of the respective programs		
Types of Teaching:	S1 (SS): Lectures (1 SWS) S1 (SS): Field exercise / Practical Application (1 SWS) S1 (SS): Exercises (4 SWS)		
Pre-requisites:	**Recommendations:** Introduction to Hydrogeology, 2019-10-01 Hydrogeological Seminar, 2018-11-06 Hydrogeochemistry, 2019-10-01		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Prepare and submit a report on the performance and the results of the groundwater flow modeling and hydrochemical modeling.		
Credit Points:	8		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Prepare and submit a report on the performance and the results of the groundwater flow modeling and hydrochemical modeling. [w: 1]		
Workload:	The workload is 240h. It is the result of 90h attendance and 150h self-studies.		

Data:	InnoProGeom. MA. Nr. 3661 / Examination number: 30120	Version: 05.12.2018	Start Year: WiSe 2019
Module Name:	**Innovation Project Geomatics**		
(English):			
Responsible:	Benndorf, Jörg / Prof. Dr.-Ing.		
Lecturer(s):	John, André / Dr.-Ing.		
Institute(s):	Institute for Mine Surveying and Geodesy		
Duration:	1 Semester(s)		
Competencies:	After successful completion of the module, students are able to: • create innovative solutions for a complex challenge in the context of geomatics for mineral resource management as result of a team effort, • apply their project management and interpersonal communication skills to achieve innovative solutions, • develop a concept for the scenario of a market entry for the created innovative solutions and • present and defend the solution in front of an expert panel.		
Contents:	A detailed challenge will be provided inspired by topics of current interest in the larger community of geomatics in mineral resource management. For the team-project, teams will be defined by the supervisor. The teams will conduct independent work supported by regularly scheduled audits, selected expert lectures and also the possibility of consulting experts. Teams have to manage their project work including tasks, schedules and team roles independently. A solution to the challenge has to be created by applying their knowledge gained in all modules taken before, extended by individual focused auto-didactical investigations. Given a scenario that the solution should be brought to the national and/or international market, a market entry plan has to be generated. The innovative solution and the market entry plan have to be presented in a consistent report and be defended in front of an expert panel assembled by the course coordinator.		
Literature:	Typical literature will be recommended by expert lecturers and/or has to be investigated independently.		
Types of Teaching:	S1 (WS): Innovation Seminar - Expert lecures, audits, consulting hours, independent group work / Seminar (2 SWS)		
Pre-requisites:	**Mandatory:** Abschluss von Modulen des Studiengangs im Umfang von mindestens 50 LP (Proof of the successful conclusion of at least 50 LPs/ECTS of mandatory, optional and free elective modules as defined in the study documents for the MSc in Geomatics for Mineral Resource Management.)		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP*: Report on the innovation project AP*: Oral defense of the innovation project * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Credit Points:	10		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP*: Report on the innovation project [w: 2]		

	AP*: Oral defense of the innovation project [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Workload:	The workload is 300h. It consists of 30 hours audits, lectures and consulting hours, and 270 hours independent group work, report writing and preparation for examination.

Data:	HYFM. MA Nr. 2027 / Examination number: 30255	Version: 16.10.2019	Start Year: SoSe 2021
Module Name:	**Field Methods in Hydrogeology**		
(English):			
Responsible:	Scheytt, Traugott / Prof. Dr.		
Lecturer(s):	Scheytt, Traugott / Prof. Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	Student will be able to: • Select, install, and operate field equipment and sensors used in hydrogeology for hydraulic interpretation (samplers, flow measurement systems and data sondes) • Conduct field hydraulic measurements • Identify and deal with statistical outliers • Interpret existing and measured data to characterize hydrogeological units • Plan and conduct a hydrogeologic and water quality field study • Evaluate and critique hydrologic studies from published literature • Create and demonstrate a standard operating procedure for measuring a specific hydrologic process by adapting an existing hydrologic technique		
Contents:	The course teaches subjects related to the field work of groundwater hydrologist in the context of planning and execution groundwater projects. The topics covered are related to drilling of research and observation wells. The course teaches drilling methods, the concepts of well design and the field hydrologist supervision work during drilling. In addition, the course includes study of pumping methods, sampling and groundwater level measurement. These methods are demonstrated in the hydrogeological test site TU Bergakademie Freiberg. Another significant subject taught in the course is performing and interpreting pumping tests for analyzing aquifer characteristics. The subject is taught in the classroom as well as in the field, where a pumping test is performed during a day in the field. The fieldwork will be prepared through the theoretical basics of the hydraulic field tests. Particularly, pumping test, Slug & Bail-test, infiltration test, and the limitations of their uses. Other topics will be taught such direct push methods and sampling of water and solid samples required for testing building construction sites.		
Literature:	• Kruseman, G.P. & de Ridder, N.A. (1991): Analysis and Evaluation of Pumping Test Data.- ILRI Publication. • Batu, V. (1998): Aquifer Hydraulics.- Wiley & Sons.		
Types of Teaching:	S1 (SS): Lectures (1 SWS) S1 (SS): Field exercise / Practical Application (1 SWS)		
Pre-requisites:	**Recommendations:** Introduction to Hydrogeology, 2019-10-01 Hydrogeological Seminar, 2018-11-06 Hydrogeochemistry, 2019-10-01		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: For the award of credit points, it is necessary to prepare and submit a final report including interpretation of the data collected from the field.		

Credit Points:	3
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: For the award of credit points, it is necessary to prepare and submit a final report including interpretation of the data collected from the field. [w: 1]
Workload:	The workload is 90h. It is the result of 30h attendance and 60h self-studies.

Data:	RENEM. MA. Nr. / Examination number: -	Version: 07.10.2019	Start Year: WiSe 2020
Module Name:	**Rheology, Neotectonics, Microtectonics**		
(English):			
Responsible:	Ratschbacher, Lothar / Prof. Dr.		
Lecturer(s):	Kroner, Uwe / PD Dr. Schneider, Susanne / Dr.		
Institute(s):	Institute of Geology		
Duration:	2 Semester(s)		
Competencies:	Acquisition of 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.		
Contents:	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:	Variable; publications in international journals; Passchier & Trouw (2006) Microtectonics; Twiss & Moores (2006) Structural Geology.		
Types of Teaching:	S1 (WS): RENEM / Lectures (2 SWS) S1 (WS): RENEM / Seminar (1 SWS) S2 (SS): RENEM / Lectures (2 SWS) S2 (SS): RENEM / Exercises (2 SWS)		
Pre-requisites:			
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP/KA* (KA if 5 students or more) [MP minimum 30 min / KA 90 min] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Credit Points:	8		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP/KA* [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Workload:	The workload is 240h. It is the result of 105h attendance and 135h self-studies. The total time is 180 h (100 h are spent in class, remaining 80 h are spent on preparation and self-study).		

Data:	MPETMET. MA. Nr. 2057 / Examination number: 33203	Version: 28.01.2020	Start Year: WiSe 2020
Module Name:	**Petrology of Metamorphic Rocks**		
(English):			
Responsible:	Schulz, Bernhard / Prof. Dr.		
Lecturer(s):	Schulz, Bernhard / Prof. Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	Acquisation of theoretical and practical skills in the analysis of metamorphic rocks: • Identification and classification of metamorphic rocks in accordance with abundance and modal classification with optical microscopy. • Characterisation of metamorphic processes, reactions and microstructural developments by optical microscopy and scanning electron microscopy. • Detection of microstructural approaches for spatially resolving mineral-chemical analyses of metamorphic minerals. • Derivation and reconstruction of pressure-temperature-time-deformation paths in metamorphic rocks by application of geothermobarometers at metapelites and metabasites. • Interpretation of metamorphic pressure-temperature-time-deformation paths in terms of various orogenic and plate tectonic geodynamic settings. • Presentation of case studies from various metamorphic terrains.		
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:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises and seminars / Exercises (4 SWS)		
Pre-requisites:	**Recommendations:** Grundlagen der Strukturgeologie, 2015-09-07 Knowledge in optical microscopy under polarised light. The course "Polarisationsmikroskopie gesteinsbildender Minerale" under courtesy of B. Schulz and O. Frei of module "Petrology of Metamorphic Rocks".		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min] PVL: Participation in the seminars PVL have to be satisfied before the examination.		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 180h. It is the result of 90h attendance and 90h self-		

	studies.

Data:	THCH. Ma / Examination number: 35805	Version: 25.09.2019	Start Year: SoSe 2020
Module Name:	**Thermochronology**		
(English):			
Responsible:	Pfänder, Jörg / PD Dr.		
Lecturer(s):	Jonckheere, Raymond / Dr. Pfänder, Jörg / PD Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	Students have a deep knowledge of the basic principles of thermochronologic dating methods and are able to apply these in geosciences. The focus is on medium to low temperature chronometers, i.e. fission track dating, K-Ar and Ar-Ar dating as well as U-Th-He dating.		
Contents:	The course teaches the basic physical-chemical principles of various medium to low temperature chronometers and explains their applicability in the geosciences, especially in tectonics and volcanology. In particular, the fission trace dating technique, the K-Ar and Ar-Ar dating method as well as the U-Th-He dating method and their applicability to different geoscientific questions are explained. In addition to physical-chemical fundamentals, technical aspects such as fission track etching techniques or noble gas mass spectrometry are also covered, as well as the modelling of the temperature history of individual samples and sample sets. Exercises dealing in particular with the evaluation and interpretation of real data sets with the aid of various software packages deepen the acquired knowledge.		
Literature:	McDougall & Harrison, Geochronology and Thermochronology by the ^{40}Ar/^{39}Ar Method, Oxford University Press, New York, Oxford. Malusà M.G. & Fitzgerald P.G. (eds.), 2018. Fission-Track Thermochronology and its Application to Geology. Springer Textbooks in Earth Sciences, Geography and Environment. Springer Verlag. Reiners P.W., Carlson R.W., Renne P.R., Cooper K.M., Granger D.E., McLean N.M. & Schoene B., 2018. Geochronology and Thermochronology. John Wiley & Sons, Hoboken, USA, Chichester, UK.		
Types of Teaching:	S1 (SS): Lectures (2 SWS)		
Pre-requisites:	**Recommendations:** Geochronology and Isotope Geochemistry, 2019-11-25 Fundamentals in Chemistry and Physics		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP/KA (KA if 8 students or more) [MP minimum 20 min / KA 30 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP/KA [w: 1]		
Workload:	The workload is 120h. It is the result of 30h attendance and 90h self-studies.		

Data:	MPGEO MA Nr. 3699 / Examination number: 36001	Version: 08.08.2019	Start Year: SoSe 2021
Module Name:	**Continuum Multiphysics in the Geosciences**		
(English):	Continuum Multiphysics in the Geosciences		
Responsible:	Nagel, Thomas / Prof. Dr.-Ing.		
Lecturer(s):	Nagel, Thomas / Prof. Dr.-Ing.		
Institute(s):	Institute of Geotechnics		
Duration:	1 Semester(s)		
Competencies:	At the end of this module the student understands the continuum mechanical principles of describing coupled fluid flow, heat transport, deformation and reactive processes in porous, fractured and granular media and can apply them to a wide range of geoscientific and geotechnical topics. Students are capable of deriving simple models themselves and analyse the assumptions underlying existing formulations as well as understand their consequences.		
Contents:	This module introduces a structured approach to modelling coupled multiphysical processes in porous, fractured and granular geomaterials. Such models are the basis for modern numerical simulations of geoscientific and geotechnical applications such as geofluid flow, geothermal systems, geological disposal facilities, the design of geoinfrastructures, etc. The module emphasises differences between general physical principles and system-specific assumptions to train the geoscientist in a critical assessment of model-based analyses. The following aspects will be covered during the course. • Refresher on tensor calculus • Continuum theories for multiphase media • From global to local balance relations • Aspects of constitutive theories • Example 1: Coupled fluid flow and deformation in rocks and soils • Example 2: Non-isothermal effects in geothermal reservoirs Students should have a foundation in mathematics (linear algebra, calculus and PDEs) and physics (basic mechanics).		
Literature:	Kolumban Hutter and Klaus Jöhnk. Continuum methods of physical modeling: continuum mechanics, dimensional analysis, turbulence. Springer, 2004. Gerhard A. Holzapfel. Nonlinear Solid Mechanics: A Continuum Approach for Engineering. John Wiley & Sons Ltd., 2000. Wolfgang Ehlers and Joachim Bluhm. Porous media: theory, experiments and numerical applications. Springer Science & Business Media, 2002. Ray M. Bowen. “Continuum Physics”. In: ed. by A. Cemal Eringen. Academic Press, Inc., 1976. Chap. Part I – Theory of Mixtures, pp. 1–127. Peter Haupt. Continuum mechanics and theory of materials. Springer, 2002.		
Types of Teaching:	S1 (SS): Continuum Multiphysics in the Geosciences / Lectures (2 SWS)		
Pre-requisites:			
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP/KA (KA if 4 students or more) [MP minimum 30 min / KA 120 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w):		

	MP/KA [w: 1]
Workload:	The workload is 120h. It is the result of 30h attendance and 90h self-studies.

Data:	InternGeom. MA. Nr. 3660 / Examination number: 30121	Version: 05.12.2018	Start Year: WiSe 2019
Module Name:	**Industry Internship Geomatics**		
(English):			
Responsible:	Benndorf, Jörg / Prof. Dr.-Ing.		
Lecturer(s):			
Institute(s):	Institute for Mine Surveying and Geodesy		
Duration:	1 Semester(s)		
Competencies:	Students will apply their gained knowledge in practical tasks during an industry internship in a geomatic-oriented enterprise, consultant company, public authority or similar institutions institution. Students will deepen their understanding of the business context of their subject, and develop cross-disciplinary and interpersonal skills.		
Contents:	The internship contains of: • 20 days practical work in a company or related institution, • regular consultations with the university supervisor, • a short and consistent internship report, • an evaluation talk with the supervisor. The organization of an internship is in the responsibility of the student. The supervisor has to agree upfront, of the organized internship is suitable for this module.		
Literature:	n.a.		
Types of Teaching:	S1: Practical work in an enterprise, consulting company, public authority or similar institution (20 days) / project		
Pre-requisites:			
Frequency:	constantly		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP*: Written report and evaluation discussion No grading. * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Credit Points:	5		
Grade:	The examination results are not rated. The credits are given when the exams are passed successfully.		
Workload:	The workload is 150h. (20 working days)		

Data:	IndTermProj MA Nr. 3703 / Examination number: 31027	Version: 06.02.2020	Start Year: WiSe 2020
Module Name:	**Individual Term Project**		
(English):			
Responsible:	Matschullat, Jörg / Prof. Dr.		
Lecturer(s):	Matschullat, Jörg / Prof. Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	• Acquisition of skills in understanding and interpreting research literature • Obtain experience towards fluency in scientific writing about • Presenting advanced academic content in English		
Contents:	Self-chosen, yet supervisor-approved topics related to the MGEX focal areas. Within the seminar attendance time, presented talks are critically discussed and evaluated. The student paper is critically evaluated by the respective topic supervisor.		
Literature:	Literature:Publications in international journals Malmfors B, Garnsworthy P, Grossman M (2003) Writing and presenting scientific papers. Nottingham Univ Press. Heard SB (2016) The scientist's guide to writing: How to write more easily and effectively throughout your scientific career. Princeton Univ. Press. Saramäki J (2018) How to write a scientific paper: An academic self-help guide for PhD Students		
Types of Teaching:	S1 (WS): Seminar (6 SWS)		
Pre-requisites:			
Frequency:	each semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Successful participation, student paper (10 pages), oral presentation (15 min) with critical discussion		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Successful participation, student paper (10 pages), oral presentation (15 min) with critical discussion [w: 1]		
Workload:	The workload is 120h. It is the result of 90h attendance and 30h self-studies. The self-studies contain preparation and learning time (home studies) as well as writing the student papers.		

Data:	MINLI. BA.HPT.Nr / Examination number: 33208	Version: 14.07.2016	Start Year: WiSe 2016
Module Name:	**Mineral Liberation Analysis (MLA) of Mineral Resources**		
(English):			
Responsible:	Schulz, Bernhard / Prof. Dr.		
Lecturer(s):			
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	Bewertung von Erzen und Aufbereitungsprodukten aus der automatisierten Liberierungsanalyse (Mineral Liberation Analysis, MLA) mit Rasterelektronenmikroskop (REM). Aufsetzen und Spezifizierung von automatisierten Messungen mit REM. Numerische und graphische Auswertung von Datenbank-Files der automatisierten Analysen mit REM. Evaluation of metal ores and processed metal ores by automated mineral liberation analysis (MLA) by Scanning Electron Microscope (SEM). Set-up and speciation of automated measurements by SEM. Numerical and graphical assessment of databas files produced from automated SEM measurements.		
Contents:	Methodik der automatisierten REM-Analyse, Auswerte-Programme, Daten-Extraktion, Interpretation, Verfassen von Berichten an Aufbereitungsingenieure. Methods of automated SEM analysis, evaluation software, data extraction, interpretation, writing of reports for mineral processing engineers.		
Literature:	Gu, Y. (2003). Automated Scanning Electron Microscope Based Mineral Liberation Analysis. Journal of Minerals and Materials Characterization & Engineering, vol. 2, no. 1: 33–41.; Fandrich, R., Gu, Y., Burrows, D. & Moeller, K. (2007). Modern SEM-based mineral liberation analysis. International Journal of Mineral Processing, 84, 310-320.		
Types of Teaching:	S1 (WS): Mineral Liberation Analysis (MLA) of Mineral Resources - Präsentation von Verfahren der automatisierten Mineral Liberation Analysis (MLA) mit Rasterelektronenmikroskop. Teilnehmer bearbeiten Daten mit eigenen Laptops. Presentation of methods of Mineral Liberation Analysis (MLA) by Scanning Electron Microscope (SEM). Participants evaluate data by using their own Laptops. / Exercises (2 SWS)		
Pre-requisites:	**Recommendations:** Knowledge of analytical methods based on electron beam intruments		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Report with protocol on the evaluation of a Mineral Liberation Analysis by Scanning Electron Microscope (SEM)		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Report with protocol on the evaluation of a Mineral Liberation Analysis by Scanning Electron Microscope (SEM) [w: 1]		
Workload:	The workload is 90h. It is the result of 30h attendance and 60h self-studies. Der Zeitaufwand beträgt 60 h und setzt sich zusammen aus 30 h Präsenzzeit und 30 h Selbststudium. Letzteres umfasst die Anfertigung		

	des Berichts mit Protokoll. Expenditure of time is 60 hrs. This is composed of 30 hrs presence in class and 30 hrs homework, including preparation of report with protocol.

Data:	GSTROE. BA. Nr. 514 / Examination number: -	Version: 11.10.2016	Start Year: WiSe 2016
Module Name:	**Geo-fluid Modelling**		
(English):			
Responsible:	Amro, Mohd / Prof. Dr.		
Lecturer(s):	Shao, Haibing / Junior-Prof.		
Institute(s):	Institute of Geotechnics Institute of Drilling Engineering and Fluid Mining		
Duration:	1 Semester(s)		
Competencies:	The idea of this module is to teach basic concepts behind the numerical modelling of fluid flow processes in the subsurface. It is designed to give the students hands-on experience of setting up and running numerical models. With this module, the students should be able to conduct numerical analysis on geo-fluid related processes.		
Contents:	The lecture will introduce the physical processes of fluid flow, mass and heat transport in the subsurface. Their underlying governing equations will be explained in details. Particular focus will be the numerical solution of these partial differential equations, with finite element method. With help from the lecturer, the students will be asked to work in small groups and conduct 3 case studies on computer (Computerpraktikum). These studies need to be completed by constructing and simulating numerical models with the open-source software OpenGeoSys. The students are expected to analyze the modelling results and summarize them in written reports. The modelling skills learned in this module can be applied in Soil protection and agriculture (Fluid flow in the subsurface); Mining operation (Groundwater drainage); Geotechnics; Groundwater management; Exploitation of geothermal energy; Oil and gas reservoir engineering.		
Literature:	Fetter, C.W. (1999) Contaminant Hydrogeology, Prentice Hall, ISBN: 9780137512157. Kolditz, O., Görke, U.-J., Shao, H., Wang, W. (Eds.) (2012) Thermo-Hydro-Mechanical-Chemical Processes in Porous Media, Benchmarks and Examples. Springer. ISBN: 9783642271762.		
Types of Teaching:	S1 (WS): Lectures (1 SWS) S1 (WS): Computerpraktikum / Practical Application (1 SWS) S1 (WS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Allgemeine Hydrogeologie, 2016-08-22 Partielle Differentialgleichungen für Ingenieure und Naturwissenschaftler, 2009-05-27 Grundkenntnisse der Geohydraulik, PC-Grundkenntnisse		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min] AP: Assignment AP: Practical assignment		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		

	AP: Assignment [w: 1] AP: Practical assignment [w: 2]
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies. Self-study includes preparation and follow-up work in class instruction as well as preparation for and completion of the assignments as well as the written exam, i.e. “Klausurarbeit”.

Data:	SUSBFR. MA. Nr. 090 / Examination number: 35706	Version: 26.03.2021	Start Year: SoSe 2021
Module Name:	**Environmental Geotechnics**		
(English):			
Responsible:	Butscher, Christoph / Prof. Dr.		
Lecturer(s):	Butscher, Christoph / Prof. Dr.		
Institute(s):	Institute of Geotechnics		
Duration:	1 Semester(s)		
Competencies:	Students become familiar with topics of environmental geotechnics. They know the relevance and consequences of abandoned contaminated sites, waste disposal and old mining. They understand the respective processes and can discuss and plan mitigation measures.		
Contents:	Waste disposal: scientific fundamentals; legal framework; geological-hydrogeological aspects of construction and operation of landfills, industrial sedimentation basins and deep geological repositories; computer-aided stability analysis; preparation of a geotechnical report. Old mining: legal framework; exploration methods; methods of assessment, remediation and securing; regional topics in Saxony (lignite open pits, uranium mining); water management of flooded underground mines; international case studies.		
Literature:	Price, D.G.: Engineering Geology, Principles and Practice, Springer-Verlag, Berlin-Heidelberg, 2009 Suthersan et al. (2017): Remediation Engineering. CRC Press, Boca Raton Daniel (ed.) (1993): Geotechnical Practice for Waste Disposal. Chapman & Hall, London		
Types of Teaching:	S1 (SS): Waste disposal - Waste disposal / Lectures (1 SWS) S1 (SS): Old mining - Old mining / Lectures (1 SWS)		
Pre-requisites:	**Recommendations:** B.Sc. in Geosciences or Geo-Engineering; Basic Knowledge of Geosystems		
Frequency:	each semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA: Environmental Geotechnics [120 min]		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA: Environmental Geotechnics [w: 1]		
Workload:	The workload is 90h. It is the result of 30h attendance and 60h self-studies. Latter includes the review of the teached materials and exam preparation.		

Data:	BOSEI. MA. Nr. 3531 / Examination number: 32602	Version: 22.02.2021	Start Year: WiSe 2015
Module Name:	**Fundamentals of Borehole Seismics and Acoustics**		
(English):			
Responsible:	Buske, Stefan / Prof. Dr.		
Lecturer(s):	Geerits, Tim / Dr.		
Institute(s):	Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	At the end of the module students are able to • explain the principles of borehole seismic methods • apply and practice borehole seismic methods • explain relevant terms in English.		
Contents:	The course consists of two parts. Both parts include international literature and relevant terms in English. The first part (*Borehole Acoustics*) comprises the theoretical basics of wave propagation in boreholes and the analysis to characterize the direct vicinity of the borehole. This includes *borehole acoustic tools* (wireline, logging-while-drilling), *slowness analysis* (slowness-time/frequency-coherency, dispersion corrections) and wave propagation in and around fluid-filled borehole and *imaging away from the borehole* (data in CSG/CRG domain. The second part comprises the principles of *Borehole Seismics* presented with the help of synthetic and real data and examples. This includes *Basic VSP theory, VSP geometries/acquisition/planning/QC, checkshot processing, acoustic log calibration & synthetic seismograms, zero-offset VSP processing, VSP imaging, case study inversion test and VSP multiples, VSP anisotropy/AVO.*		
Literature:	Tang, X.M., Cheng, C.H., Quantitative borehole acoustic methods. Elsevier, Amsterdam, 2004.		
Types of Teaching:	S1 (WS): 1 week intensive course / Lectures (1 Wo)		
Pre-requisites:			
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min]		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 90h. It is the result of 40h attendance and 50h self-studies.		

Data:	PGEODAT. MA. NR. 139 / Examination number: 30712	Version: 07.10.2019	Start Year: WiSe 2020
Module Name:	**Multivariate Statistics and Geostatistics**		
(English):	Multivariate Statistics and Geostatistics		
Responsible:	Gerhards, Christian / Prof. Dr.		
Lecturer(s):	Gerhards, Christian / Prof. Dr. Tolosana-Delgado, Raimon / PD Dr.		
Institute(s):	Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	The students will obtain a deepened knowledge on theoretical aspects of multivariate geodata analysis as well as practical experience by application of the methods to actual data sets and interpretation of the results.		
Contents:	- theoretical concepts of geodata modeling - methods of multivariate statistics (e.g., analysis of variance, principal component analysis) - geostatistical interpolation and simulation Depending on the audience, the lecture can be held in German.		
Literature:	Chilès, J.-P., Delfiner, P., 2012, Geostatistics - Modeling Spatial Uncertainty, 2nd Ed., Wiley Schabenberger, O., Gotway, C.A., 2005, Statistical Methods for Spatial Data Analysis, Taylor & Francis Sama, D.D., 2009, Geostatistics with Applications in Earth Sciences, 2nd Ed., Springer		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises (2 SWS) S1 (WS): Practical Application (2 SWS)		
Pre-requisites:	**Recommendations:** Introductory lecture on data analysis/statistics, Mathematics for Engineers 1 + 2		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Project and project documentation		
Credit Points:	9		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Project and project documentation [w: 1]		
Workload:	The workload is 270h. It is the result of 90h attendance and 180h self-studies.		

Data:	EEG MA Nr. 2035 / Examination number: 35705	Version: 28.01.2020	Start Year: WiSe 2020
Module Name:	**Environmental Engineering Geology**		
(English):			
Responsible:	Butscher, Christoph / Prof. Dr.		
Lecturer(s):	Butscher, Christoph / Prof. Dr.		
Institute(s):	Institute of Geotechnics		
Duration:	2 Semester(s)		
Competencies:	Students become familiar with topics of environmental geotechnics. They know the relevance and consequences of abandoned contaminated sites, waste disposal and old mining. They understand the respective processes and can discuss and plan mitigation measures. They can scientifically present topics in the area of old mining. They can prepare survey reports of legacy contamination and of stability analyses including risk assessment and proposal of mitigation measures.		
Contents:	Legacy contamination and soil remediation: Introduction to legacy contamination; legal basics; assessment of abandoned contaminated sites; properties of typical contaminants; soil remediation techniques; post-rehabilitation maintenance; land recycling; legacy contamination in Saxony; preparation of a survey report. Waste disposal: scientific fundamentals; legal framework; geological-hydrogeological aspects of construction and operation of landfills, industrial sedimentation basins and deep geological repositories; computer-aided stability analysis; preparation of a geotechnical report. Old mining: legal framework; exploration methods; methods of assessment, remediation and securing; regional topics in Saxony (lignite open pits, uranium mining); water management of flooded underground mines; international case studies.		
Literature:	Suthersan et al. (2017): Remediation Engineering. CRC Press, Boca Raton Daniel (ed.) (1993): Geotechnical Practice for Waste Disposal. Chapman & Hall, London		
Types of Teaching:	S1 (WS): Legacy contamination and soil remediation / Lectures (1 SWS) S1 (WS): Legacy contamination and soil remediation / Exercises (1 SWS) S2 (SS): Waste disposal / Lectures (1 SWS) S2 (SS): Waste disposal / Exercises (1 SWS) S2 (SS): Old mining / Lectures (1 SWS) S2 (SS): Old mining / Exercises (1 SWS)		
Pre-requisites:			
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA* [120 min] AP*: Homework (includes two reports and one presentation) * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Credit Points:	8		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA* [w: 1] AP*: Homework (includes two reports and one presentation) [w: 1] * In modules requiring more than one exam, this exam has to be passed		

	or completed with at least "ausreichend" (4,0), respectively.
Workload:	The workload is 240h. It is the result of 90h attendance and 150h self-studies.

Data:	GEOCHEM. BA. Nr. 038 / Examination number: 31023	Version: 19.10.2009	Start Year: SoSe 2010
Module Name:	**Introduction to Geochemistry**		
(English):			
Responsible:	Matschullat, Jörg / Prof. Dr.		
Lecturer(s):	Pleßow, Alexander / Dr. Matschullat, Jörg / Prof. Dr. Kleeberg, Reinhard / Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	Basic understanding of the chemistry of planet Earth and other celestial bodies. From sampling via sample preparation and analysis - following the selection of appropriate methods - the accompanying short lectures and practical training units deliver the necessary technical-analytical knowledge.		
Contents:	Starting with nucleosynthesis and the formation of solar systems, the periodic system of the elements is being introduced and the chemical differentiation of our planet discussed. Thereafter, all Earth spheres (atmo-, hydro-, pedosphere, oceans and marine geochemistry, sediments and sedimentary rocks) are being introduced and discussed. In parallel, a solid base is being laid for an understanding of modern inorganic analytics and resulting demands for sampling and sample preparation, the selection of appropriate analytical methods as well as quality control and quality assurance.		
Literature:	Faure G (1998) Principles and applications of geochemistry. 2nd ed. Prentice Hall, New Jersey; Heinrichs H, Herrmann AG (1990) Praktikum der Analytischen Geochemie. Springer Verlag, Heidelberg; Jenkins R, Snyder R (1996) Introduction to X-Ray Powder Diffractometry: Chemical Analysis 138: 432 p.; John Wiley & Sons		
Types of Teaching:	S1 (SS): Introduction to Geochemistry / Lectures (2 SWS) S1 (SS): Methoden der geochemisch-mineralogischen Analytik / Lectures (1 SWS)		
Pre-requisites:	**Recommendations:** Grundlagen der Geowissenschaften I, 2015-11-17 Einführung in die Mineralogie, 2015-04-17		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies. This encompasses the preparation for lectures and tests as well as post-lecture work.		

Data:	PTMP.MA / Examination number: 35806	Version: 25.09.2019	Start Year: SoSe 2020
Module Name:	**Plate Tectonics and Magmatic Processes**		
(English):			
Responsible:	Pfänder, Jörg / PD Dr.		
Lecturer(s):	Pfänder, Jörg / PD Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	Understanding the magmatic processes that are active in different recent geodynamic settings. Assignment of certain geochemical and petrological rock signatures to specific plate tectonic settings. Understanding of material flows in geologically active regions over space and time.		
Contents:	Based on basic geological, petrological and geochemical knowledge, this course deals with the material processes and physical parameters that lead to the formation of melts and corresponding rock types in different geodynamic settings. It thus builds on the module "Trace elements in magmatic systems". It covers mid-ocean ridge systems, subduction zones, island arcs, active continental margins as well as intra-plate regions and orogens. One focus is on material flows over space and time and the associated shifts in the chemical composition of different terrestrial reservoirs. In addition, processes are discussed that have led to the formation of continental crust and the enrichment of economically relevant elements from the Archean to present. The tools used are major- and trace-elements of various rocks and minerals as well as isotope data such as Hf-Nd-Sr-Pb-Mo-W isotopes, Li-7, Be-10, Al-26 and Ar-38 anomalies, or U-Th decay series imbalances.		
Literature:	Wilson, M., Igneous Petrogenesis, Wiley; Allègre, C.J., Isotope Geology; Turekian, K. & Holland, H., Treatise on Geochemistry, Elsevier; Primary literature		
Types of Teaching:	S1 (SS): Lectures (2 SWS)		
Pre-requisites:	**Recommendations:** Trace Elements in Magmatic Systems, 2019-09-25		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP/KA (KA if 8 students or more) [MP minimum 20 min / KA 30 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP/KA [w: 1]		
Workload:	The workload is 120h. It is the result of 30h attendance and 90h self-studies.		

Data:	UWGEOCH. MA. Nr. 2065 / Examination number: 31020	Version: 10.05.2019	Start Year: SoSe 2020
Module Name:	**Environmental Geochemistry**		
(English):			
Responsible:	Matschullat, Jörg / Prof. Dr.		
Lecturer(s):	Matschullat, Jörg / Prof. Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	Students learn to access, discern and judge natural and anthropogenic processes in most environmental compartments, related sources, sinks, retention processes and cycles.		
Contents:	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:	S1 (SS): Lectures (2 SWS) S1 (SS): Seminar (2 SWS) S1 (SS): Excursion (2 d)		
Pre-requisites:	**Recommendations:** Introduction to Geochemistry, 2009-10-19 Basic (geo)chemical knowledge is needed.		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min] AP: Student paper		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 2] AP: Student paper [w: 1]		
Workload:	The workload is 150h. It is the result of 76h attendance and 74h self-studies. The latter comprises literature evaluation, home study, and preparation for the exam(s).		

Data:	GEOGEL. MA. Nr. 2021 / Examination number: 30902	Version: 12.07.2010	Start Year: WiSe 2010
Module Name:	**Field Exercise**		
(English):			
Responsible:	Stanek, Klaus / Prof. Dr.		
Lecturer(s):	Gloaguen, Richard / Dr. Stanek, Klaus / Prof. Dr. Kroner, Uwe / PD Dr. Tichomirowa, Marion / Prof. Dr. Schulz, Bernhard / Prof. Dr. Ratschbacher, Lothar / Prof. Dr.		
Institute(s):	Institute of Geology Institute of Mineralogy		
Duration:	1 Semester(s)		
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:	S1 (WS): Fieldwork with applications of various methods in tectonics, literature and remote sensing preparation, sampling, field report preparation / Practical Application (8 SWS)		
Pre-requisites:	**Recommendations:** Bachelor-level field exercises		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Written report		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Written report [w: 1]		
Workload:	The workload is 150h. It is the result of 120h attendance and 30h self-studies. The latter is spend on preparation and self study.		

Data:	SUSRAD. MA. Nr. 2091 / Examination number: 34103	Version: 06.07.2016	Start Year: SoSe 2015
Module Name:	**Radioactivity**		
(English):			
Responsible:	Mischo, Helmut / Prof. Dr.-Ing.		
Lecturer(s):	Mischo, Helmut / Prof. Dr.-Ing. Weyer, Jürgen / Dr.-Ing.		
Institute(s):	Institute of Mining and Special Civil Engineering		
Duration:	1 Semester(s)		
Competencies:	Basic knowledge of radioactive decay, measurement of radiation, units, technique of sampling, decontaminations techniques, ventilation		
Contents:	• Radioactive decay • Special consideration of Rn222 and Radon decay • Products • ICRP principles • Protection against radiation • Measurement and sampling • Pathways • Risk analysis • Optimal remedial procedures • Decontamination techniques • Ventilation systems • Gases • Airway resistance		
Literature:	ICRP publications, especially ICRP 43 and 65, conference proceedings		
Types of Teaching:	S1 (SS): 45 hours / Lectures (3 SWS) S1 (SS): seminars and practical training, excursions to rehabilitation sites - 45 hours / Practical Application (3 SWS)		
Pre-requisites:	**Recommendations:** Fundamentals in engineering and natural science		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP/KA (KA if 15 students or more) [MP minimum 30 min / KA 120 min] PVL: Project report PVL have to be satisfied before the examination.		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP/KA [w: 1]		
Workload:	The workload is 180h. It is the result of 90h attendance and 90h self-studies. The latter includes industrial placement.		

Data:	Geomod. MA. Nr. 638 / Examination number: 30114	Version: 05.12.2018	Start Year: WiSe 2019
Module Name:	**Geomodelling – Geostatistics for Natural Resource Modelling**		
(English):			
Responsible:	Benndorf, Jörg / Prof. Dr.-Ing.		
Lecturer(s):			
Institute(s):	Institute for Mine Surveying and Geodesy		
Duration:	1 Semester(s)		
Competencies:	After successful completion of the course, students are able to: - explain the theoretical foundation of spatial data analysis, geostatistical model building and estimation, - apply geostatistical methods in the context of estimating natural re-sources/reserves, - critically evaluate model assumptions of different estimation and simuation method and choose suitable methods for specific applications, - discuss the critical character of the SMU-size to recoverable reserves, - conduct a resource/reserve estimation in a simple case study.		
Contents:	Importance of Resource Modelling and Estimation in the Value Chain of Mining, Uni-variate and Multi-variate Explorative Data Analysis, Analysis of Spatial Continuity, the Spatial Random Function Model, Model Assumptions of Stationarity and Ergodicity, Inference of a Spatial Random Function using unbiased Estimators, Dealing with Preferential Sampling, Variography and Variogram Modeling, Simple Methods for Spatial Estimation including the Polygon Method, Triangulation, Inverse Distance Power and Polynomial Regression, Geostatistical Methods for Spatial Estimation including Simple Kriging, Ordinary Kriging and Universal Kriging, Integrating Secondary Information into Spatial Modeling using Techniques of Co-Kriging, other methods including Indicator Kriging and Block Kriging, Introduction in Modeling spatial Uncertainty using Conditional Simulation, the Method of Sequential Gaussian Simulation, Geostatistical Considerations in Estimating Reserves in Terms of Volume-Variance Relationship for defining Smallest Minable Units and Grade Tonnage Curves, Applications in Mining Cases, Introduction to CRIRSCO-based International Reporting standards (example JORC Code).		
Literature:	M. Armstrong: “Basic Linear Geostatistics”, Springer Verlag; H. Akin, H. Siemes: „Praktische Geostatistik“, Springer Verlag; A. G. Journel, and C.J. Huijbregts, 1978, Mining Geostatistics, Academic Press; P. Goovaerts: “Geostatistics for Natural Resource Evaluation“, Oxford University Press; T. Schafmeister: “Geostatistik für die hydrogeologische Praxis“, Springer Verlag		
Types of Teaching:	S1 (WS): Geomodelling – Geostatistics for natural resource modelling - Lecture / Lectures (2 SWS) S1 (WS): Geomodelling – Geostatistics for natural resource modelling - Practical work in the computer lab / Practical Application (2 SWS)		
Pre-requisites:	**Recommendations:** Angewandte Statistik, 2021-11-22 Infinitesimalrechnung, An introductory course in statistics.		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA* [90 min]		

	AP*: Set of assignments * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Credit Points:	5
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA* [w: 2] AP*: Set of assignments [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Workload:	The workload is 150h. It consists of 60h presence time (lectures and practical), and 90 hours independent work including group work, practical, self-study and preparation for examination.

Data:	GWCGWMA. MA. Nr. 3631 / Examination number: 31725	Version: 04.07.2018	Start Year: SoSe 2019
Module Name:	**Ground Water Chemistry for GW-Management - Advanced**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr. Hoth, Nils / Dr.		
Lecturer(s):	Hoth, Nils / Dr. Klamerth, Nikolaus / Dr. rer. nat.		
Institute(s):	Institute of Mining and Special Civil Engineering Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	Students will gain confidence and experience in sampling, sample handling (conservation, storage) as well as measuring field parameters. Furthermore they enhance their knowledge about analytical techniques for groundwater. He gets a general understanding with respect to the use of isotopes to trace flow and reactive systems in the subsurface (within aquifers). In general they practice and deepen their knowledge about handling of photometry and other analytical techniques.		
Contents:	- different analytical techniques wet chemistry (gravimetry, volumetry), spectroscopy, chromatography, electro-analysis - in detail: acid-base titration, UV-VIS and IR-spectroscopy - AAS, AES (MP-AES), hXRF Part of hydrogeochemical modelling - with PHREEQC speciation of a water sample , ionic balance error, saturation index equilibrium to mineral phases, interaction with a gas phase , cation exchange etc. Lecture groundwater chemistry (sampling and analytical techniques) combined with laboratory exercises Determination of limit of detection and limit of quantification. Using photometry for different species now again , in more detail Lecture isotope hydrology: Basics of isotope measurements in context to trace subsurface flow systems. Stable (H, O, C, N, S) isotopes in aquatic systems. Explanation of investigations on different test sites (field examples) – study and interpretation of flow and reactive systems.		
Literature:	Stumm & Morgan (1996): Aquatic Chemistry. John, Wiley & Sons; APPELO & POSTMA (1996) or (2005): Geochemistry, groundwater and pollution, Balkema. CLARK & FRITZ (1997): Environmental Isotopes in Hydrogeology, Lewis Publishers.		
Types of Teaching:	S1 (SS): GW chemistry - analytical techniques / Lectures (2 SWS) S1 (SS): Stable Istope hydrology - trace flow and reactions / Lectures (1 SWS) S1 (SS): groundwater chemistry - advanced practica / Practical Application (1 SWS)		
Pre-requisites:	**Recommendations:** Ground Water Chemistry for GW-Management - Basics, 2018-07-04		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA*: GW chemistry - analytical techniques [90 min]		

	KA*: Isotope hydrology - trace flow and reaction [90 min] AP*: practical lab reports * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Credit Points:	6
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA*: GW chemistry - analytical techniques [w: 1] KA*: Isotope hydrology - trace flow and reaction [w: 1] AP*: practical lab reports [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies. (120 h are spent on preparation, preparing the reports for the lab classes and self study)

Data:	EARTHSY. BA. Nr. 748 / Examination number: 31014	Version: 03.05.2011	Start Year: SoSe 2010
Module Name:	**Introduction to Earth System Science**		
(English):			
Responsible:	Matschullat, Jörg / Prof. Dr.		
Lecturer(s):	Matschullat, Jörg / Prof. Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	Successful participants obtain an understanding for the complexity of environmental challenges, and for the individual parts of the geosphere and their interactions – the prerequisite for any responsible work in many environmental fields. In addition, the module assists in learning how to write short scientific communications.		
Contents:	The lecture covers the theoretical background of many typical tasks in environmental research and practice. Examples from all environmental compartments are being discussed from the initial concept via sampling to the interpretation of results. A complimentary seminar trains the partticipants to write scientific texts on lecture topics.		
Literature:	Berner EK, Berner RA (1996) Global environment. Water, air, and geochemical cycles. Prentice Hall; 376 p. Boeker E, van Grondelle R (2001) Environmental science. Physical principles and applications. Wiley; 362 p. Ernst WG (ed, 2000) Earth Systems. Processes and Issues. Cambridge University Press, Cambridge; 566 p. Goudie A (2006) The human impact on the natural environment. 6th ed. Blackwell Publishing; 357 p. Matschullat J, Müller G (eds, 1994) Geowissenschaften und Umwelt. Springer Verlag, Heidelberg; 364 S.		
Types of Teaching:	S1 (SS): Lectures (2 SWS) S1 (SS): Incl. Excursion / Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** None		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min] AP: Written Essay AP: Written Essay		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 2] AP: Written Essay [w: 2] AP: Written Essay [w: 1]		
Workload:	The workload is 90h. It is the result of 45h attendance and 45h self-studies.		

Data:	MINING. MA. Nr. 2914 / Examination number: 31703	Version: 28.04.2010	Start Year: WiSe 2010
Module Name:	**Introduction to Mining**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr.		
Lecturer(s):	Drebenstedt, Carsten / Prof. Dr.		
Institute(s):	Institute of Mining and Special Civil Engineering		
Duration:	1 Semester(s)		
Competencies:	Basic knowledge in role of mining and mining engineering processes and relationship to other disciplines; Understanding of sustainable development in mining industry: balance between mining production, social development and environment protection.		
Contents:	Mining is one of the oldest and most important sectors in our civilisation building the backbone of many further industries. Developed economies highly dependent on mineral and energy imports. The world knows many wars about reserves and resources. Mining production employs million of workers worldwide and is especially in developing countries an important source of income. On other side mining has a great influence to the environment and social sphere. Mining is today a modern industry with high standard in working safety and environment protection. The largest machines the world knows are operating in open pit mines. The lecture introduces this interesting and important world of mining and gives an understanding for economic, social and technical processes. Case studies will illustrate the practical side of knowledge application.		
Literature:	Hartmann et al: SME Mining Engineering Handbook, Vol. 1 and 2, Society of Mining, Metallurgy and Exploration, Littleton, Colorado, actual edition Hustrulid, Kuchta: Open pit mine planning and design, Balkema, latest edition		
Types of Teaching:	S1 (WS): Lectures (1 SWS) S1 (WS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** No requirements.		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min]		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 90h. It is the result of 30h attendance and 60h self-studies.		

Data:	HYDCH. MA Nr. 2025 / Examination number: 30252	Version: 01.10.2019	Start Year: WiSe 2020
Module Name:	**Hydrogeochemistry**		
(English):			
Responsible:	Scheytt, Traugott / Prof. Dr.		
Lecturer(s):	Scheytt, Traugott / Prof. Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	The goals for this course are 1) to gain a good understanding of basic principles of inorganic groundwater chemistry; 2) to develop adequate quantitative skills; 3) be able to manipulate and analyze both hydrogeologic and geochemical data; and 4) to develop adequate communication skills so that you can prepare technical reports and presentations.		
Contents:	This course is about natural processes in groundwater and the impacts of human activities on groundwater. The course is providing a theoretical and practical background necessary to address groundwater chemistry and contamination problems. The course will emphasize the chemistry of natural waters with the important reactions affecting groundwater chemistry. These reactions include dissolution and precipitation, sorption and ion exchange and redox processes. There are take-home exercises related to all course parts, which will be explained and discussed in the class.		
Literature:	Appelo, C.A.J. & Postma, D. (2005): Geochemistry, Groundwater, and Pollution.- Balkema		
Types of Teaching:	S1 (WS): Vorlesung / Lectures (2 SWS) S1 (WS): Übung / Exercises (1 SWS)		
Pre-requisites:			
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA: Midterm exam [90 min] KA: Final exam [90 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA: Midterm exam [w: 1] KA: Final exam [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	SUSLSE. MA. Nr. 088 / Examination number: 60217	Version: 01.01.2014	Start Year: SoSe 2014
Module Name:	**Licensing, Stakeholder Involvement and Expectation Management**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr. Bongaerts, Jan C. / Prof. Dr.		
Lecturer(s):	Bongaerts, Jan C. / Prof. Dr.		
Institute(s):	Professor of Environmental & Resource Management Institute of Mining and Special Civil Engineering		
Duration:	1 Month(s)		
Competencies:	Upon completion of industrial activity at a given site (e.g., mining, chemical production), liabilities must be investigated, assessed, and removed/remediated with respect to safe usage in the future. This is an iterative decision process involving many parties, often with conflicting interests and different ways to influence the outcome of this decision process. This module addresses the need to handle public inquiries, concerns, or conflicts on environmental and remediation issues. It shows environmental managers, regulators and public servants in this field, and consultants at industrial facilities how to identify the causes of environmental issues and concerns, create community relations programs to address issues or establish a proactive dialogue to prevent or minimise future environmental conflicts, and handle technical and risk communication in a highly efficient manner. The aspects which have to be observed within such a complex process include (but are not restricted to) • legal requirements, • economic conditions, • environmental objectives and regional political aims, • communication, information management and negotiation methods. The subjects will be presented using overview texts and summary texts, graphs, and case studies. Discussions among students and between tutors and students will be facilitated by electronic means of communication such as email and a web-based discussion platform. Special emphasis will be laid on presentation of selected cases and discussion of critical parameters like timing cost, communication problems, information handling. Students will be trained in groups and individually. This module will also feature checklists, forms and worksheets as tools for further reference in the daily work.		
Contents:	Expectations by the various stakeholders are identified as driving forces within a remediation project. The management of expectations of all involved stakeholders as well as transparent assessment and decision procedures are a core ingredient of this module, and will be discussed using case studies from a great variety of real-world projects and experiences. Students will be encouraged to contribute their personal and professional experiences to the module in order to both focus the content to the specific needs of the audience and to demonstrate the great cultural variety of negotiation and management styles.		
Literature:	John D. Leshy: The Mining Law: A Study in Perpetual Motion, Resources for the Future, ISBN: 0915707268, ISBN-13: 9780915707263, 542pp, 1987;		

	Warren Richard Plunkett, Raymond F. Attner, Gemmy Allen: Management: Meeting and Exceeding Customer Expectations, Thomson – South Western, 2005, ISBN 0324259131, 742 pp
Types of Teaching:	S1 (SS): Lectures (4 d) S1 (SS): Seminar (1 d)
Pre-requisites:	**Recommendations:** No previous knowledge of management is required.
Frequency:	yearly in the summer semester
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [120 min] PVL: Preparation and presentation of a project on a practical case PVL have to be satisfied before the examination.
Credit Points:	6
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]
Workload:	The workload is 180h. It is the result of 40h attendance and 140h self-studies.

Data:	LIMNO. MA. Nr. 3390 / Examination number: 31022	Version: 29.04.2021	Start Year: SoSe 2011
Module Name:	**Limnology**		
(English):			
Responsible:	Lau, Maximilian / JProf.		
Lecturer(s):	Pleßow, Alexander / Dr. Lau, Maximilian / JProf.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	Limnology as the historical base of modern ecology offers a tightly knit dissemination of physical-chemical-biological fundamentals in theory and practical applications. Successful participants perceive limnological challenges and are capable of tackling elated problems independently. They are qualified to work in respective professional applications.		
Contents:	Fundamentals and applications of Limnology. Physical and chemical processes (Light, heat, movement, element cycles). Organisms and their interaction (plankton, food webs, (partial) ecosystems. Applied Limnology (Methods and case studies in theory and practicle applications, e.g., eutrophication, acidification, litoral damages)		
Literature:	O'Sullivan PE, Reynolds CS (2003) The Lakes Handbook, I und II; Blackwell Science. Schwoerbel J, Brendelberger H (2005) Einführung in die Limnologie, 9. Aufl., Gustav Fischer. Uhlmann D, Horn W (2001) Hydrobiologie der Binnengewässer; Ulmer 2206. Wetzel RG, Likens GE (eds, 1991) Limnological Analyses, 2nd ed., Springer. Wetzel RG (2001) Limnology, 3rd ed. Elsevier. Aktuelle Literatur für Seminarreferat		
Types of Teaching:	S1 (SS): Lectures (2 SWS) S1 (SS): Excursion (5 d)		
Pre-requisites:	**Recommendations:** Einführung in die Prinzipien der Biologie und Ökologie, 2014-03-11 Physik für Naturwissenschaftler II, 2014-06-02 Physik für Naturwissenschaftler I, 2014-06-02 Allgemeine, Anorganische und Organische Chemie, 2016-04-20		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min] PVL: Report (field work) PVL have to be satisfied before the examination.		
Credit Points:	5		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 150h. It is the result of 70h attendance and 80h self-studies. These self studies include preparation for lectures and field work.		

Data:	ABGP. MA. Nr. 3532 / Examination number: 32603	Version: 22.02.2021	Start Year: SoSe 2016
Module Name:	**Advanced Methods in Borehole Seismics and Acoustics**		
(English):			
Responsible:	Buske, Stefan / Prof. Dr.		
Lecturer(s):	Geerits, Tim / Dr.		
Institute(s):	Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	The aim of this course is to learn the principles and the applications of advanced borehole geophysics methods with focus on seismic techniques and to describe relevant terms in English.		
Contents:	Beside an introduction to the most important methods in borehole geophysics (*Formation Evaluation Tool, e.g. resistivity, NMR, formation pressure testing and sampling, and their standard deliverables*), this course comprises the following topics: Logging While drilling (LWD) multipole borehole acoustic array tools and their measurement principles; Borehole wave types (head waves and guided waves, e.g. Stoneley waves, flexural waves, etc.); Intrinsic azimuthal anisotropy (HTI) from cross-dipole wireline shear wave measurements; Shear wave imaging away from the wellbore using cross-dipole wireline measurements; International literature and relevant terms in English.		
Literature:	Tang, X.M., Cheng, C.H., Quantitative borehole acoustic methods. Elsevier, Amsterdam, 2004.		
Types of Teaching:	S1 (SS): 1 week intensive course / Lectures (1 Wo)		
Pre-requisites:			
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min]		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 90h. It is the result of 40h attendance and 50h self-studies.		

Data:	ATMOSCL. MA. Nr. 3031 / Examination number: 31025	Version: 08.05.2019	Start Year: WiSe 2010
Module Name:	**Basics of Climate Change**		
(English):			
Responsible:	Matschullat, Jörg / Prof. Dr.		
Lecturer(s):	Matschullat, Jörg / Prof. Dr. Zimmermann, Frank / Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	**Fachliche Qualifikationsziele:** Die Studierenden können: • Physikalische und chemische Grundlagen des Klimasystems inklusive bedeutender Wechselwirkungen und Rückkopplungen strukturieren. • Auf verschiedenen Zeit- und Raumskalen bedeutsame Antriebskräfte von • Klimavariabilität und -wandel bewerten und aus der Klimahistorie Gelerntes auf • Gegenwart und Zukunft übertragen. • Mit Klimabeobachtungen und -projektionen verbundene Unsicherheiten einschätzen und auf die Bewertung von Strategien zum Umgang mit dem Klimawandel anwenden • Mit spezifischen Herausforderungen von extremen Wetter- und Klimaereignissen umgehen • Klimawandelaussagen in den Medien sowie Ergebnisse vorhandener Studien zum Klimawandel kritisch reflektieren und bewerten **Weitere Kompetenzen:** Die Studierenden können: • Wissenschaftliche Erkenntnisse zusammenfassen und vor einem Fachpublikum präsentieren • Pro und Kontra in klimawandelbezogenen Debatten diskutieren und wissenschaftliche Debatten moderieren • In der Klimaforschung bedeutsame statistische Methoden auf eigene Datensätze anwenden • Standardsoftware und spezielle statistische Software (z.B. Statgraphics) souverän anwenden • Ergebnisse statistischer Analysen (klimatologisch) interpretieren		
Contents:	Im **Teilbereich „Klimawandel“** werden die physikalischen und chemischen Hintergründe von Klimavariationen und -veränderungen vermittelt. Dabei stehen die bedeutenden Wechselwirkungen und Rückkopplungen im Klimasystem im Vordergrund. (Prä)Historische und beobachtete Klimaveränderungen und ihre Auswirkungen auf verschiedenen Sektoren werden vorgestellt. Basierend auf der Vermittlung der grundlegenden Funktionsweise globaler Klimamodelle werden die projizierten Klimaänderungen im 21. Jahrhundert vermittelt und im Hinblick auf ihre gesellschaftliche, ökonomische, ökologische und politische Relevanz diskutiert. Dabei werden auch mögliche Strategien zur Begegnung erwarteter Klimaveränderungen beleuchtet. Im dazugehörigen Seminar werden anhand verschiedener Texte und		

	Diskussionen, die multiplen Gründe für Unstimmigkeiten über den Klimawandel vor Augen geführt. Die Studenten üben sich in der Präsentation wissenschaftlicher Inhalte sowie in der Diskussion von Klimawandelaspekten. Der **Teilbereich „Klimadatenanalyse“** stellt die in der Klimaforschung bedeutsamen statistischen Verfahren und Methoden vor. Angefangen von der Sicherstellung der Datenqualität über die Beschreibung der Daten durch statistische Kenngrößen und Grafiken werden die Methoden zur Untersuchung von Klimaveränderungen (Mittelwerte, Variabilität und Extreme) erläutert. Verfahren zur Beschreibung von Beziehungen in den Datensätzen und Signifikanztests ergänzen dies. In den Übungen (übe
Literature:	**Teilbereich „Klimawandel“:** IPCC Zustandsberichte Burroughs (2007) Climate change – a multidisciplinary approach Dessler (2011) Introduction to modern climate change Dessler & Parson (2010) The science and politics of global climate change Neelin (2010) Climate change and climate modelling Richardson, Steffen, Liverman (2011) Climate change: global risks, challenges and decisions Hulme (2009) Why we disagree about climate change: understanding controversy, inaction and opportunity **Teilbereich „Klimadatenanalyse“:** Wilks (2006) Statistical methods in the atmospheric sciences Schönwiese CD (2006) Praktische Statistik für Meteorologen und Geowissenschaftler Von Storch & Zwiers (2003) Statistical analysis in climate research Barnett (2004) Environmental statistics – methods and applications Conrad & Pollak (1950) Methods in climatology
Types of Teaching:	S1 (WS): Klimawandel / Lectures (2 SWS) S1 (WS): Klimawandel / Seminar (1 SWS) S1 (WS): Klimadatenanalyse / Lectures (1 SWS) S1 (WS): Klimadatenanalyse / Exercises (2 SWS)
Pre-requisites:	**Recommendations:** Bachelor in Geoökologie (oder adäquater Bachelor-Abschluss). Ausreichende Englisch-Kenntnisse
Frequency:	yearly in the winter semester
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP/KA: Zur Vorlesung Klimawandel (KA if students or more) [MP minimum 60 min / KA 120 min] AP: Seminarbeitrag AP: Klimadatenanalyse, Bericht und Präsentation
Credit Points:	9
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP/KA: Zur Vorlesung Klimawandel [w: 2] AP: Seminarbeitrag [w: 3] AP: Klimadatenanalyse, Bericht und Präsentation [w: 4]
Workload:	The workload is 270h. It is the result of 90h attendance and 180h self-studies. Letzteres umfasst die Vor- und Nachbereitung der Vorlesung, Prüfungsvorbereitung sowie die Erarbeitung der alternativen

	Prüfungsleistungen.

Data:	SUSGMF. MA. Nr. 083 / Examination number: 60204	Version: 01.01.2014	Start Year: WiSe 2014
Module Name:	**Management and Finance of Mining Operations along the Life Cycle**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr. Bongaerts, Jan C. / Prof. Dr.		
Lecturer(s):	Bongaerts, Jan C. / Prof. Dr.		
Institute(s):	Professor of Environmental & Resource Management Institute of Mining and Special Civil Engineering		
Duration:	1 Month(s)		
Competencies:	Environmental remediation projects require careful financial planning and control since their time frame can be often quite long and uncertain and considerable financial means are required from different sources. Public funding institutions and private/corporate sources require that a remediation project be carried out at minimal cost in minimal time. Strong financial skills are absolutely essential for a successful future career of this course's participants. Students will, therefore, be equipped with a sound knowledge and broad overview of general management concepts with special emphasis on project finance, financial control and accounting, cost estimating and forecasting/simulation techniques as well as funding mechanisms. Students will also familiarise themselves with concepts how to handle uncertainty and risk.		
Contents:	According to the objectives, the module is structured into two separate but closely linked parts: Part A: General management • Management and strategic thinking • Project and team structures, management styles • Introduction to structural models of corporations and project teams • Fundamentals of human resources management: choosing the ri ght people and structures Part B: Financial management • Fundamentals of finance, basic concepts: balance sheets, profit/loss statements, cash-flow reports, ratio analysis • Using conceptual models for financial planning: fundamentals and practical use of soft-ware tools • Cost-estimating techniques for large-scale remediation projects • Cash-flow planning in remediation projects • Dealing with uncertainties in financial forecasts • Cost control and reporting • Sources of finance: public, corporate, foundations. Their role and specific expectations/requirements to spending money and reporting • Incorporating the potential after-use and redevelopment scenarios of remediated site into the planning and evaluation of remediation projects • Communication of financial information at different levels The subjects will be presented using overview texts and summary texts,		

	and graphs. The students will receive numerous handouts that not only contain the content of the lectures and case studies but will also serve for future reference. Students will be encouraged to participate actively in the presentation to solicit ideas as well as individual situations experienced and integrate these in the structured presentation. Where appropriate real-life situations will be simulated. A wide range of software tools for simulation of financial processes will be presented in the context of case studies to demonstrate their application to practical situations. Presentation of small group projects and case studies forms an essential part of the module in order to train communication skills.
Literature:	Peter Attril & Eddie McLaney: Financial Accounting for decision makers, Fourth edition, Pearson education, 2004; Kenneth Merchant, Wim Van der Stede; Management Control Systems, Performance Measurement, Evaluation and Incentives, 2nd Edition, Pearson education, 2007; Rudolf Volkart: Corporate Finance
Types of Teaching:	S1 (WS): Lectures (4 d) S1 (WS): Exercises (4 d)
Pre-requisites:	**Recommendations:** No previous knowledge of management is required.
Frequency:	yearly in the winter semester
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [120 min] PVL: Home assignment PVL have to be satisfied before the examination.
Credit Points:	6
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]
Workload:	The workload is 180h. It is the result of 64h attendance and 116h self-studies.

Data:	ATMOSBIO. MA. Nr. 3205 / Examination number: 31019	Version: 08.05.2019	Start Year: WiSe 2013
Module Name:	**Biosphere Atmosphere Interaction**		
(English):			
Responsible:	Matschullat, Jörg / Prof. Dr.		
Lecturer(s):	Matschullat, Jörg / Prof. Dr. Zimmermann, Frank / Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
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.		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): Exercises (2 SWS)		
Pre-requisites:	**Recommendations:** B.Sc. in Geoecology or related. Sufficient knowledge of the English language.		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Participation is to be demonstrated by active seminar contributions with student papers.		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Participation is to be demonstrated by active seminar contributions with student papers. [w: 1]		
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies. The latter includes preparation and learning time (home studies) as well as writing the student papers.		

Data:	SEMSMRM. MA. Nr. 2092 / Examination number: 31720	Version: 02.05.2014	Start Year: WiSe 2014
Module Name:	**Master-Seminar Sustainable Mining and Remediation Management with Colloquium**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr.		
Lecturer(s):			
Institute(s):	Institute of Mining and Special Civil Engineering		
Duration:	1 Month(s)		
Competencies:	Experiences with own scientific work, written and oral summary and presentation of the results		
Contents:	The students will get a specific topic for their work as well as hints for the literature study. The students have to familiarize with this topic and they have to prepare an oral 30 min presentation. A written copy of the presentation has to be prepared as well. The students should improve their ability to communicate and to speak free in front of a greater audience. They should learn how to prepare a presentation (Selection of literature, material, time schedule) and they should gain experience how to prepare scientific papers. Seminar lecture to specific topics with guest-lecturers from the industry complete the module.		
Literature:	Will be specified according to the topic of the work		
Types of Teaching:	S1 (WS): Colloquia (lecture with discussion, 8 hours) / Seminar (1 d) S1 (WS): Seminar (1 d)		
Pre-requisites:	**Recommendations:** Knowledge and abilities form the 1. and 2. semester of the study course Sustainable Mining and Remediation Management. (see study order)		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP*: Written paper AP*: Oral presentation [30 min] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP*: Written paper [w: 1] AP*: Oral presentation [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Workload:	The workload is 120h. It is the result of 16h attendance and 104h self-studies. The self study includes the preparation of the presentation, the written copy of the presentation and consultations.		

Data:	ASDAMCS. MA. Nr. 529 / Examination number: 30118	Version: 05.12.2018	Start Year: SoSe 2020
Module Name:	**Applied Spatial Data Analysis and Modelling - Case Study**		
(English):			
Responsible:	Benndorf, Jörg / Prof. Dr.-Ing.		
Lecturer(s):	Löbel, Karl-Heinz / Dr. Ing. Benndorf, Jörg / Prof. Dr.-Ing.		
Institute(s):	Institute for Mine Surveying and Geodesy		
Duration:	1 Semester(s)		
Competencies:	After successful completion of the course, students are able to: • independently create solutions for complex practical problems in mining and geoengineering applying knowledge about mine surveying, mining engineering, geotechnical engineering and engineering geology, utilizing modern methods in geospatial data analysis, geo-modelling and GIS, • critically assess and interpreted results of the analysis and provide recommendations related to expected impact of mining activities during active and post-mining phase, • coordinate team work, create project plans and manage the work progress, • present results in a report and/or a presentation to a panel of independent experts, conduct auto-didactical education related to detailed handling of typical software.		
Contents:	• project work on a case study related to after mine care • supporting acquisition of georeferenced data • impact analysis on environment and safety • data base structures suited to map the problem on hand • GIS project management • interpolation, 2½- and 3D model building • geospatial data analysis • network analysis • client/server concepts • GIS and internet presentation of results in thematic maps and presentations		
Literature:	David Maguire, Michael Batty, Michael Goodchild: GIS, Spatial Analysis, and Modeling. ISBN: 1-58948-130-5; The ESRI Guide to GIS Analysis, Volume 1 - Geographic Patterns and Relationships. ISBN: 1-879102-06-4, Volume 2 - Spatial Measurements and Statistics. ISBN: 1-58948-116-X; Josef Fürst: GIS in Hydrologie und Wasserwirtschaft, ISBN 978-3-87907-413-6; Wolfgang Liebig, Jörg Schaller (Hrsg.) : ArcView GIS - GIS-Arbeitsbuch, ISBN 978-3-87907-346-7; Peter Fischer-Stabel (Hrsg.):Umweltinformationssysteme, ISBN 978-3-87907-423-5; Franz-Josef Behr: Strategisches GIS-Management - Grundlagen, Systemeinführung und Betrieb, ISBN 978-3-87907-350-4; Thomas Brinkhoff: Geodatenbanksysteme in Theorie und Praxis, ISBN 978-3-87907-433-4		
Types of Teaching:	S1 (SS): Applied Spatial Data Analysis and Modelling for After Mine Care - Case Study - Lectures / Lectures (1 SWS) S1 (SS): Applied Spatial Data Analysis and Modelling for After Mine Care		

	- Case Study - Practical exercises / Practical Application (2 SWS)
Pre-requisites:	**Recommendations:** Allgemeine Grundlagen im Markscheidewesen, 2018-01-11 Grundlagen der Geoinformationssysteme, 2014-06-16
Frequency:	yearly in the summer semester
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP*: Oral examination [30 min] AP*: Report on project * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Credit Points:	5
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP*: Oral examination [w: 2] AP*: Report on project [w: 3] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Workload:	The workload is 150h. It consists of 45h lectures 105h independent work including group work, practical, self-study and preparation for examination.

Data:	GEOMOD. MA. Nr. 121 / Examination number: 30715	Version: 30.10.2019	Start Year: WiSe 2020
Module Name:	**Applied Geomodelling**		
(English):	Applied Geomodelling		
Responsible:	Gerhards, Christian / Prof. Dr.		
Lecturer(s):	Gerhards, Christian / Prof. Dr.		
Institute(s):	Institute of Geophysics and Geoinformatics		
Duration:	1 Semester(s)		
Competencies:	The students will be made familiar with the mathematical and computer scientific aspects of 3d geomodelling and are able to use the tools in advanced geoscientific applications. They will be able to use of typical 3d geomodelling software and understand their connectional differences.		
Contents:	- principles of heterogeneous data - spatial geodata models, cellular partitions - interpolation and parametrization - case studies for the modeling of geological structures Depending on the audience, the lecture can be held in German.		
Literature:	Mallet J.-L. 2002, Geomodelling, Oxford University Press Houlding, S.W., 1994, 3D Geoscience Modeling: Computer Techniques for Geological Characterization, Springer		
Types of Teaching:	S1 (WS): Lectures (1 SWS) S1 (WS): Exercises (2 SWS)		
Pre-requisites:			
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Project documentation		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Project documentation [w: 1]		
Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies.		

Data:	RHEMINE. MA. Nr. 2017 / Examination number: 30410	Version: 23.01.2019	Start Year: WiSe 2019
Module Name:	**Rheology; Microtectonics, Neotectonics**		
(English):			
Responsible:	Ratschbacher, Lothar / Prof. Dr.		
Lecturer(s):	Kroner, Uwe / PD Dr. Ratschbacher, Lothar / Prof. Dr. Schneider, Susanne / Dr.		
Institute(s):	Institute of Geology		
Duration:	2 Semester(s)		
Competencies:	Verständnis der materialwissenschaftlichen Aspekte von Gesteinsdeformation, Erdbebengeologie und Störungszonen Understanding the Materials Science aspects of rock deformation; earthquake geology; nature of fault zones		
Contents:	• Materialwissenschaftliche Betrachtung von Gesteinen (Materials Science of rocks) • Theorie und Praxis der neotektonischen, paläoseismologischen und geomorphologischen Analyse (Aspects of neotectonics, paleoseismology, tectonic geomorphology) • Erdbebengeologie (Earthquake geology)		
Literature:	Twiss & Moores (various editions) Structural Geology Burbank & Andersen (2011) Tectonic Geomorphology McCalpin (2009) Paleoseismology Yeats et al. (1997) The Geology of Earthquakes Publikationen in Fachzeitschriften		
Types of Teaching:	S1 (WS): Rheology and Neotectonics / Lectures (3 SWS) S1 (WS): Rheology and Neotectonics / Exercises (1 SWS) S1 (WS): Rheology and Neotectonics / Seminar (1 SWS) S2 (SS): Microtectonics / Lectures (1 SWS) S2 (SS): Microtectonics / Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Bachelor Geowissenschaften		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP/KA (KA if 10 students or more) [MP minimum 30 min / KA 60 min] The type of exam will be announced at the beginning of the term.		
Credit Points:	8		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP/KA [w: 1]		
Workload:	The workload is 240h. It is the result of 105h attendance and 135h self-studies. Letzteres umfasst Vor- und Nachbereitung der Lehrveranstaltung und Prüfungsvorbereitungen.		

Data:	OREDEP. MA. Nr. 2915 / Examination number: 31201	Version: 28.04.2010	Start Year: SoSe 2011
Module Name:	**Ore Deposits & Economic Geology**		
(English):			
Responsible:	Seifert, Thomas / Prof. Dr.		
Lecturer(s):	Seifert, Thomas / Prof. Dr.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	Offering engineers and non-geoscientists the opportunity to get some background knowledge on the genesis of ore deposits and resulting implications for exploration and processing.		
Contents:	An introduction to ore-forming environments. Major case studies of ore and industrial mineral deposits will also be discussed. An integral part of the course is the study of hand specimens.		
Literature:	Evans, A. M. (1993). Ore Geology and Industrial Minerals, Oxford: Blackwell.Guilbert, J.M. and Park, C.F. (1986). The Geology of Ore Deposits, New York: Freeman.Kesler, E. (1994) Mineral Resources, Economics and the Environment, New York: Macmillan.		
Types of Teaching:	S1 (SS): Lectures (1 SWS) S1 (SS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** No requirements.		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min]		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 90h. It is the result of 30h attendance and 60h self-studies.		

Data:	GEOMS. MA. Nr. 2018 / Examination number: 30413	Version: 22.01.2019	Start Year: SoSe 2019
Module Name:	**Forschungsseminar Tektonik/Geochronologie**		
(English):	Research Seminar in Tectonics and Geochronology		
Responsible:	Ratschbacher, Lothar / Prof. Dr.		
Lecturer(s):	Ratschbacher, Lothar / Prof. Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	The goal is to enhance the abilities in scientific thinking, presentation, and discussion. This involves participation in lectures of external scientists and own presentations. Der Student soll lernen, wissenschaftlich integrativ zu denken, ein wissenschaftliches Thema selbstständig zu bearbeiten und vor einem Fachpublikum zu präsentieren und zu verteidigen.		
Contents:	Participation in scientific discussions, presentations, and scientific writing excersises. Development of own scientific ideas, defending of them in front of a critical audience, and writing of scientific articles. Qualifikationsziele: Erlernen, Anwenden und Optimieren von Recherchestrategien, Erlernen der verschiedenen Beschaffungswege und Nutzung elektronisch verfügbarer Ressourcen, Verwaltung von Literaturzitaten und Erstellen von Bibliographien. Freies Reden und Vermittlung von Inhalten. Führen wissenschaftlicher Diskussionen. Fähigkeit zur Entwicklung eigener Meinungen und Forschungsansätze aus der Zusammenschau unterschiedlicher Meinungen und von Veröffentlichungen. Bewertung wissenschaftlicher Meinungen und wissenschaftlicher Daten. Verstehen von unterschiedlichen Forschungsansätzen und Entwicklung von Forschungsideen. Bearbeiten eines wissenschaftlichen Themas in vorgegebener Zeit, einschließlich Erarbeitung und Präsentieren eines Vortrages.		
Literature:	Article of scientific literature Artikel der internationalen Fachliteratur		
Types of Teaching:	S1 (SS): Lectures (1 SWS) S1 (SS): Seminar (1 SWS)		
Pre-requisites:	**Recommendations:** Geowissenschaftliche Kenntnisse		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: AP: Literary studies, scientific presentation and discussion		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): AP: Literary studies, scientific presentation and discussion [w: 1]		
Workload:	The workload is 90h. It is the result of 30h attendance and 60h self-studies.		

Data:	PRAKGTB. MA. Nr. 2096 / Examination number: 31721	Version: 01.05.2014	Start Year: WiSe 2014
Module Name:	**Practical Training SMRM**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr.		
Lecturer(s):			
Institute(s):	Institute of Mining and Special Civil Engineering		
Duration:	4 Week(s)		
Competencies:	By help of own practical work and observation the students should get abilities and skills in the field of sustainable technologies in geotechnics and mining, rehabilitation and the design and recultivation of former mining areas.		
Contents:	The practical training consists of practical work in enterprises and institutions with relation to mining and remediation.		
Literature:	Ordnung für das Grundpraktikum, TU Bergakademie Freiberg, 2003		
Types of Teaching:	S1 (WS): Practical training in enterprises and institutions working in the field of mining or remediation / Practical Application (4 Wo)		
Pre-requisites:	**Recommendations:** Students have to apply by their own in recognized enterprises/institutions. Recommendations can be obtained from institutes of TU Bergakademie Freiberg which are included in the course.		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: PVL: Written confirmation of 20 shifts of practical work in recognized enterprises AP: Written report (approximately 20 pages A4) about practice in the enterprise and shift-diary PVL have to be satisfied before the examination.		
Credit Points:	6		
Grade:	The examination results are not rated. The credits are given when the exams are passed successfully.		
Workload:	The workload is 180h. It includes practical work (20 shifts) and preparation of the report.		

Data:	HYGWMA. MA. Nr. 3632 / Examination number: 31726	Version: 04.07.2018	Start Year: SoSe 2019
Module Name:	**Hydrogeology for GW-Management - Advanced**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr. Hoth, Nils / Dr.		
Lecturer(s):	Hoth, Nils / Dr.		
Institute(s):	Institute of Mining and Special Civil Engineering		
Duration:	1 Semester(s)		
Competencies:	Students gain 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 competence skills will be enforced.		
Contents:	- detailed understanding of hydrological aspects of water cycle (measurement of the different parts) - estimation of GW recharge - hydrological processes in arid, semi-arid zones - aspects of irrigation methods - Karst hydrogeology (different types of karst, karst phenomena, relevant karts features, karst indicators, karstifiable rocks, physical/ chemical dissolution) - flow and transport in karst systems (contaminations, tracers, protection), regional examples of different karst systems - River bank filtration - geophysical exploration techniques and practical aspects of borehole logging - data evaluation and GIS-based data handling - 2D data analysis, kriging, basics of variogram-analysis Practical exercises: to GIS-based data handling and 2D – data analysis (spatial interpolation)		
Literature:	Dreybrodt (1988) Processes in Karst Systems Physics, Chemistry and Geology, Goldscheider & Drew (2007) Methods in Karst Hydrogeology Simmers (2003) Understanding water in a dry environment – hydrological processes in arid and semi-arid zones Kitanidis (1997) Introduction to geostatistics – applications to hydrogeology Ray et al. (2003) Riverbank filtration – improving source water quality		
Types of Teaching:	S1 (SS): Lectures (2 SWS) S1 (SS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Hydrogeology for GW-Management - Basics, 2018-07-04 Basic knowledge in statistics and data management.		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min] PVL: Homework - assignments PVL have to be satisfied before the examination.		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		

Workload:	The workload is 120h. It is the result of 45h attendance and 75h self-studies. (75 h are spent with preparation, preparing home work and report and self study).

Data:	MARVERM. BA. Nr. 641 / Examination number: 30116	Version: 05.12.2018	Start Year: WiSe 2019
Module Name:	**Underground Mine Surveying**		
(English):			
Responsible:	Benndorf, Jörg / Prof. Dr.-Ing.		
Lecturer(s):	Benndorf, Jörg / Prof. Dr.-Ing.		
Institute(s):	Institute for Mine Surveying and Geodesy		
Duration:	1 Semester(s)		
Competencies:	After successful completion of the course, students are able to: • apply the theory of error propagation in the context of planning and critical analysis of measurement results for underground surveying campaigns, • optimize the case specific use of suitable surveying instrumentation, the measurement design and data processing method for campaigns related to the absolute spatial orientation of underground mining workings, • independently conduct typically underground mine surveying tasks and analyze results.		
Contents:	• legal regulations with respect to underground mine surveying (in particular German law: "Verordnung über markscheiderische Arbeiten und Beobachtung der Oberfläche - Markscheider-Bergverordnung") • application of the theory of error propagation and GUM - Guide to the Expression of Uncertainty in Measurement for precision surveying design and evaluation of results • transfer of coordinates and directional angels from surface to underground (mechanical and optical shaft plumbing, gyroscopic measurements, application of inertial systems) • alignment control in underground drifts and tunnels • underground geodetic infrastructure and mine mapping • drill hole surveying • recent developments in underground positioning and navigation		
Literature:	Schulte, Löhr, Vosen: Markscheidekunde für das Studium und die betriebliche Praxis. Springer Verlag; Meixner, H. und Bukrinskij, A.: Markscheidewesen für Bergbaufachrichtungen. VEB Deutscher Verlag für Grundstoffindustrie, Leipzig 1985; Knufinke, P.: Allgemeine Vermessungs- und Markscheidekunde.; 1. Auflage, ISBN: 3-89653-530-7. Deutscher Markscheiderverein e.V., Bochum, 1999; Ogundare, J. O. (2015). Precision surveying: the principles and geomatics practice. John Wiley & Sons. Zeitschriften: Markscheidewesen, AVN, VDV-Magazin		
Types of Teaching:	S1 (WS): Underground Mine Surveying / Lectures (2 SWS) S1 (WS): Underground Mine Surveying - exercises and practical work in groups (3 SWS) / Practical Application (3 SWS)		
Pre-requisites:	**Mandatory:** Allgemeine Grundlagen der Vermessungs- und Instrumententechnik, 2015-06-01 oder Introduction to surveying or similar subjects **Recommendations:** Basic knowledge about surveying, surveying instrumentation and underground mining.		

Frequency:	yearly in the winter semester
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP [30 min] PVL: Exercises and practical work in groups PVL have to be satisfied before the examination.
Credit Points:	5
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP [w: 1]
Workload:	The workload is 150h. It consists of 75h presence time (lectures and underground surveying practical), and 105 hours independent work including group work, practical, self-study and preparation for examination.

Data:	HYTRACE. MA Nr. 3548 / Examination number: 30256	Version: 16.10.2019	Start Year: SoSe 2021
Module Name:	**Tracers in Hydrogeology**		
(English):			
Responsible:	Scheytt, Traugott / Prof. Dr.		
Lecturer(s):	Scheytt, Traugott / Prof. Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	Upon successful completion of the course, students will have demonstrated the ability to plan, execute and interpret a tracer test using artificial dye tracers. The will have shown the ability to make use of further compounds as tracers (isotopes, trace compounds) for determination of groundwater processes.		
Contents:	In groundwater, a variety of organic (including pesticides, pharmaceutical agents, sweeteners, Petroleum hydrocarbons, VOCs) and inorganic (including metals, rare earth elements, anions) substances are solved, their occurrence and concentrations reveal groundwater age, the infiltration function, or the transport processes. In addition, there are a number of reactive and non-reactive tracers that can be added to the groundwater and can provide important information about the flow and reactivity of groundwater and aquifer during tracer or push-pull test. Finally, isotopes and isotope ratios provide important insights into the recharge and age of groundwater. These experiments and investigations are needed to evaluate groundwater flow and transport. The course includes a tracer experiment conducted and interpreted in the hydrogeological test field.		
Literature:	Leibundgut, Ch., Maloszewski, P. & Külls, Ch. (2009): Tracers in Hydrology.- Wiley Blackwell.		
Types of Teaching:	S1 (SS): Lectures (1 SWS) S1 (SS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Introduction to Hydrogeology, 2019-10-01 Hydrogeochemistry, 2019-10-01		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA: Exam [90 min] AP: Preparing and submitting a report on the tracer investigation		
Credit Points:	3		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA: Exam [w: 1] AP: Preparing and submitting a report on the tracer investigation [w: 1]		
Workload:	The workload is 90h. It is the result of 30h attendance and 60h self-studies.		

Data:	MWFT. MA. Nr. 3633 / Examination number: 31727	Version: 04.07.2018	Start Year: SoSe 2019
Module Name:	**Mine Water I – Formation and Treatment**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr. Hoth, Nils / Dr.		
Lecturer(s):	Hoth, Nils / Dr.		
Institute(s):	Institute of Mining and Special Civil Engineering		
Duration:	1 Semester(s)		
Competencies:	The student will gain general knowledge about the formation of acidic mine waters and how to investigate the detailed behaviour. Furthermore he gets knowledge about treatment strategies. So in the end he is able to choose proper measures for partial avoiding of acidic mine water formation and he can choose suitable and site specific treatment strategies		
Contents:	Lecture: - Basics of sulphide weathering - Acid Mine and Acid Rock Draiange (AMD/ ARD) generation - Relevant buffer systems - General aspects of water treatment of different mine waters - Examples of special case site studies – technology of the treatment - Primary, secondary and tertiary measures against acidification for different mine sites Exercises: - Detailed explanation of investigation strategies to characterise and balance acid mine drainage behaviour for dump and tailings bodies - Detailed explanation of water treatment systems for different mine sites - Preparing an report about investigation of a given test site. Figure out the idea and planning of a water treatment for a given special mine water composition.		
Literature:	JAMBOR, J.L.& BLOWES, D.W.: Short Course Handbook on Environmental Geochemistry of Sulfid Mine Wastes. Younger (2002): Mine water hydrogeology and geochemistry. Beale & Read (2013) Evaluating water in pit slope stability Wolkersdorfer (2013) Grubenwasserreinigung – Verfahren und Vorgehensweise		
Types of Teaching:	S1 (SS): Lectures (2 SWS) S1 (SS): Exercises (1 SWS)		
Pre-requisites:	**Recommendations:** Basic knowledge in hydrogeochemistry		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min] PVL: Exercieses and homework PVL have to be satisfied before the examination.		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1]		
Workload:	The workload is 180h. It is the result of 45h attendance and 135h self-studies. (135 h are spent on preparation for the classes, preparing the report and with self study)		

Data:	Biogeoch MA Nr. / Examination number: 36101	Version: 12.08.2020	Start Year: WiSe 2020
Module Name:	**Biogeochemistry**		
(English):			
Responsible:	Lau, Maximilian / JProf.		
Lecturer(s):	Lau, Maximilian / JProf.		
Institute(s):	Institute of Mineralogy		
Duration:	1 Semester(s)		
Competencies:	Based on milestones of biogeochemical research, the students are introduced to the key drivers of global material cycles. At the end of the module students are able to identify open questions in the earth system sciences, conceive possible experimental approaches to answer them, and develop presentation and dissemination skills.		
Contents:	The module links the biological and geochemical processes in the fundamental "spheres" of planet earth – hydro-, geo-, bio- and atmosphere - and provides a detailed overview of key global material cycles. Characteristics of the earth' different climatic zones are presented. Milestones in the development of today's biogeochemical understanding of terrestrial and aquatic ecosystems are discussed. By example of a few key ecosystems (lakes, wetlands, permafrost soils), the application of modern biogeochemical methods (e.g., analysis of stable, light isotopes, working with global data sets, modeling) is presented and further developed in practical exercises .		
Literature:	Schlesinger, Bernhard: An Analysis of Global Change, Academic Press; Stumm & Morgan: Aquatic Chemistry, Wiley; Articles of the journals Nature Geoscience und Earth Science Reviews		
Types of Teaching:	S1 (WS): Lectures (1 SWS) S1 (WS): Exercises (1 SWS) S1 (WS): Practical Application (1 d)		
Pre-requisites:	**Recommendations:** Recommendations: BSc of Geoecology, Angewandter Naturwissenschaft, Chemistry or other engineering or natural sciences.		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA* [60 min] AP*: Excursion report * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA* [w: 3] AP*: Excursion report [w: 2] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.		
Workload:	The workload is 120h. It is the result of 38h attendance and 82h self-studies. The latter comprises home study and preparation of a report.		

Data:	GEOFER. MA. Nr. 013 / Examination number: -	Version: 12.07.2010	Start Year: WiSe 2010
Module Name:	**Remote Sensing**		
(English):			
Responsible:	Gloaguen, Richard / Dr.		
Lecturer(s):	Gloaguen, Richard / Dr. Ratschbacher, Lothar / Prof. Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	Acquisation of theoretical and practical skills in remote sensing with a focus on the analysis of surface processes		
Contents:	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:	S1 (WS): Lectures (1 SWS) S1 (WS): Exercises (3 SWS)		
Pre-requisites:	**Recommendations:** Grundlagen der Geofernerkundung, 2014-07-01 Bachelor course in remote sensing		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA [90 min] AP: Project presentation		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA [w: 1] AP: Project presentation [w: 4]		
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies.		

Data:	HYGWMB. MA. Nr. 3629 / Examination number: 31723	Version: 04.07.2018	Start Year: WiSe 2018
Module Name:	**Hydrogeology for GW-Management - Basics**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr. Hoth, Nils / Dr.		
Lecturer(s):	Hoth, Nils / Dr.		
Institute(s):	Institute of Mining and Special Civil Engineering		
Duration:	1 Semester(s)		
Competencies:	The student will gain general knowledge to characterise and investigate hydrogeological systems. So he will be able to solve relevant hydrogeological tasks. He will be able to select appropriate techniques for investigation and data evaluation. Furthermore he will gain knowledge around groundwater protection measures.		
Contents:	Lecture: - general understanding of subsurface flow-processes (water-saturated GW-zone and water-unsaturated “soil-zone”). - porous media behaviour of loose rock aquifers (differences of kf-value versus permeability) - fissure/ fracture driven preferential flow in hard rock bodies - methods to estimate relevant flow parameters (challenges around) - pumping test (design, performance) and evaluation - saline water intrusion (fresh-saltwater interface at coastal sites). - Ground water flow to wells and drilling of wells (well development, rehabilitation) - basic understanding of acid mine drainage generation - Well head protection zones – general GW protection - European water frame work Practical exercises: Estimation of relevant aquifer parameters (kf-values) Characterisation of water samples Sampling (low flow sampling), filtration, impact of construction materials on monitoring wells, Classification of loose rock materials hXRF-measurements as basis for qualitative characteristics of loose rock and dump/ tailings materials		
Literature:	Fetter (1993): Applied Hydrogeology. Domenico & Schwartz (1998): Physical and Chemical Hydrogeology. USGS (2004) Water Supply Paper. Sterret (2007): Groundwater and Wells. DWGW-Richtlinie W101		
Types of Teaching:	S1 (WS): Lectures (2 SWS) S1 (WS): hydrogeology - practica and exercises / Practical Application (2 SWS)		
Pre-requisites:	**Recommendations:** Basic knowledge in Geology, Applied Geosciences		
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: KA* [90 min] AP*: Practica and exercises		

	* In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Credit Points:	6
Grade:	The Grade is generated from the examination result(s) with the following weights (w): KA* [w: 2] AP*: Practica and exercises [w: 1] * In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.
Workload:	The workload is 180h. It is the result of 60h attendance and 120h self-studies. (120 h are spent on preparation for the classes, preparing the reports and self study)

Data:	TecDep. MA. Nr. 3681 / Examination number: 35901	Version: 31.01.2019	Start Year: WiSe 2019
Module Name:	**Tectonics and Mineral Deposits**		
(English):			
Responsible:	Kroner, Uwe / PD Dr.		
Lecturer(s):	Kroner, Uwe / PD Dr.		
Institute(s):	Institute of Geology		
Duration:	1 Semester(s)		
Competencies:	The students will be able to understand and describe (1) the causal links of plate tectonics, mantle cycle and mineral deposits at a global scale and (2) the principles of structural geology and tectonics regarding mineralization on a regional scale.The students will be able to evaluate selected structural controlled mineral deposits, for example different mineral deposits of the Erzgebirge. Special attention will be paid to structural field techniques at the outcrop level.		
Contents:	Plate tectonics and mineral deposits. Mantle (juvenile) material cycle. Crustal exogenic-endogenic material recycling exemplified by Sn/W/Au/U mineralization. Principles of tectonics - the structural control of mineral deposits. The formation of syn orogenic mineral deposits of the Erzgebirge - tectonic, metamorphic and magmatic processes.		
Literature:	Sawkins, F.J. (1990): Metal Deposits in Relation to Plate Tectonics, Springer, 461 pp.; Davies, G.F. (1999) Dynamic Earth – Plates, Plumes and Mantle Convection, Cambridge University Press, 458 pp., Twiss, R.J. and Moores, E.M. (1992): Structural Geology, W.H. Freemann and Company, 532 pp.; recent scientific articles.		
Types of Teaching:	S1 (WS): Blockkurs (block course) / Lectures (2 SWS) S1 (WS): Geländepraktikum (field course) / Practical Application (3 d)		
Pre-requisites:			
Frequency:	yearly in the winter semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP [30 min]		
Credit Points:	4		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP [w: 1]		
Workload:	The workload is 120h. It is the result of 54h attendance and 66h self-studies.		

Data:	BBREKL. MA. Nr. 2087 / Examination number: 31719	Version: 13.07.2014	Start Year: SoSe 2014
Module Name:	**Reclamation**		
(English):			
Responsible:	Drebenstedt, Carsten / Prof. Dr.		
Lecturer(s):	Drebenstedt, Carsten / Prof. Dr.		
Institute(s):	Institute of Mining and Special Civil Engineering		
Duration:	1 Semester(s)		
Competencies:	The module provides the development of expertise and methodological skills in the field of mining engineering. The students learn the theory and practice of reclamation in mining as essential element of balance for mining impacts. They understand the parallelism of mine and reclamation planning and the fact, why reclamation can exceed the mine project phase. Additionally the students will be qualified to explain scientifically reclamation measures, plan technical measures and calculate the financial expenses.		
Contents:	- Impacts of mining and its effects - Legal requirements for permission - Scientific fundamentals of reclamation (soil, ground water balance,...) - Utilization requirements and realization in the post-mining landscaping (agriculture, forestry, waterbodies, nature protection, recreation, miscellaneous) - Concepts, Case studies		
Literature:	Pflug (Hrsg.), 1998, Braunkohlentagebau und Rekultivierung, Springer Verlag Olschowy, Bergbau und Landschaft, 1993, Paray Verlag Gilscher, Bruns, 1999, Renaturierung von Abbaustellen, Verlag Eugen Ulmer Stuttgart		
Types of Teaching:	S1 (SS): Lectures (3 SWS) S1 (SS): Exercises (2 SWS) S1 (SS): Practical Application (1 SWS)		
Pre-requisites:	**Recommendations:** Mathemathic-scientific fundamentals		
Frequency:	yearly in the summer semester		
Requirements for Credit Points:	For the award of credit points it is necessary to pass the module exam. The module exam contains: MP/KA (KA if 21 students or more) [MP minimum 30 min / KA 60 min] PVL: Submission and positive evaluation of module exercises PVL: Participation in 2 excursions of the chair Surface-Mining PVL have to be satisfied before the examination.		
Credit Points:	6		
Grade:	The Grade is generated from the examination result(s) with the following weights (w): MP/KA [w: 1]		
Workload:	The workload is 180h. It is the result of 90h attendance and 90h self-studies. Self-study includes autonomous and instructed preparation and performance of follow-up course work and examination preparation.		