Study Guide

Chair of Mining Engineering and Mineral Economics

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Montanuniversität Leoben
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mining engineering
mineral economics

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Dear Students of our Master Study Programs,

Welcome to Montanuniversität Leoben,

Chair of Mining Engineering and Mineral Economics,

this Study Guide provides an overview on the Master courses offered by the Chair of Mining Engineering and Mineral Economics.

It should not only give you a detailed outline on the content of our programs, but also assist you when registering for a course. It describes the topics, learning outcomes and any prerequisites you might need.

Please note that not all of the courses are offered both in winter- and summer semester. We therefore advise you to contact our MIRO (Montanuniversität International Relations Office), incoming@unileoben.ac.at, before registering for a course.

In case you have any questions do not hesitate to contact us!
For academic questions and the syllabus:
Birgit Knoll, Chair of Mining Engineering and Mineral Economics
birgit.knoll@unileoben.ac.at
For questions concerning applications procedures for Erasmus- or any other incoming students:
MIRO
incoming@unileoben.ac.at

We wish you good luck for your studies!
Glückauf

Dipl.-Ing. Dr.mont. Michael Tost
Head of the Chair of Mining Engineering and Mineral Economics
Study Program Director

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Applied Geodesy

Course Nb	200.199
ECTS	2
Type	Lecture
Offering period	Summersemester
Lecturer	Mayer, Moser-Tscharf
Course description	
Content	• Theory of errors in observations and adjustments; method of least squares • Reference and mapping systems • Methods of precise surveying • Methods of 3D positioning • Instrument checking, calibration and adjustment
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Sustainable knowledge in the field of surveying. • At the beginning of the course the students have to pass an entrance test with the following contents: o Implementation and evaluation of an angle measurement with a theodolite o Calculation of the 1st and 2nd main task of geodesy o Planning, implementation and calculation of a traverse o Planning, implementation and calculation of a levelling

	o Coordinate and mapping systems in geodesy and reference systems for position and height measurements
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • Detect and adjust errors in surveying • Apply reference and mapping systems including calculations • Plan, implement and evaluate precise surveying methods for distance measurements, angle measurements and levelling • Apply 3D positioning including error considerations • Know and apply the common methods for instrument checking, calibration and adjustment
Languages of instruction	English
Teaching and learning method	Lectures Active participation and discussion
Assessment (Exam Method and Evaluation)	Oral and written exam
Further information	
Recommended reading	Ghilani, C. D. and Wolf, P. R., Elementary Surveying
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Applied Geodesy (Practical)

Course Nb	200.200
ECTS	2
Type	Practical
Offering period	Summersemester
Lecturer	Gubaidullina, Mayer, Moser-Tscharf
Course description	
Content	• Theory of errors in observations and adjustments; method of least squares • Reference and mapping systems • Methods of precise surveying • Methods of 3D positioning • Instrument checking, calibration and adjustment • This course deepens the contents of 200.199 by independently carrying out practical measurements.
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Sustainable knowledge in the field of surveying. • At the beginning of the course the students have to pass an entrance test with the following contents: o Implementation and evaluation of an angle measurement with a theodolite o Calculation of the 1st and 2nd main task of geodesy o Planning, implementation and calculation of a traverse

	o Planning, implementation and calculation of a levelling o Coordinate and mapping systems in geodesy and reference systems for position and height measurements
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Detect and adjust errors in surveying • Apply reference and mapping systems including calculations • Plan, implement and evaluate precise surveying methods for distance measurements, angle measurements and levelling • Apply 3D positioning including error considerations • Know and apply the common methods for instrument checking, calibration and adjustment
Languages of instruction	English
Teaching and learning method	Lecture, as well as practical and computational exercises in individual and group work
Assessment (Exam Method and Evaluation)	Practical and computational short tasks in the context of the course

Further information	
Recommended reading	Ghilani, C. D., Wolf, P. R.: Elementary Surveying
Note	This practical can only be enrolled together with the lecture Applied Geodesy (200.199)! The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Artisanal and Small-scale Mining in Developing Countries

Course Nb	200.149
ECTS	3
Type	Lecture
Offering period	Wintersemester
Lecturer	Hruschka
Course description	
Content	The course covers the importance and the development potential of Artisanal and Small-scale Mining (ASM) as well as the severe problems of ASM with regards to technical, social, legal, political, economic and environmental aspects. Case studies from Latin America, Africa and Asia are used to illustrate the challenges and possible solutions. Starting out from a characterization of ASM as a poverty- as well as an opportunity-driven activity of roughly 50 million people in developing countries (chapter 1) and the typical ASM technology used by them (chapter 2), the course addresses the most important crosscutting key issues relevant for the ASM sector (chapter 3), such as environmental impacts and in particular mercury use, safety and occupational health, public health, child labour, gender, organization, legalization and formalization, coexistence with industrial mining, contribution to local development, climate change etc. Chapter 4 covers the interrelated key issues of conflict minerals, voluntary ASM standards- and certification initiatives, as well as the increasing

	relevance of legal requirements for responsible mineral supply chains based on the OECD Due Diligence Guidance. Chapter 5 deals with sustainable development-based strategies, approaches and instruments for ASM project planning and attempts to provide an outlook on future trends. The course concludes with an overview of relevant initiatives, institutions and further sources of information (chapter 6).
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1)
Objective (expected results of study and acquired competences)	On completion of this course, participants are expected to understand the differences and similarities of industrial mining and artisanal small-scale mining and the driving forces of communities and actors engaged in ASM. Participants shall be able to: • Resolve complex and multidisciplinary problems of ASM in developing countries. • Analyze private or public development initiatives (by governments, mining companies or NGOs) for the ASM sector and anticipate their potential positive or negative effects.
Languages of instruction	English
Teaching and learning method	Multimedia-supported lecture with case studies. Active participation and discussion

Assessment (Exam Method and Evaluation)	Written exam assessing the acquired understanding of the topic, and oral exam (usually as panel discussion) assessing the acquired abilities as stated in the learning objectives. Both parts must be passed positive. In case of exams in online mode, both parts might be oral.
Further information	
Recommended reading	Electronic copies of relevant documents and articles will be provided
Note	The most recently updated version of the course documents (PowerPoint presentation for each chapter and supplementary materials) will be made available for download one week before the lecture. The password to access the course documents will be provided by the lecturer. The assessment methods will be announced in detail in the first lecture.

Continuous Mining Methods and Conveying Technologies in Surface and Underground Mining

Course Nb	200.111
ECTS	3
Type	Lecture
Offering period	Wintersemester
Lecturer	Bertignoll, Sifferlinger
Course description	
Content	This is a general course about continuous mining methods and conveying technologies in surface and underground mining. The following topics will be covered: • Basics of surface and underground mining • Surface Mining o Introduction o Bucket wheel excavator o Surface miner o Sizer/Breaker o Safety in surface mining • Underground mining o Introduction o Continuous mining in room and pillar (coal, salt, trona and potash) o Longwall mining methods o Continuous mining in hard rock o Safety in underground mining • Conveying technologies in surface and underground mining o Introduction

	o Overview continuous conveying technologies o Conveyor belt systems o Trucks and shuttle cars o Rail bound transport systems o Applications of conveying systems
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basic Engineering Physics and Math (e.g. logarithms and power functions, equations, integrals, function analysis) • Basic Mining Engineering • Rock Mechanics
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Understand and apply the basics of continuous surface and underground mining methods • Explain the different surface and underground mining operations • Differentiate between the mining and conveying methods by comparing the benefits and drawbacks, challenges and limitations
Languages of instruction	English
Teaching and learning method	Lecture
Assessment (Exam Method and Evaluation)	Oral exam

Further information	
Recommended reading	SME Mining Engineering Handbook – Peter Darling
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Deposit Modelling and associated Software

Course Nb	200.109
ECTS	2
Type	Integrated course
Offering period	Wintersemester
Lecturer	Haindl
Course description	

Content	• Basics of data collection and organization of exploration results in a database
	• Database management
	• Data Analysis and Geological Modelling
	  o Geological Controls
	  o Composites
	• Resource Modelling
	  o Basics in Geostatistics
	• Resource Classification

Previous knowledge expected	• Good English skills (Minimum: CEF Level B1)
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • List required steps and input parameter to create a deposit model. • Describe possible threats and limits of computer-generated models. • Use geostatistical methods to estimate resources. • Classify a deposit model based on the estimation.

	• Perform simple tasks (like creating strings or wireframes) using Datamine Studio and Geovia Surpac.
Languages of instruction	English
Teaching and learning method	Mandatory attendance (75% required) Theoretical introduction with assignments Practical part in computer laboratory
Assessment (Exam Method and Evaluation)	• Continuous assessment: Intermediate written exam and assignments
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Economic Geology and Mining Economics

Course Nb	200.001
ECTS	6
Type	Lecture
Offering period	Wintersemester
Lecturer	Haindl
Course description	
Content	• Basic introduction to micro mining economics o Sustainability and mining capital • Economic geology (deposit as factor of production) o Mineral occurrence, deposit, Mineral law o Prospection and exploration (+ costs) o Modelling, reserves and resources o Documentation of a deposit • Mining economics o Factors of production: labour o Factors of production: means of production, energy o Financial analysis and statements o Financing o Mine valuation • Risks and sensitivity analyses
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basics in Mining
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Perform simple financial analysis of mining related projects.

	• Explain official financial statements of a mining business. • Analyze elemental factors of production for a mining company. • Evaluate risks of a mining operation. • Use sensitivity analysis for financial analysis of mining projects. • Contrast official standards for reserves and resources reporting. • Describe basics of the mine valuation process.
Languages of instruction	English
Teaching and learning method	Theoretical knowledge transmission and active participation for calculations (Flipped Classroom Concept) Voluntary assignments
Assessment **(Exam Method and Evaluation)**	Written
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. Lecture notes will be available via Moodle.

Environmental Aspects of Mineral Extraction

Course Nb	200.058
ECTS	3
Type	Lecture
Offering period	Summersemester
Lecturer	Moser-Tscharf
Course description	
Content	This course provides a comprehensive outline and understanding on the impacts that mineral extraction may have on society and environment. • The unit covers the following broad areas o Mining, sustainability and ethical responsibilities o Impacts of mining projects on atmospheric environment o Impacts of mining projects on terrestrial environment o Impacts of mining projects on aquatic environment o Impacts of mining projects on social values
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basics of Open Pit Mining • Basics of Underground Mining
Objective (expected results of study and acquired competences)	The students should become familiar and be capable of demonstrating an understanding with the environmental and social aspects associated with mining projects. On completion of this course the participants shall be able to:

	• Describe the principles of mining and sustainable development in context with ethical responsibilities • Identify, analyze and understand the major impacts of mining projects in atmospheric, terrestrial and aquatic environments • Describe the major issues associated with social/community impacts of mining projects
Languages of instruction	English
Teaching and learning method	• Interactive lecture (incl. short tasks) • Lecture • Active participation, discussions • Individual research and presentation
Assessment (Exam Method and Evaluation)	Written and oral
Further information	
Recommended reading	• Azcue, J. M., Ed.: Environmental impacts of mining activities. Springer, 1999. • Environmental Law Alliance Worldwide (ELAW): Guidebook for Evaluation Mining Project EIAs, 1st edition, 2010 • Evans, A.M.: An introduction to economic geology and its environmental impact. Blackwell Science Ltd, 1997. • Sengupta, M.: Environmental impacts of mining – monitoring, restoration and control. Lewis Publishers, 1993.

	• Wagner, H. et al.: Umweltauswirkungen der Rohstoffgewinnung. Montanuniversität Leoben, 2006.
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Environmental Engineering in Mining, Mine Rehabilitation and Post Mining Operation

Course Nb	200.112
ECTS	6
Type	Lecture
Offering period	Summersemester
Lecturer	Moser-Tscharf
Course description	
Content	• This course provides a comprehensive outline and understanding on the impacts that mineral extraction may have on society and environment, as well as mitigation techniques and methods for Mine Rehabilitation and typical actions in the Post Mining Phase. • The unit covers the following broad areas o Mining, sustainability and ethical responsibilities o Impacts of mining projects on atmospheric environment o Impacts of mining projects on terrestrial environment o Impacts of mining projects on aquatic environment o Impacts of mining projects on social values o Site reclamation and mine closure o Rehabilitation and Revegetation
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basics of Open Pit Mining • Basics of Underground Mining

Objective (expected results of study and acquired competences)	The students should become familiar and be capable of demonstrating an understanding with the environmental and social aspects associated with mining projects as well as Site reclamation and mine closure. On completion of this course the participants shall be able to • Describe the principles of mining and sustainable development in context with ethical responsibilities • Identify, analyze and understand the major impacts of mining projects in atmospheric, terrestrial and aquatic environments • Describe the major issues associated with social/community impacts of mining projects • Discuss the aspects of site reclamation and mine closure in context with the prevention of environmental impacts for decades after mining ceases
Languages of instruction	English
Teaching and learning method	• Interactive lecture (incl. short tasks) • Lecture • Active participation, discussions • Individual research and presentation
Assessment	Written and oral
Further information	
Recommended reading	• Azcue, J. M., Ed.: Environmental impacts of mining activities. Springer, 1999 • Environmental Law Alliance Worldwide (ELAW): Guidebook for Evaluation Mining Project EIAs, 1st edition, 2010

	• Evans, A.M.: An introduction to economic geology and its environmental impact. Blackwell Science Ltd, 1997. • Sengupta, M.: Environmental impacts of mining – monitoring, restoration and control. Lewis Publishers, 1993. • Wagner, H. et al.: Umweltauswirkungen der Rohstoffgewinnung. Montanuniversitaet Leoben, 2006.
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Excavation Engineering

Course Nb	200.059
ECTS	3
Type	Integrated course
Offering period	Wintersemester
Lecturer	Hartlieb, Sifferlinger
Course description	
Content	This course provides an overview of the different excavation technologies used in mining and civil engineering. It mainly covers excavation by drilling and blasting, as well as mechanical excavation concepts, but also discusses alternative excavation concepts as e.g. Laser, and high-pressure water jets. The technologies are explained in detail, i.e. their technical functionality, pros and cons, environmental side effects and economic performance
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basics of mining and mining related processes • Rock mechanics
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Know about the different excavation concepts • Know about different methods used for underground drifting and production • Identify and design the excavation method best suited for their operation
Languages of instruction	English

Teaching and learning method	Integrated lecture Group assignment for independent work, Industry field trip (1 day) if possible Interactive lectures
Further information	
Recommended reading	Lecture notes in pdf format
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Excursion

Course Nb	200.198
ECTS	2
Type	Field Trip
Offering period	Winter-/Summersemester
Lecturer	Hartlieb, Tost
Course description	
Content	• Visits of mining operations in Austria, in the European Union and overseas as an additional training to the theoretical study program at the university • Discussions with mine managers about the organization of mining operations and the planning of new mines.
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Bachelor in Mineral Resources Engineering or Applied Geosciences is essential. • Detailed knowledge of open pit- and underground mining methods • Knowledge of mine organization
Objective (expected results of study and acquired competences)	• Application of previously gained knowledge. • Comparison of theoretical knowledge and application case. • Comprehensive insight of entire mining operations from technological to economic aspects, from mining to processing.
Languages of instruction	English

Teaching and learning method	• Mine visits and tours • Talks to mine managers and discussion with persons in charge • Active preparation of the tour points • Final report after the excursion.
Further information	
Recommended reading	Will be updated on the website according to the specific dates and tour points of the excursion.
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Feasibility Study

Course Nb	200.009
ECTS	3
Type	Seminar
Offering period	Wintersemester
Lecturer	Hartlieb
Course description	
Content	In this course students work on real project of an Austrian mine or quarry. The goal is to independently work on the project goals set by the company. It includes application of existing knowledge on all aspects related to a mine, i.e but not exclusively mine planning and scheduling, geomechanics, finances, project management
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Open pit mining systems and methods • Underground mining systems and methods • Mining machinery • Auxilliary equipment • Mine planning and scheduling • Rock mechanics
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Independently perform a mining related project • Manage this project, work as a team • Present the project results to the customer
Languages of instruction	English
Teaching and learning method	• Independent course work with supervision and feedback sessions by lecturer

Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture.

Geoinformatics

Course Nb	200.185
ECTS	2,5
Type	Lecture / Practical
Offering period	Wintersemester
Lecturer	Mayer
Course description	
Content	• Introduction into the methods and concepts of spatial informatics and some applications in the mineral extraction industry. Practical work using software tools.
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1)
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Visualize spatial data, as used in the mineral resources industry with software tools • Perform simple analyzes and calculations, such as resource estimations.
Languages of instruction	English
Teaching and learning method	Lectures Active participation, discussions
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Introduction in Mining

Course Nb	200.096
ECTS	2,5
Type	Lecture
Offering period	Two weeks intensive course prior to the start of the wintersemester
Lecturer	Moser-Tscharf
Course description	
Content	This two-weeks self-study course gives a basic introduction in: • Excavation Engineering • Surface Mining Methods • Underground Hard Rock Mining Methods • Rock Mechanics • Rock and Rock Mass Parameters • Mine Ventilation • Mining Subsidence Engineering • Mine Surveying • Environmental Aspects of Mineral Extraction
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Background in mining or related fields, e.g.: o Tunneling o Mineral Processing o Geology o Environmental Engineering o Mine Surveying
Objective (expected results of study and acquired competences)	The aim of this course is to give incoming students an insight into mining and into the requirements and focus of the courses of the mining study programs at Montanuniversität.

	On completion of this course the participants shall be able to: • Know and use relevant terms and definitions in the abovementioned topics • Solve basic tasks in the field of the abovementioned topics • Understand the interaction between the abovementioned topics • Follow Master lectures in Mining at Montanuniversitaet
Languages of instruction	English
Teaching and learning method	Online self-study assisted by moodle
Further information	
Recommended reading	• Introductory mining engineering, Hartman, Howard L; Mutmansky, Jan M, 2002, 2. Ed • SME Mining Engineering Handbook, Society for Mining, Metallurgy and Exploration

Introductory Mining Engineering

Course Nb	200.067
ECTS	3
Type	Lecture
Offering period	Wintersemester
Lecturer	Varelja
Course description	
Content	This course gives a general introduction to mining. Starting from the intersection of geology and economic geology, to basic mining equipment and its modes of operation, to the wide range of underground and open pit mining methods who will be discussed in detail, highlighting their relevance as well as pre-requisites to the deposit and rock mechanics.
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Geology and knowledge of deposit types • Basic rock mechanics and mineral processing
Objective (expected results of study and acquired competences)	On completion of this course the participants shall: • Know the economic definition of a deposit • Know the basic mining processes and their equipment • Be able to distinguish between different mining system classifications • Know the main surface and underground mining methods, explain them and their area of use. • Know the main excavation concepts and their area of application as well as constraints

Languages of instruction	English
Teaching and learning method	Lectures
Assessment **(Exam Method and Evaluation)**	Written
Further information	
Recommended reading	Will be uploaded to moodle
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Lab in Introductory Mining Engineering

Course Nb	200.028
ECTS	1
Type	Practical
Offering period	Wintersemester
Lecturer	Haindl
Course description	
Content	Practical approach to underground mine design • Genesis of a deposit • Access to underground mine Mining method and layout
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1)
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Identify possible mine methods based on given constraints of a deposit. • Describe possibilities to access an orebody • Prepare a report describing the deposit portfolio.
Languages of instruction	English
Teaching and learning method	• Workshop • Mandatory attendance (75% required) • Group work • Model examination via VR
Assessment (Exam Method and Evaluation)	Final written report and presentation of group activities

Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Lab in Mine Ventilation

Course Nb	200.107
ECTS	1
Type	Practical
Offering period	Wintersemester
Lecturer	Sifferlinger
Course description	
Content	• Numerical and analytical analysis of ventilation networks • Resistance, pressure drop & air flow • Fan performance and air flow calculations • Gas distribution and dilution analysis • Introduction in ventilation simulation software • Ventilation survey calculations
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basic knowledge of: o Mine ventilation systems o Underground atmosphere o Ventilation surveys
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • Perform simple ventilation network analysis, fan design for underground mines, evaluation ventilation survey data; gas dilution and environment calculation • Set up of ventilation models with simulation software
Languages of instruction	English
Teaching and learning method	Laboratory

Further information	
Recommended reading	McPherson, Malcolm J. Subsurface ventilation and environmental engineering. 2012
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Lab in Rock Mechanics 1

Course Nb	200.104
ECTS	2
Type	Practical
Offering period	Summersemester
Lecturer	Frühwirt, Gams
Course description	
Content	• Rock mechanics basics • Laboratory testing • Rock mass rating • Slopes • Open pit • Dams
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Good mechanical and mathematical skills
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • Understand the principles of stresses, strains and failure of rock and rock mass • Find parameters of rock and rock mass • Design slopes and open pit mines
Languages of instruction	English
Teaching and learning method	Calculation exercise Practical work in Laboratory
Assessment (Exam Method and Evaluation)	Entrance exam (has to be passed) 2 additional exams

Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Lab in Rock Mechanics 2

Course Nb	200.105
ECTS	2
Type	Practical
Offering period	Summersemester
Lecturer	Frühwirt, Gams
Course description	
Content	• Numerical analysis • Design of underground openings • Support design
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Rock Mechanics 1 – Open Pit, Slopes, Dams (200.123) • Lab in Rock Mechanics 1 (200.104)
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • Do basic numerical analysis • Design underground openings • Design support
Languages of instruction	English
Teaching and learning method	Calculation exercise
Assessment (Exam Method and Evaluation)	Entrance exam (has to be positive) Project work, presentation and oral exam

Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Marine Mining

Course Nb	200.148
ECTS	2
Type	Lecture
Offering period	Wintersemester
Lecturer	Groß, Wamser
Course description	
Content	• Introduction in marine mining • Marine mining methods • Overview of marine mineral deposits • Geology and mining methods for different raw materials • Environmental impact • Marine mining regulations • International law of the sea • International dispute resolution • Safety regulations for offshore employment
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basics of mechanical excavation methods, geology and mineralogy
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • Know the principles of marine mining methods depending on different geological requirements • Have a basic understanding of legal requirements for marine mining activities • Assess potential legal problems and know mechanics for dispute resolution
Languages of instruction	English

Teaching and learning method	Lectures Active participation and discussion
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Mine Operation, Scheduling, Costing

Course Nb	200.110
ECTS	3
Type	Integrated course
Offering period	Wintersemester
Lecturer	Frömmer, Haindl
Course description	
Content	• Basics of a mining operation (exploration, factors of production) • Link mining operation – economic situation • Reserves and resources • Cost accounting • Scheduling in mining
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1)
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • Describe internal and external influences on a mining operation from an economic point of view. • Explain cost accounting principles. • Create a simple mine schedule with given constraints.
Languages of instruction	English
Teaching and learning method	• Class lecture with discussions • Active participation and interaction are supported • Practial part in computer laboratory with assignments

Assessment (Exam Method and Evaluation)	• Continuous assessment: Attendance (min. 75%) Written test (part Mr. Frömmer) 60% (pre-condition for the participation at the exercise) Active participation 10% Written test (part Haindl) 30%
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Mine Surveying Project Study

Course Nb	200.049
ECTS	3
Type	Seminar
Offering period	Wintersemester
Lecturer	Mayer, Moser-Tscharf
Course description	
Content	• Project study on various topics in the field of Mine Surveying and Mining Subsidence Engineering. • The respective topics are selected in coordination with the students' experiences or with the current research and project activities of Chair of Mining Engineering
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Knowledge in surveying and mining
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Structure the project, define the sequence with milestones and form working groups • Combine interdisciplinary knowledge from mine surveying and mining subsidence engineering on a practical topic
Languages of instruction	English
Teaching and learning method	Practical groupwork
Assessment (Exam Method and Evaluation)	Project report and presentation

Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Mineral Economics

Course Nb	200.193
ECTS	3
Type	Lecture
Offering period	Wintersemester
Lecturer	Drnek
Course description	
Content	• Theory of mineral demand • Determinants of mineral demand • Demand functions, elasticities of demand, supply-cost functions of mineral resources and secondary materials • Competitive vs. producer markets • Factors affecting mineral prices, commodity exchanges, objectives and instruments of mineral policy • Long-term trends on mineral markets • Statistics of energy resources and mineral commodities. • The raw-material commodities are introduced in detail.
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Good general knowledge is helpful
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • Understand the connections and events on raw material markets • Know the fundamentals for analyses of the raw material markets

	• Impart knowledge in the field of raw material policies and trade
Languages of instruction	English
Teaching and learning method	• Intensive and permanent active participation; i.e.: presentations, pre-reading assignments • Critical analysis and argument of the presented material Teaching and learning method • Presentation of theory and practical examples • Question and answer session • Discussion • Analysis of current economic situation
Assessment (Exam Method and Evaluation)	• The written exam is in classroom and consists of four questions and one calculation example. In exceptional cases (if the law requires it) the exam can be online oral.
Further information	
Recommended reading	Britton S. et al: Minerals Economics. In: Mining Engineering Handbook, SME (2nd ed., Vo.1),p. 43 – 139 Fettweis G.B.: Der Produktionsfaktor Lagerstätte. In: Die elementaren Produktionsfaktoren des Bergbaubetriebs. Band 1 Gschwindt, E.: Projektierung von Bergwerken im Ausland, In: Die Wirtschaftlichkeit und Bewertung im Bergbau. Band III Von Wahl: Bergwirtschaft Band I bis III Von Wahl: Wirtschaftliche Bewertung von Lagerstätten und von Bergwerksunternehmen. In: Die Wirtschaftlichkeit und Bewertung im Bergbau. Band III

	• Business- and Financial section of the following newspapers: Frankfurter Allgemeine Zeitung Neu Zürcher Zeitung Süddeutsche Zeitung Financial Times The Times: London and New York • Reference Books: Gabler: Wirtschaftslexikon • Further Reading: Annual Report Rio Tinto (Internet) Annual Report BHP (Internet)
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Mine Ventilation, Water Control, Infrastructure

Course Nb	200.106
ECTS	3
Type	Lecture
Offering period	Wintersemester
Lecturer	Sifferlinger
Course description	
Content	• Repetition of the basics of mine ventilation from BSc program including mine climate • Context of mine ventilation in the frame of mine design and layout • Basics of air flow mechanics and relevant physical laws • Basics and principles of mine ventilation including air flow principles in underground mining including ventilation laws • Analytical mine ventilation calculations • Numerical mine ventilation calculations, demonstration of ventilation software • Secondary ventilation including design and layout
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Mathematics 1 • Physics of airflow • Basics of underground mining
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Understand why it is important to have a proper mine ventilation system

	• Know the work safety risks associated with insufficient mine ventilation • Apply principles of air flow physics to mine ventilation problems • Do analytical calculations of simple ventilation networks • Understand the algorithm which is typically used in mine ventilation software packages • Do the design and layout of a secondary ventilation system • Understand the influence of design parameters of secondary ventilation on the ventilation results
Languages of instruction	English
Teaching and learning method	Lectures Homework calculations Active participation and discussion
Assessment (Exam Method and Evaluation)	Oral exam
Further information	
Recommended reading	Mc Pherson M. J.: Mine Ventilation Handbook
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Mining in Austria, in the European Union and worldwide

Course Nb	200.140
ECTS	1
Type	Lecture
Offering period	Wintersemester
Lecturer	Sanchez
Course description	
Content	This lecture aims at providing an overview of mining operations, background, raw materials policy, and mining economics in a worldwide perspective. Therefore, background statistics, and theoretical considerations, are mixed with presentations from industry and government representatives aiming at providing a comprehensive oversight.
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basic knowledge in mineral economics • Main economic drivers in the mining industry
Objective (expected results of study and acquired competences)	On completion of this lecture the participants shall be able to have a good comprehension of: • The mining industry in terms of production and economic outlook • Worldwide demand and supply of mineral resources • Critical future issues of the mining industry • Mining in different areas of the world

Languages of instruction	English
Teaching and learning method	Lectures, presentations, active participation and discussions
Assessment (Exam Method and Evaluation)	Written and oral
Further information	
Recommended reading	Will be updated to moodle
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Mining Subsidence Engineering

Course Nb	200.045
ECTS	3
Type	Lecture
Offering period	Wintersemester
Lecturer	Babaryka, Moser-Tscharf
Course description	
Content	• Definition of mine damages (legal and technical aspects), • Basic principles of Mining Subsidence Engineering and differences to Mining Rock Mechanics • The dynamics of ground movement and the critical areas of extraction in a subsidence trough according to Lehmann • Important angles of ground movement • Influence of shallow and deep underground mining • Vertical and horizontal ground movement (ground movement elements) • Fundamentals of pre-calculation of ground movement,
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1)
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Define mining damage in technical and legal sense

	• Explain the principles of Mining Subsidence Engineering and be able to delimit it from Mining Rock Mechanics • Discuss how depth and other geometrical and geotechnical parameters do influence ground movements • Use different simple approaches to pre-calculate ground movements
Languages of instruction	English
Teaching and learning method	Interactive Lecture, as well as practical and computational exercises in individual and group work
Assessment (Exam Method and Evaluation)	• Written exam • Practical and computational short tasks in the context of the course
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Monitoring Techniques, Data Handling and Analysis in Mining

Course Nb	200.118
ECTS	3
Type	Lecture
Offering period	Summersemester
Lecturer	Hartlieb, Häupl
Course description	
Content	This lecture deals with any kind of data in Mining in a wider sense. Every mining operation produces a lot of data in different sub-processes (from geology, to drilling & blasting, loading, hauling, processing,), but just little of that data is used in an operational context today. Every person working in the mine, like mine managers, mine foreman and machine operators, has different needs towards these data and want to utilise the available information for their best possible use. Starting from the different types of data and measurement systems available, the lecture will explore the ways of gathering and storing the data, as well as suitable ways of analysis, presentation (KPIs) and evaluation methods
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Students should be accustomed to mining operations on surface and underground. • Knowledge about mining system, machines and auxiliary processes is mandatory to follow the course.

	• General computer literacy, basic programming and a desire to dig into complex relationship is beneficiary
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • have knowledge about the data a mine produces, data collection, storage and processing • independently evaluate small datasets and derive meaningful conclusions • have an overview on data collection systems and solutions on the market • define and evaluate the need for KPI-driven data collection solutions
Languages of instruction	English
Teaching and learning method	Class teaching, assisted by project work and self-study
Assessment (Exam Method and Evaluation)	Written and oral
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Occupational and Process Safety

Course Nb	200.147
ECTS	3
Type	Lecture
Offering period	Winter-/Summersemester
Lecturer	Sifferlinger
Course description	
Content	• Safety, Risk, Definitions • Occupational Safety • Process Safety • Risk assessment and analysis and mitigation of hazards • Teamwork example risk mitigation • Homework examples risk mitigation • Major hazards in mining • Accident reporting in Europe, USA and Australia • Mine disaster examples • People-based safety • Failure Mode and Effects Analysis • Safety in confined spaces, Proximity detection in NO-GO-Zones • Software Lifecycle Management • Need for robots in mining
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basics in Engineering • Knowledge of Mining or Industry

Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • Do a simple risk assessment • Start up a simple safety culture • Implement a simple safety strategy
Languages of instruction	English
Teaching and learning method	Lectures with active participation
Assessment (Exam Method and Evaluation)	Written and oral Presentation of homework example with PPT and two questions
Further information	
Recommended Reading	Klein James A., Vaughen Bruce K., Process Safety, CRC Press 2017 Lööw Joel, Johansson Bo, Andersson Eira, Johansson Jan, Designing Ergonomic, Safe., and Attractive Mining Workplaces, CRC Press 2019
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Open Pit Mining

Course Nb	200.051
ECTS	4
Type	Lecture
Offering period	Summersemester
Lecturer	Häupl, Heiss
Course description	
Content	This lecture deals with typical mining processes in open pit mining and quarrying. Starting with the mining situation in Austria typical alpine style mining areas and influencing factors are discussed. Thus, an overview on quarry operations from an economical and technical point of view is conducted. Technically the following topics are covered: • Mine planning (planning process, planning principles, planning techniques, planning models and tools) • Mine operation (main processes: extraction, loading, hauling, crushing, stock pile, waste dump; auxiliary processes: power supply, maintenance/repair, water management, communication) • Surface Mining Methods (evaluation of mining methods and systems, mechanical surface mining methods, aqueous surface mining methods, comparison of surface mining methods) • Mine safety and emergency • Environment and reclamation Economically the following topics are covered: • Factors of production: Material, utilities & energy, goods and services

	• Business processes: Drilling & Blasting, Loading & Hauling, Mineral-Processing, Mineral-Stock, Shipment onto the market • Balance of cost and total revenue • Organizational structure and main processes (leading and supporting processes / internal and external processes) • Process organization with a detailed view on the supply and value-chain
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basic knowledge on open pit mining and mining equipment • Basic knowledge on geology, petrography and technical rock parameters • General business knowledge
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to have knowledge • about open pit mining, quarrying and heavy machinery, • about evaluation, design and operation of open pits, • about mining business economics, • about organizing, analyzing and administrating an open pit operation
Languages of instruction	English
Teaching and Learning Method	Lecture Active participation and discussion Case study discussion has a prominent focus on interactive collaboration of the participants in teamwork

Assessment (Exam Method and Evaluation)	Oral examination
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Planning of Mineral Resources Projects

Course Nb	200.146
ECTS	3
Type	Lecture
Offering period	Summersemester
Lecturer	Frömmer
Course description	
Content	• Introduction project planning and project development, mine lifecycle and phases • Planning cycles, Management system • Dealing with and management of probabilities and uncertainties, information acquisition • Path dependent decision tree • Interactions of involved planning tasks and (eventually) contradicting goals • Strategic mine planning, mine design, mine operation • Exemplary discussion of exploration concepts (goals, requirements, benefit, evaluation) • Exemplary discussion of longterm/midterm mine design • Aspects of sensitivity of changes • Project evaluation, due diligence • Some exemplary illustrations of particular aspects (deposit, technical development, economical evaluation, etc.)
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basic knowledge on all of the involved fields (geology, mining, processing, environmental aspects, economics, risk analysis)

Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Understand the steps and progress of planning projects (project cybernetics) • Understand the relevance of information, uncertainties and risk
Languages of instruction	English
Teaching and learning method	Lecture Active participation and discussion
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Regulation of Mining Demages and Ensuring Land Use

Course Nb	200.091
ECTS	1,5
Type	Lecture
Offering period	Summersemester
Lecturer	Babaryka, Moser-Tscharf
Course description	
Content	• The law in Austria and Germany governing mining damage • Construction in mining areas Subsoil and structural damage • Pseudo mining damage: delimitation of mining damage - structural damage • Assessment of mining damages: determination of market value and calculation of depreciation of affected objects • Compensation for subsidence damage - Calculation of diminished value • Mining damage protection - damage removal • Ensuring land use after termination of mining activities • Determination of the risk potentials of closed mines near surface and risk zoning for spatial planning • Eternity burdens in mining - future costs
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Sustainable knowledge in the field of mining subsidence especially the following contents:

	o The dynamics of ground movement and the critical areas of extraction in a subsidence trough according to Lehmann o Ground Movement elements and their distribution above the extraction site o Pre-calculation of Ground Movements with different methods,
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to apply the knowledge about: • Understand the legal of background and relevant laws in relation to mining damage • Assess mining damage based on examples • Distinguish between pseudo mining damage and “real” mining damage • Explain and apply different methods for mitigation of and protection against mining damage • Calculate diminished value due to mining damage and know how compensation of mining damage works • Consider follow-up land use in the process of mine-closure • Discuss the relation of mining, mining damage and spatial planning
Languages of instruction	• English
Teaching and learning method	• interactive lecture • Practical and computational exercises in individual and group work

Assessment (Exam Method and Evaluation)	• Written exam • Practical and computational short tasks in the context of the course
Further information	
Recommended reading	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Risk Management in Mines

Course Nb	200.143
ECTS	3
Type	Lecture
Offering period	Summersemester
Lecturer	Tost
Course description	
Content	• Introduction into the objectives and methods of risk management in mines • Definitions: hazard, risk, damage, severity, volatility, uncertainty, complexity, ambiguity • ISO 31000: 2018 Risk Management • Risks in Business • Risks in mining: safety, human, geological, technical, economic, contractual, political, time, environmental • Methods of risk identification: brain storming, risk check lists, expert risk evaluation • Methods of risk analysis: Regression and correlation analysis, probabilistic event analysis, fault tree analysis, Delphi-method, Monte Carlo simulation, scenario building • Risk evaluation: risk matrix-severity and probability; risk register • Risk control: eliminate, monitoring: physical, environmental, financial, human • Specific situations: projects, emerging risks, health & safety

Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Proven knowledge of mining engineering (Bachelor in Mineral Resources Engineering, examination in major mining engineering subjects) • In case these are missing the student has to pass an entrance test at the beginning of the course with the following contents: o Surface and underground mining methods o Mining equipment o Mine ventilation o Geology
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Comprehend what risks are, especially the inherent risks in mining • Explain the risk management process with an emphasis on mining risks • Identify and quantify mining risks • Apply risk analyses and evaluation techniques • Analyse the results of evaluations and formulate responses (i.e. have basic capabilities to perform risk assessment and management in mines)
Languages of instruction	English
Teaching and learning method	Interactive lectures Active participation and discussion Moodle, videos, reading materials and bonus assignments

Assessment (Exam Method and Evaluation)	Written examination
Further information	
Recommended reading	ISO 31000:2018- Risk Management. International Standards Organization
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Rock Mechanics 1 – Open Pit, Slopes, Dams

Course Nb	200.123
ECTS	3
Type	Integrated course
Offering period	Summersemester
Lecturer	Frühwirt, Gams
Course description	
Content	• Rock and rock mass properties • Slopes – objective • Slope failure mechanisms • Slope design • Numerical modelling • Slope monitoring
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Bachelor in mining engineering or equivalent • Basic knowledge in mining engineering • Basic knowledge in rock mechanics
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Describe rock and rock mass properties • Apply methods for determining rock and rock mass properties • Describe the objectives of slopes • Understand mechanisms of slope stability/instability • Select slope stability calculation methods and approaches • Conduct slope stability calculations • Design appropriate monitoring measures for slopes

Languages of instruction	English
Teaching and learning method	Lecture Group discussion Practical exercises are made in the parallel course “Lab in Rock Mechanics 1 (200.104)”
Assessment (Exam Method and Evaluation)	• Intermediate tests • Slope design task • Oral examination
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Rock Mechanics 2 – Underground, Surface Damage

Course Nb	200.103
ECTS	3
Type	Integrated course
Offering period	Wintersemester
Lecturer	Frühwirt
Course description	
Content	• Stress and stress measurement • Stress changes around excavations • Rock and rock mass fracturing and failure • Support • Mine infrastructure • Pillar design • Stope design • Rock engineering mine design
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Bachelor in mining engineering or equivalent • Advanced knowledge in mining engineering • Positive completion of the integrated courses Underground Mining (200.044), Rock Mechanics 1 (200.123) and Lab in Rock Mechanics 1 (200.104)
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • estimate primary stress situation • select appropriate stress measurement methods • describe the stress changes around excavations

	• discuss rock and rock mass fracturing and failure • describe different support systems • select appropriate support measures • conduct rock engineering design of infrastructure • describe the strength of pillars • discuss the stresses acting inside pillars • conduct rock engineering design of pillars • discuss stope stability • conduct rock engineering design of stopes • describe the rock engineering mine design approach • conduct rock engineering mine designs
Languages of instruction	English
Teaching and learning method	• Lecture • Group discussion • Practical exercises are made in the parallel course “Lab in Rock Mechanics 2 (200.105)”
Assessment (Exam Method and Evaluation)	• Intermediate tests • Mine design task • Oral examination

Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester. The participation in the parallel course “Lab in Rock Mechanics 2 (200.105)” is highly recommended.

Selected Aspects of Engineering Surveying in Mining and Tunelling

Course Nb	200.201
ECTS	3
Type	Lecture
Offering period	Summersemester
Lecturer	Keszleri-Futivic, Mayer, Moser-Tscharf
Course description	
Content	• Objectives and methods of engineering surveying • Selected topics of engineering surveying in mining and tunneling: o Construction surveying o Heading control and stake out o Monitoring and control measurements in mining and tunneling o Deformation analysis o Shaft Surveying o Hydrographic surveying o Error propagation o Adjustment calculation o Geodetic corrections
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Sustainable knowledge in the field of surveying. • At the beginning of the course the students have to pass an entrance test with the following contents: o Implementation and evaluation of an angle measurement with a theodolite

	o Calculation of the 1st and 2nd main task of geodesy o Planning, implementation and calculation of a traverse o Planning, implementation and calculation of a levelling o Coordinate and mapping systems in geodesy and reference systems for position and height measurements
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Plan and carry out of stake out in mining and tunneling • Plan, implement and evaluate the complete orientation (3D) of a mine • Plan and carry out surveying for heading control • Plan, assemble, survey and analyze deformation profiles and networks • Select the method and planning of geodetic as well as hydrographic surveying • Consider possible geodetic corrections when transferring measurements to maps and back • Perform error considerations for surveying tasks
Languages of instruction	English
Teaching and learning method	Interactive Lecture
Assessment (Exam Method and Evaluation)	Written and oral

Further information	
Recommended reading	Möser, Müller, Schlemmer, Werner: Handbuch Ingenieurgeodäsie- Grundlagen; 3.Auflage; ISBN 3-87907-293-0 Torge, W., Müller, J.: Geodesy; 4th edition; ISBN 978-3-11-020718-7
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Selected Aspects of Engineering Surveying in Mining and Tunelling (Practical)

Course Nb	200.202
ECTS	3
Type	Practical
Offering period	Summersemester
Lecturer	Keszleri-Futivic, Mayer, Moser-Tscharf
Course description	
Content	• Objectives and methods of engineering surveying • Selected topics of engineering surveying in mining and tunneling: o Construction surveying o Heading control and stake out o Monitoring and control measurements in mining and tunneling o Deformation analysis o Shaft Surveying o Hydrographic surveying o Error propagation o Adjustment calculation o Geodetic corrections
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Sustainable knowledge in the field of surveying • At the beginning of the course the students have to pass an entrance test with the following contents: o Implementation and evaluation of an angle measurement with a theodolite

	o Calculation of the 1st and 2nd main task of geodesy o Planning, implementation and calculation of a traverse o Planning, implementation and calculation of a levelling o Coordinate and mapping systems in geodesy and reference systems for position and height measurements
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Plan and carry out of stake out in mining and tunneling • Plan, implement and evaluate the complete orientation (3D) of a mine • Plan and carry out surveying for heading control • Plan, assemble, survey and analyze deformation profiles and networks • Select the method and planning of geodetic as well as hydrographic surveying • Consider possible geodetic corrections when transferring measurements to maps and back • Perform error considerations for surveying tasks
Languages of instruction	English
Teaching and learning method	• Workshop • Lecture • Practical and computational exercises in individual and group work

Assessment (Exam Method and Evaluation)	• 2 written tests in the semester • Practical and computational short tasks in the context of the course • Practical field exercises as group work
Further information	
Recommended reading	Möser, Müller, Schlemmer, Werner: Handbuch Ingenieurgeodäsie- Grundlagen; 3.Auflage; ISBN 3-87907-293-0 Torge, W., Müller, J.: Geodesy; 4th edition; ISBN 978-3-11-020718-7
Note	This practical can only be enrolled together with the lecture “Selected Aspects of Engineering Surveying in Mining and Tunelling” (200.201)! The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Seminar in Mining Engineering and Mineral Economics

Course Nb	200.114
ECTS	2
Type	Seminar
Offering period	Wintersemester
Lecturer	Ungerer
Course description	
Content	This course aims at high-quality scientific working procedures, writing of thesis of publications as well as presentation of results. Students will have a short introduction, and will then independently elaborate on a topic assigned, producing a report and presenting the findings to the audience)
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basics of Mining and mining related processes
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Independently perform a mining related project • Write a report / thesis • Avoid plagiarism and fraud • Present findings
Languages of instruction	English
Teaching and learning method	• Lecture with exercises • Independent course work with supervision and feedback sessions by lecturer

Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Spatial Planning

Course Nb	200.144
ECTS	2
Type	Lecture / Practical
Offering period	Wintersemester
Lecturer	Moser-Tscharf
Course description	
Content	• Functional and Legal Spatial Planning • Overview of the levels and planning instruments of Spatial Planning in Austria and Europe including data access (Open Data) • Regional and local level of spatial planning in Austria (e.g. zoning plan) • Usage of spatial planning tools based on examples • How and where can I get information about sources of data and accuracy of these data • Spatial Planning tasks associated with Mining License Procedures • Reorganization of Land • Cadaster and Land registration
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1)
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Use the planning instruments of Spatial Planning in Austria (federal, regional and local) • Know how and where to get information about sources of data and accuracy of these data

	• Use data sets and services of the Austrian Provinces and Municipalities • Work with cadaster and land register and know how to use this information • Solve spatial planning tasks associated with Mining License Procedures
Languages of instruction	English (primary), German
Teaching and learning method	• Interactive lecture • Practical group work
Assessment (Exam Method and Evaluation)	• Written exam • Project report and presentation
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Special Mineral Economics

Course Nb	200.165
ECTS	1,5
Type	Lecture
Offering period	Summersemester
Lecturer	Drnek
Course description	
Content	• Principal determinants of mineral demand • Demand functions • Supply-cost functions of minerals, recycling and secondary supply • Mineral markets and prices • Major trends on resource markets • Mineral policy with special regard to resource-related environmental policy. The raw-material commodities are only briefly introduced
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Good general knowledge is helpful
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to • Understand the connections and events on raw material markets • Know the fundamentals for analyses of the raw material markets • Apply the knowledge in the field of raw material policies and trade
Languages of instruction	English

Teaching and learning method	Interactive lecture Active participation in discussions and questions-and-answer sessions Active analysis of current economic situation
Further information	
Recommended reading	Britton S. et al: Minerals Economics. In: Mining Engineering Handbook, SME (2nd ed., Vo.1),p. 43 – 139 Fettweis G.B.: Der Produktionsfaktor Lagerstätte. In: Die elementaren Produktionsfaktoren des Bergbaubetriebs. Band 1 Gschwindt, E.: Projektierung von Bergwerken im Ausland, In: Die Wirtschaftlichkeit und Bewertung im Bergbau. Band III Von Wahl: Bergwirtschaft Band I bis III Von Wahl: Wirtschaftliche Bewertung von Lagerstätten und von Bergwerksunternehmen. In: Die Wirtschaftlichkeit und Bewertung im Bergbau. Band III • Business- and Financial section of the following newspapers: Frankfurter Allgemeine Zeitung Neu Zürcher Zeitung Süddeutsche Zeitung Financial Times The Times: London and New York • Reference Books: Gabler: Wirtschaftslexikon • Further Reading: Annual Report Rio Tinto (Internet) Annual Report BHP (Internet)

Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Sustainable Development: History of thought, basic concepts and current applications

Course Nb	200.098
ECTS	6
Type	Lecture
Lecturer	Grübler, Tost
Course description	
Content	The class provides a basic introduction to the history and the multiple conceptual bases of Sustainable Development as well as its current applications across different social goals and industrial sectors. The class is divided into two main sections: history and concepts of Sustainable Development; and mining & other current SD applications. The two sections are taught jointly. In the history/concepts section the concept of sustainable development is traced first to its origins (renewable resource management, conservation movement, human rights, Brundtland Commission, UN MDGs and SDGs). An overview of underlying fundamental concepts (e.g. soft vs. hard sustainability formulations, ecosystem services, planetary boundaries) from a multidisciplinary perspective including ethics, economics, social and environmental sciences is given. In the mining & current applications of sustainable development section, a historical perspective of mining development and current sustainability initiatives in extractive industries are reviewed.

	Also applied SD concepts and principles, in particular the UN Sustainable Development Goals (SDGs) and ongoing extensions (e.g. The World in 2050 Initiative) are discussed. Throughout the class, special focus will be devoted to discuss the case of extractive industries.
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basic understanding of mining and raw materials
Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Understand and differentiate the various concepts of sustainability and sustainable development • Have a basic understanding of key components, i.e. the areas of the 17 SDGs, including e.g. climate change, poverty reduction and inequality • Understand what SD means for mining and what role and contribution raw materials have in the context of SD • Integrate SD considerations into project planning and assessment
Languages of instruction	English
Teaching and learning method	• Interactive lecture • Presentations and videos • Q&A, discussions • Case studies • Guest lectures
Assessment (Exam Method and Evaluation)	Written and oral

Further information	
Recommended reading	• The 17 Sustainable Development Goals: https://sdgs.un.org/goals • Mapping Mining to the SDGs: An Atlas: https://www.undp.org/publications/mapping-mining-sdgs-atlas
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Sustainability in the Raw Materials Sector

Course Nb	200.037
ECTS	3
Type	Integrated course
Offering period	Summersemester
Lecturer	Tost
Course description	
Content	• Basic introduction to the history of Sustainable Development o Renewable resource management, conservation movement, human rights, Brundtland Commission, UN MDGs and SDGs • Overview of underlying fundamental concepts o Soft vs. hard sustainability, ecosystem services, planetary boundaries • Historical perspective of mining development and current sustainability initiatives in extractive industries (GMI, ICMM, EITI, SLO, etc) o Mining related case study • Applied SD concepts and principles, in particular the UN Sustainable Development Goals (SDGs)
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Basic understanding of mining and mineral raw materials

Objective (expected results of study and acquired competences)	On completion of this course the participants shall be able to: • Name and differentiate the various concepts of sustainability and sustainable development • Explain key components, i.e. the areas of the 17 SDGs, including e.g. climate change, poverty reduction and inequality • Identify what SD means for mining and understand and explain what role and contribution raw materials have in the context of the various underlying concepts of sustainability • Rethink implications for your career and personal life • Visualize spatial data, as used in the mineral resources industry with software tools • Perform simple analyzes and calculations, such as resource estimations.
Languages of instruction	English
Teaching and learning method	• Interactive lectures with active participation and discussions • Moodle, presentations and videos • Case study
Assessment (Exam Method and Evaluation)	Written assignments

Further information	
Recommended Reading	• The 17 Sustainable Development Goals: https://sdgs.un.org/goals • Mapping Mining to the SDGs: An Atlas: https://www.undp.org/publications/mapping-mining-sdgs-atlas
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.

Underground Mining

Course Nb	200.044
ECTS	4
Type	Integrated course
Offering period	Wintersemester
Lecturer	Frühwirt, Gams
Course description	
Content	• Underground mining methods • Mine development • Mine access • Pillar supported mining methods • Backfill supported mining methods • Cave mining methods
Previous knowledge expected	• Good English skills (Minimum: CEF Level B1) • Bachelor in mining engineering or equivalent • Basic knowledge about underground mining and underground mining methods
Objective (expected results of study and acquired competences)	On completion of this course the participant should be able to: • Select an appropriate mining method • Select an appropriate mine access • Design an underground mine • Design mine access and mine development • Evaluate different mine design options
Languages of instruction	English
Teaching and learning method	• Lecture • Group discussion • Presentation and joint discussion of design tasks

Assessment (Exam Method and Evaluation)	• Mine design tasks • Oral examination
Further information	
Note	The assessment methods and the compulsory readings of this course will be announced in detail in the first lecture. The latest version of the lecture notes will be uploaded at the beginning of the semester.