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List of abbreviations:

General:

hpw  Hours per week (Work load)
CP   Credit Point (1CP entspricht 1 ECTS-Punkt)

Course type / Modul:

(PF)  Compulsory subject
(WPF) Compulsory optional subject
(WF)  Elective (additional Exam)

Type of Modul:

V    Lecture
Ü    Exercise
V/Ü  Lecture and exercise
V/E  Lecture and fieldtrip
P    Project report
St.  Student research project
S    Seminar paper
AB   Written thesis
B    Written report

Type of Exam:

(K)  Written Exam
(M)  Oral Exam
(H)  Thesis/paper
(R)  Presentation
(P)  Internship

Skills:

FK   Professional skills
MK   Technical skills
SK   System expertise
SOK  Social skills
Module 1 Shaft Sinking

Degree Programme: M.Sc. Mining Engineering
Number of the Module: 1
Name of the Module: Shaft Sinking
Course(s): Shaft Sinking and Deep Foundations
Tutorial for Shaft Sinking and Deep Foundations
Term: 1
Responsible person for the module: Univ.-Prof. Dr.-Ing. Oliver Langefeld
Lecturer: Univ.-Prof. Dr.-Ing. Oliver Langefeld
Language: Englisch
Position within the Curriculum: Compulsory subject (PF)

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</tbody>
</table>

Requirements:

Learning objectives / Skills: The student to use appropriate knowledge, principles and techniques to plan and execute the sinking and construction of pre-shafts, shafts, staples and inside shafts, ventilation boreholes and auxiliary shafts in underground mines. To plan and execute the construction of pillars in deep foundations, vertical sub-surface technical barriers and dams, subterranean curtains and bored pile walls, construction pits and construction shafts both in structural engineering and in civil engineering projects in transportation and infrastructure like harbours, bridges, dams, utility supplies, channels and tunnels. The student to identify analyse and solve engineering problems resulting from the need to conduct shaft sinking and deep foundations in mining as well as in civil engineering projects, and to enable the students to apply this knowledge in order to develop, discuss and justify proper engineering solutions to those tasks and problems.

Course Outline:
* Characterization and Classification of vertical openings
* Technical and organizational Planning of Shaft Sinking Projects
* Dimensioning and construction of Pre-Shafts
* Shaft Sinking with conventional drilling and blasting
* Consolidation methods (Freezing shaft and injection method)
* Shaft Boring Methods
* Shaft Reinforcement, Support and Lining
* Shaft Haulage Technology (Basics)

Assessment:
Assignment (20%) and Oral or Written Examination (80%)

Media:
Lecture (Activity-based Learning Approach), Beamer-Presentation, Skript, Tutorials, Laboratory, Group and Project works

Literature:
• Secondary literature-to be announced in the lecture

Additional Information:
Module 2 International Mining

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<th>Degree Programme:</th>
<th>MSc Mining Engineering</th>
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<td>Responsible person for the module:</td>
<td>Univ.-Prof. Dr.-Ing. habil. Tudeshki</td>
</tr>
<tr>
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<td>Univ.-Prof. Dr.-Ing. habil. Tudeshki</td>
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Requirements: Basic lectures on: geology, underground and surface mining

Learning objectives / Skills:

International Mining: The students receive factual knowledge about the global mining industry, the worldwide mining and the associated commodity markets as well as insight into the processes of pricing. In addition to basic mining technologies they will acquire knowledge of special mining technologies. In the seminar, which is combined to the project work of Mining and Finance, the students will work on a special topic of international mining and train the capabilities of free speech.

Mining and Finance: Students will acquire knowledge of the necessary steps for preparation of feasibility studies, project development and project financing. Mediation of skills to assess international raw material projects economically is an important goal of the lecture. In the tutorial the students work in small groups on practical examples, prepare a report and present the results in a seminar.

Course Outline:

International Mining:
- international commodity markets
  - reserves, consumption/production
  - countries, companies, market conditions
  - stock exchanges for commodities, prices
- mining technologies of selected international mining projects
  - surface and underground mining
  - special technologies, e.g. marine mining
- independent seminar on a special topic of international mining

Mining and Finance:
- project participants
- type and content of project studies
- risk assessment
- type of project financing
- market analysis and prices, project costs

Assessment: group work with final presentation (seminar)

Media: lecture, projector-presentation, lecture notes
<table>
<thead>
<tr>
<th>Literature:</th>
<th>PC-based spreadsheet analysis</th>
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Module 3 Geoinformation Systems (GIS)

**Degree Programme:** M.Sc. Mining Engineering

**Number of the Module:** 3

**Name of the Module:** Geoinformation Systems (GIS)

**Course(s):**
- Geoinformation Systems
- Tutorial for Geoinformation Systems
- GIS-based analysis and surface modelling

**Term:** 1 and 2

**Responsible person for the module:** Prof. Busch

**Lecturer:** Prof. Busch

**Language:** English

**Position within the Curriculum:** Compulsory Subject (PF)

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</table>

**Requirements:** BSc in Engineering/ natural sciences

**Learning objectives / Skills:** Profound understanding about theoretical aspects of modeling of spatial objects, knowledge about principles of Geographic Information Systems and their functionalities; Ability to use the software ArcGIS (ESRI) and to use special functions for spatial analysis and modeling of surfaces.

**Course Outline:** Introduction to GIS, definitions, purpose of GIS, Geographic Information and Spatial Data, GIS-functionality, thematic mapping; Computer-lab courses: basic functionalities of ArcGIS software and advanced geo-data processing with ArcGIS, Digital Elevation Models, spatial interpolation methods, proximity analysis, overlay functions, design of thematic maps

**Assessment**
- Written examination

**Media:** lecture, beamer presentation, lecture notes, computer-lab-course

**Literature:**
- Graeme F. Bonham-Carter: Geographic Information Systems for Geoscientists: Modelling with GIS.
- Nicholas Chrisman: Exploring geographic information systems.
- Tor Bernhardsen: Geographical Information Systems.
- David J. Unwin, David O'Sullivan: Geographic Information Analysis
- Laurie Kelly, Michael F. Worboys, Matt Duckham. GIS. A computing perspective.
systems.
- ArcGIS online manual and resource centre (http://resources.arcgis.com/en/help/main/10.1/).

Additional Information:
Module 4 Mineral Resources

**Degree Programme:** M.Sc. Mining Engineering

**Number of the Module:** 4

**Name of the Module:** Mineral Resources

**Course(s):**
- Geostatistics
- Economic Geology

**Term:** 1 and 2

**Responsible Person for the Module:** Prof. Lehmann

**Lecturer:**
- Prof. Lehmann
- Dr. Müller

**Language:** English

**Position within the Curriculum:** Compulsory Subject (PF)

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<td>3</td>
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</table>

**Requirements:** basic Lectures on: statistics, Geology, surface and underground mining

**Learning Objectives / Skills:**
- Advanced Geostatistics: After completion of the course students will understand the principles and calculation methods of geostatistical methods and their applications (e.g. kriging) in modern simulation methods.
- Economic Geology: Basic knowledge of geology related to mineral deposits

**Course Outline:**
- **Geostatistics**
  - short repetition of basic statistics
  - fundamentals of geostatistics, Variography
  - calculation, evaluation and interpretation of variograms
  - use of geostatistical basic data in interpolation methods
  - Kriging (2D and 3D)
- **Economic Geology**
  - Structure of the Earth, geologic time, global geological cycles, rocks and ore, water, magmatic and hydrothermal ore deposits, weathering

**Assessment:** Oral or written Examination

**Media:** lecture, projector-presentation, lecture notes

**Literature:**
- **Geostatistics:**
- **Economic Geology:**

**Additional Information:** Recommended: 1-day field trip (Geology of the Harz Mountains)
# Module 5 Advanced Drilling Engineering I

**Degree Programme:** MSc Mining Engineering  
**Number of the Module:** 5  
**Name of the Module:** Advanced Drilling Engineering  
**Lehrveranstaltungen:**  
- Advanced Drilling Engineering I  
- Tutorial for Advanced Drilling Engineering I  
**Semester:** 1  
**Responsible person for the Module:** PD Dr. Dr.-Ing. habil. Catalin Teodoriu  
**Lecturer:** PD Dr. Dr.-Ing. habil. Catalin Teodoriu  
**Language:** Englisch  
**Position within the Curriculum:** Compulsory Subject (PF)

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**Requirements:** Basics in Drilling Technology, Drilling- und Workover Equipment  
**Learning objectives / Skills:**  
Specialized knowledge of drilling technology, including machines and special application  
Advanced Applications in the Drilling Practice  
Provides students with an introduction to advanced drilling topics such as underbalanced drilling, modern drilling technologies, geothermal well drilling and fishing operations. Additionally this course offers the opportunity to learn about team work.

**Course Outline:**  
- Drilling Concepts (Drilling the Limit, etc.)  
- Well Design Procedure (Well Construction)  
- Drilling Optimization  
- Drilling Performance Analysis  
- Drillstring Dynamics  
- Drilling Problems (Risk Analysis, Solutions)  
- HP/HT Wells, Horizontal and Extended Reach Wells, Multilaterals  
- Under Balanced Drilling  
- New Developments in Drilling Operations  
- Offshore Drilling (Well Design and Special Consideration)  
- Blow Out (Fire Fighting)  
- Geothermal Drilling Technology  
- Drilling through Gas Hydrates  
- Case Studies

**Assessment:** Written Examination  
**Media:** Interactive multimedia presentation, Video, Skript, Präsenzübungen, Hands-On Teaching  
**Literature:** SPE.ORG the eLibrary of SPE  
**Additional Information:** The Tutorial will be „Hands-on teching“. The concept connects the theoretical topics of the lecture with practical aspects and experiments. The main goal of this approach is to handover small projects to the students, in order for them to get an better understanding of the theoretic topics of the lecture. The small projects can be the development of functioning models.
Module 6 Ventilation and Climatization – Advanced Level

Degree Programme: M.Sc. Mining Engineering

Number of the Module: 6

Name of the Module: Ventilation and Climatization – Advanced level

Course(s): Ventilation and Climatization – Advanced level

Tutorial Ventilation and Climatization – Advanced level

Term: 2

Responsible person for the module: Univ.-Prof. Dr.-Ing. Oliver Langefeld

Lecturer: Univ.-Prof. Dr.-Ing. Oliver Langefeld

Language: English

Position within the Curriculum: Compulsory Subject (PF)

<table>
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Requirements: Ventilation and Climatization (B.Sc.)

Learning objectives / Skills:
This course develops the knowledge and skills in advanced aspects of underground mine ventilation and climatization practice and environmental control. In addition to the course Mine Ventilation and Climatization on an advanced level, emphasis is also placed on operational aspects such as controlling complex mine ventilation networks and planning ventilation and climatization requirements to manage both safety and production related risks. At the end of the course, the student will be able to:

- Demonstrate practical skill necessary to undertake an underground ventilation and climatization survey together with necessary documentation, analysis and interpretation of results;
- Demonstrate the application of advanced network analysis to ventilation and climatization systems, including thermodynamic aspects;
- Identify the requirements and issues associated with the application of appropriate ventilation and climatization monitoring and measurement systems;
- Develop ventilation designs with regards to environmental hazards found in mines and to apply the ventilation control measures that detect, monitor, minimise and/or manage these hazards;
- Identify, analyse and solve engineering problems regarding gas and dust occurrences;
- Identify, analyse and solve engineering problems resulting from the need to conduct underground mine ventilation and climatization and to enable the students to apply this knowledge in order to develop, discuss and justify proper engineering solutions to those tasks and problems.

Course Outline:

- Ventilation Basics (Fluid Flow, Friction and Shock Losses, Fans, Auxiliary Ventilation)
- Environmental Contaminants
<table>
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<tr>
<td><strong>Media:</strong> Lecture (Activity-based Learning Approach), Beamer-Presentation, Skript, Tutorials, Laboratory, Group and Project works</td>
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## Module 7 Underground Mining Equipment

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<td>Name of the Module</td>
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<td>Course(s):</td>
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<td>Term:</td>
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<td>Responsible person for the module:</td>
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### Requirements:
Tiefbau I and Tiefbau II, Mechanical Engineering

### Learning objectives / Skills:
- Explaining the layout and operating mode of underground mining machinery in both soft rock and hard rock.
- Designing the size of the machines by using formulas and experienced data
- Deciding which kind and size of machinery is the right for a special application

### Course outline:
**Hard Rock Development**
- Jumbo Drill
- Production Drill
- Load-Haul-Dump
- Trucks
- Mine Support
- Infrastructure
- Crusher
- Road Heading Machines
- Tunnel Boring Machines

**Soft Rock Development**
- Continuous Miner
- Longwall Mining Equipment
- Longwall Variations with special equipment
- Maintenance
- Water Management

### Assessment:
Oral or written examination

### Media:
Oral presentation with Power Point, Exercises and discussions

### Literature:
- Sme Mining Handbock
- Equipment Management
- Mining Engineering Analysis
- Longwall Mining, Peng
- Strata Control in in-seam roadways, Junker

### Additional Information:
Module 8 Advanced Rock Mechanics

Degree Programme: M.Sc. Mining Engineering
Number of the Module: 8
Name of the Module: Advanced Rock Mechanics
Course(s): Advanced Rock Mechanics
Term: 2
Responsible person for the module: PD Dr.-Ing. habil. Uwe Düsterloh
Lecturer: PD Dr.-Ing. habil. Uwe Düsterloh
Language: English
Position within the Curriculum: Compulsory Subject (PF)

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Requirements: BSc in engineering/ natural sciences

Learning objectives / Skills:
Based on the lecture students are able to handle the basics of a geotechnical safety assessment for underground excavations. Students can determine geotechnical parameters for rock mass as well as parameters regarding constitutive models based on lab tests. They have the capability to compute the state of stress and strain in the rock mass surrounding underground excavations by using analytical solutions. Finally students can read, verify, validate and evaluate results given from numerical calculations to estimate static stability and tightness of underground structures.

Course Outline:
* overview area of expertise
* geological basics (structure and genesis of rock mass, earth history)
* exploration techniques
* lab testing (testing technique, analysis, parameter determination)
* field testing
* primary stress
* rock mechanical calculations (analytical calculations, verification, validation, interpretation of numerical calculated results)
* safety assessment (comparison between computed stresses and strength)

Assessment: Written Examination
Media: Lecture, beamer presentation, lecture notes, exercises, experimental equipment

Literature: given parallel to lecture

Additional Information
Module 9 Advanced Mine Surveying

Degree Programme: M.Sc. Mining Engineering
Number of the Module: 9
Name of the Module: Advanced Mine Surveying
Course(s):
- Basics of Strata and Ground Movements
- Mine Mapping
- Remote Sensing
- Tutorial for Remote Sensing

Term: 2 and 3
Responsible person for the module: Prof. Busch
Lecturers: Prof. Busch
Language: English
Position within the Curriculum: Compulsory Subject (PF)

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<td>35</td>
<td>35</td>
<td>18</td>
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</table>

Requirements: BSc in engineering/ natural sciences

Learning objectives / Skills: Students will understand geomechanical processes, from the development of an underground mining cavity up to the deformation of the ground surface: incl. possibilities for the detection of ground movements, classification of ground movements and methods to reduce impacts. Students acquire knowledge about the basics of mine mapping: authorization, preparation and composition of mine-plans in international comparison. Students learn abilities for documentation and visualization of mining activities. Students will understand physical basics of remote sensing and learn methods and software tools for applications related to mining activities, e.g. mineral exploration, mapping of environmental impacts, monitoring of ground movements and hazards.

Course Outline: • Introduction to the topics rock and ground movements
• Methods for detection of ground movements and ground and object deformation
• prediction of ground movements
• subsidence from abandoned mines
• Risk assessment of suspected areas, measures to reduce mining damage
• Legal regulation of mining subsidence
• cartographic design and illustrations
• Importance and international legal regulations of mine mapping
• map projections, sections and perspective imaging
• components of mine plans, national standards
• preparation & layout and construction in mine plans
• Principles of satellite remote sensing
• Satellite & sensors: properties, search and ordering of data
• Digital Image processing with ENVI/IDL software
• Image enhancement, correction, classification and transformation
• Introduction to hyperspectral remote sensing for mineral exploration
• Lithological mapping using ASTER images
• Introduction and application of SAR for mapping of mining induced ground movements; NEST SAR processing

**Assessment:**
Written Examination

**Media:**
lecture, beamer presentation, lecture notes, computer-lab-course

**Literature:**
National Mining Standards and Regulations, e.g. Markscheider Bergverordnung 1986 (Germany), Surveying practice and statutory plans; NCB; 1955 (England); Code of Federal Regulations, Mineral Resources (U.S. Government).
Module 10 Mineral Processing

**Degree Programme:** M.Sc. Mining Engineering  
**Number of the Module:** 10  
**Name of the Module:** Mineral Processing  
**Course(s):** Mineral Processing  
**Term:** 2  
**Responsible person for the module:** Prof. A. Weber  
**Lecturers:** Prof. A. Weber  
**Language:** English  
**Position within the Curriculum:** Compulsory Subject (PF)

<table>
<thead>
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<th>Contact hours-/ Independant hours</th>
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</table>

**Requirements:** none

**Learning objectives / Skills:** This lecture is intended to outline the basic principles of mineral processing arranged in unit operations. In order to deepen the understanding of the challenges occurring in particular applications and to facilitate the orientation of the students within the field, importance will be attached to the equipment employed in mineral processing. Finally, to appreciate the interdependence of the various unit operations a few worked examples on plant practice will be integrated.

**Course Outline:**
- Introduction
- Fundamentals
- Size reduction
- Sizing separation
- Concentration separation
- Materials handling
- Plant practice

**Assessment**
- Written Examination

**Media:** Lectures, beamer presentations, script, exercises in class

**Literature**

**Additional Information**
Module 11 Underground Mine Planning

<table>
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<tr>
<th>Degree Programme:</th>
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<tr>
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<td>Responsible person for the module:</td>
<td>Univ.-Prof. Dr.-Ing. Oliver Langefeld</td>
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<td>Lecturer:</td>
<td>Univ.-Prof. Dr.-Ing. Oliver Langefeld</td>
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<td>28/62</td>
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<td>30</td>
<td>20</td>
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</tbody>
</table>

Requirements: Tiefbau I and II

Learning objectives / Skills:
This course develops the knowledge and skills in aspects of underground mine planning and environmental control. At the end of the course, the student will be able to:
- Demonstrate practical skill necessary to undertake an underground mine planning survey together with necessary documentation, analysis and interpretation of results;
- Compile technical, economic and other data required for mine planning;
- Demonstrate and apply reserve estimation methods / geostatistical methods;
- Select a suitable mining method and related equipment for a given deposit;
- Plan and schedule mine development and production;
- Identify the requirements and issues associated with mine planning;
- Demonstrate the usage of spreadsheets for mine planning;
- Identify, analyse and solve engineering problems regarding mine planning;
- Identify, analyse and solve engineering problems resulting from the need to conduct mine planning and to enable the students to apply this knowledge in order to develop, discuss and justify proper engineering solutions to those tasks and problems.

Course Outline:
- Objectives, Classification and general aspects Underground Mine Planning
- Stages of Mine Planning; Principles of Project Management
- Exploration and Classification of reserves
- Reserve estimation / Geostatistics
- Mine life / capacities
- Mining methods selection
- Equipment / Fleet selection
<table>
<thead>
<tr>
<th>Assessment:</th>
<th>Marked Project (50%) and oral or written examination (50%)</th>
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</thead>
<tbody>
<tr>
<td>Media:</td>
<td>Lecture (Activity-based Learning Approach), Beamer-Presentation, Skript, Tutorials, Group and Project works</td>
</tr>
<tr>
<td></td>
<td>Yang, B. (2012): Regulatory Governance and Risk Management: Occupational Health and Safety in the Coal Mining Industry</td>
</tr>
<tr>
<td></td>
<td>Rudenno, V. (2012): The mining valuation handbook: mining and energy valuation for investors and management</td>
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<td></td>
<td>Secondary literature-to be announced in the lecture</td>
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<td>Additional Information:</td>
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</table>
Modul 12 Advanced Surface Mining

Degree Programme: M.Sc. Mining Engineering
Number of the Module: 12
Name of the Module: Advanced Surface Mining
Course(s): Advanced Surface Mining
Mining and Environment
Term: 3
Responsible person for the module: Prof. Tudeshki
Lecturers: Prof. Tudeshki
Language: English
Position within the Curriculum: Compulsory Subject (PF)

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<td>28/62</td>
<td>3</td>
<td>25</td>
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</table>

Requirements: basic lectures on: geology, surface mining

Learning objectives / Skills:
Advanced Surface Mining: Students do learn special surface mining technologies. Aim of the course is to enable students to design open pit mines including the selection and dimensioning of mining equipment.

Mining and Environment: Students will understand and critically consider the complex objectives, tasks and content of water management and reclamation, which are closely associated. After completion of the course they are enabled to interpret exploration study results and apply them to other projects.

Course Outline:
Advanced Surface Mining:
- factors influencing the selection and dimensioning of mining equipment
- availability and effectiveness of equipment
- selection and dimensioning of loading equipment
- selection and dimensioning of haulage equipment
- software-based selection and dimensioning of surface mining equipment
- drilling and blasting technology and dimensioning of blasting in open pits

Mining and Environment:
- soil physics, soil and rock mechanics
- hydrogeology and hydrology
- water management of open pits
- dewatering technologies
- dimensioning of water wells
- legal aspects of reclamation
- reclamation goals and technologies

Assessments: Oral or written Examination
Media: lecture, projector-presentation, lecture notes
mine planning software

Additional Information:
### Module 13 Applied Rock Mechanics

<table>
<thead>
<tr>
<th>Degree Programme:</th>
<th>M.Sc. Mining Engineering</th>
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<tbody>
<tr>
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<tr>
<td>Responsible person for the module:</td>
<td>PD Dr.-Ing. habil. Uwe Düsterloh</td>
</tr>
<tr>
<td>Lecturers:</td>
<td>PD Dr.-Ing. habil. Uwe Düsterloh</td>
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</table>

**Requirements:** None

**Learning objectives /Skills:** Students are able to handle various design techniques used in different mining areas (rock mass classification, room and pillar design, analytical solutions, calculation of subsidence, slope stability, selected earth statical analysis)

**Course Outline:**
- * rock mass classification (RQD, ARMR, TQI, ..)
- * room and pillar design, roof dimensioning
- * analytical solutions for shafts and drifts in elastic, plastic and viscous rock mass
- * calculation of subsidence
- * dimensioning Longwall mining
- * anchor
- * slope stability
- * settlement, slide stabilility, slice method

**Assessment:** Written Examination

**Media:** Lecture, beamer presentation, lecture notes, exercises, experimental equipment

**Literature:** given parallel to lecture

**Additional Information:**

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Module 14 Seminar

Degree: M.Sc. Mining Engineering

Number of the Module: 14

Name of the Module: Seminar

Course(s): Seminar

Term: 1

Responsible person for the module: Univ.-Prof. Dr.-Ing. Oliver Langefeld

Lecturer: Professors of the Institute of Mining

Language: Englisch

Position within the Curriculum: Compulsory Subject (PF)

<table>
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<th>Contact hours-/ Self-Study time</th>
<th>CP</th>
<th>FK</th>
<th>MK</th>
<th>SK</th>
<th>SOK</th>
</tr>
</thead>
</table>

Requirements:

Learning objectives / Skills: The Goal of this Module is, to give the students a deeper understanding of the topics of the compulsory lectures as well as gaining an insight on current research areas and topics. The Module aims at improving the students skills, to read and interpret scientific literature and to summarize own research results in a written report and to present the results in an oral presentation to an audience. The reading, understanding and summarizing skills learned during this course will help the students while working on their Master Thesis.

Course outline: Topics according to the lectures of the Master Mining Engineering

Assessment: Written Thesis (max. 25 pages), oral presentation (about 20 minutes) and participation in the discussion following the presentation

Media: Beamer presentation, Written Thesis, Handouts

Literature: General Literature will be given by the supervisor when the Seminar begins

Additional Information:
## Module 15 Industry Internship

<table>
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<td>Lecturer:</td>
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<td>20</td>
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</tbody>
</table>

### Requirements:
- 

### Learning objectives/ Skills:
The Students get an insight into the practical work done in the industry. Additionally they get the possibility to enhance their social skills while working in teams and increase their experience presenting infront of groups.

### Course Outline:
During the Internship the students learn to work on a topic with minimal supervision in a short amount of time. The topics worked on are part of the day to day work within the company, research Institution or government institution.

### Assessment:
Written Report, and a presentation regarding the topics of the internship

### Media:
Written Report, Presentation

### Literature:

### Additional Information:
The Industry Internship can be completed either within the industry, an research Institution or a government Institution.
Module 16 Student Research Project

Degree: M.Sc. Mining Engineering
Number of the Module: 16
Name of the Module: Student Research Project
Course(s): Student Research Project
Term: 3 + 4
Responsible Person for the module: Univ.-Prof. Dr.-Ing. Oliver Langefeld
Lecturer: Professors of the Institute of Mining
Language: Englisch
Position within the Curriculum: Compulsory Subject (PF)

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</table>

Requirements: -

Learning objectives / Skills: The Student Research Project gives the students the possibility to intensify their knowledge of the topics discussed in the lectures as well as to get an insight into current research topics. Besides the technical skills required to do so, the students will have a chance to improve their soft skills, as the project offers them a platform for progress reporting, testing and sharing of ideas and group discussions on the way forward.

Course outline: Topics according to the lectures of the Master Mining Engineering
Assessment: Written Thesis (max. 20 pages per person) and a presentation of the (group) project
Media: Written Thesis, Presentation
Literature: General Literature will be given by the supervisor when the Student Research Project begins
Additional Information: A student research project can be given by all professors involved in the curriculum. It is possible to do it at university or in industry.
Module 17 Master Thesis

<table>
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<th>M.Sc. Mining Engineering</th>
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<tbody>
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<td>Name of the Module:</td>
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</table>

Requirements: Admission according to § 11 Absatz 4 of the „Allgemeine Prüfungsordnung“ (APO).

Learning objectives / Skills: During the Master Thesis the students can apply their Mining Engineering knowledge to a specific problem or research topic. This gives the student the possibility to show, that he has learned to work independently on complex scientific topics, approach the topic in a well-structured and scientific manner and express the results in a written report. Additionally the students can prove that they are able to present their results to an audience during a presentation which includes a followup discussion with the audience.

Course outline: Topics according to the lectures of the Master Mining Engineering

Assessment: Written Thesis and an oral presentation of the results

Media: Beamer, Written Thesis, oral presentation

Literature: General Literature will be given by the supervisor when the Master Thesis begins

Additional Information: A topic for the Master Thesis can be given by all professors involved in the curriculum. It is possible to do it at university or in industry.
Module 18.1. Specialized Driving Methods

Degree Programm:  Msc. Mining Engineering
Number of the Module:  18.1.
Name of the Module:  Specialized Driving Methods
Course(s):  Specialized Driving Methods
Term:  3
Responsible person for the Module:  Univ.-Prof. Dr.-Ing. Oliver Langefeld
Lecturers:  Dr. rer. nat. Nikolaos Polysos
Language:  English
Position within the Curriculum:  Compulsory optional subject (WPF)

<table>
<thead>
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<th>Course Type</th>
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</tbody>
</table>

Requirements:

Learning objectives / Skills:
Geomechanics, roadway development, mining support systems design and calculation

Course Outline:
1. Geotechnical principles of strata control
2. Rock stress and stress field in multiple seam mining
3. Rock and roadway deformation
4. Heading and support systems
5. Roadway development and support design methods and calculations
6. Roadway monitoring

Assessments:
Written examination

Media:
Oral presentation with powerpoint

Literature:
VOB, HOAI, BGB, Baugeräteliste

Additional Information:
Module 18.2. Project Development in Underground Primary Production

<table>
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<tbody>
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<td>Course(s):</td>
<td>Project Development in Underground Mining considering operative and economic aspects</td>
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<td>Lecturers:</td>
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</table>

Requirements:

Learning objectives / Skills:
Knowledge of tendering procedures, contract types and calculation basis; Evaluation of projects considering project and contract risk; assessment and comprehension of different contract types; calculation of budget and offers

Course Outline:
1. Progress of project development
2. Project charter
3. Contract types
4. Tendering procedures
5. Economic aspects
6. Type of costs and calculation of costs
7. Invitation for tender
8. Claim management

Assessments: Written examination

Media: Oral presentation with powerpoint

Literature: VOB, HOAI, BGB

Additional Information: -
## Module 18.3. Underground Blasting

<table>
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<td>Name of the Module:</td>
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<td>Course(s):</td>
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<td>Term:</td>
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<td>Responsible persons for the module:</td>
<td>Univ.-Prof. Dr.-Ing. Oliver Langefeld</td>
</tr>
<tr>
<td>Lectures:</td>
<td>Dr.-Ing. Rüdiger Triebel</td>
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<td>Position within the Curriculum</td>
<td>Compulsory optional subject (WPF)</td>
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### Course Type

| Underground Blasting (2V) | 2 | 28/62 | 3 | 50 | 30 | 10 | 10 |

### Requirements:

Basics in Underground Mining

### Learning objectives / Skills:

Underground Blasting and Explosives Engineering
- General overview on underground blasting.
- Legal framework.
- Nature of explosives and initiation systems.
- Different blast methods.
- Layout of underground drill and blast applications.
- Examples of underground blasts.
- Safety awareness.

### Course Outline:

Underground Blasting and Explosives Engineering
- Basics of underground blasting applications.
- Introduction into explosives regulations.
- Explosives and initiation systems.
- Blasting methods.
- Blasting emissions.
- Safety aspects.

### Assessment:

Oral or written Examination

### Media:

Presentations, demonstrations, videos.

### Literature:

List follows during lecture.

### Additional Information:

Excursions to mines and possibly to explosives manufacturers.
Module 18.4. Software for Underground Mine Planning

Degree Programme: M.Sc. Mining Engineering

Number of the Module: 18.4.

Name of the Module: Software for Underground Mine Planning

Course(s): Software for Underground Mine Planning

Term: 3

Responsible person for the module: Univ.-Prof. Dr.-Ing. Oliver Langefeld

Lecturer: Univ.-Prof. Dr.-Ing. Oliver Langefeld

Language: English

Position within the Curriculum: Compulsory optional subject (WPF)

<table>
<thead>
<tr>
<th>Course Type</th>
<th>hpw</th>
<th>Work Load [h]</th>
<th>CP</th>
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<tbody>
<tr>
<td>Lecture Software for Underground Mine Planning (2V)</td>
<td>2</td>
<td>28/62</td>
<td>3</td>
<td>50</td>
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Requirements: Underground Mine Planning

Learning objectives / Skills: This course provides an introduction to planning software in underground mining. The learning objective include to apply the knowledge of the mine planning process, students will be able to develop, design and model a complete mine layout on the basis of all available information as well as to identify, analyse and solve engineering problems resulting from the need to conduct underground mine planning and to enable the students to apply this knowledge in order to develop, discuss and justify proper engineering solutions to those tasks and problems.

Course Outline:
- Introduction Mine Planning Software
- Basics
- Borehole Information
- Triangulation
- Block Modeling
- Underground Design

Assessment: Assignment (20%) and oral or written examination (80%)

Media: Lecture (Activity-based Learning Approach), Beamer-Presentation, Skript, Laboratory (PC), Group and Project works

Literature:
- Secondary literature-to be announced in the lecture

Additional Information:
## Module 18.5. Advanced Drilling Engineering

<table>
<thead>
<tr>
<th>Degree Programme:</th>
<th>M.Sc. Mining Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of the Module:</td>
<td>18.5.</td>
</tr>
<tr>
<td>Name of the Module:</td>
<td>Advanced Drilling Engineering</td>
</tr>
</tbody>
</table>
| Course(s): | Underground Blasting and Explosives Engineering  
Advanced Drilling Technology II |
| Term: | 4 |
| Responsible persons for the module: | Univ.-Prof. Dr.-Ing. Oliver Langefeld  
PD Dr. Dr.-Ing. habil. Catalin Teodoriu |
| Lectures: | PD Dr. Dr.-Ing. habil. Catalin Teodoriu |
| Language: | English |
| Position within the Curriculum | Compulsory optional subject (WPF) |

<table>
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</table>

**Requirements:** Basics in Underground Mining  
Advanced Drilling Technology I

**Learning objectives / Skills:**  
Specialized knowledge of drilling technology, including machines and special application, other than oil and gas drilling  
Advanced Applications in the Drilling Practice outside oil and gas activities.  
Students will have the chance to perform live demonstration using hands on teaching equipment or building new setups to demonstrate their tasks.  
Additionally this course offers the opportunity to learn about team work

**Course Outline:**  
Drilling fluids for HPHT Conditions  
Drilling for Diamonds  
Directional drilling with application for tunneling  
Drilling and Well Construction for Salt Caverns  
Salt Saturated cementing of wells  
Well Integrity  
Horizontal Directional Drilling  
Case Studies

**Assessment:** Oral or written Examination

**Media:** Presentations, demonstrations, videos.

**Literature:** List follows during lecture.

**Additional Information:**

30
**Module 18.6. Natural Gas Storage in Rock Kaverns**

<table>
<thead>
<tr>
<th>Degree Programme:</th>
<th>M.Sc. Mining Engineering</th>
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<tbody>
<tr>
<td>Number of the Module:</td>
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<tr>
<td>Name of the Module:</td>
<td>Natural Gas Storage in Rock Kaverns</td>
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<tr>
<td>Course(s):</td>
<td>Natural Gas Storage in Rock Caverns</td>
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<tr>
<td>Term:</td>
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<tr>
<td>Responsible person for the module:</td>
<td>Univ. Prof. Dr.-Ing. habil. K.-H. Lux</td>
</tr>
<tr>
<td>Lecturers:</td>
<td>Univ. Prof. Dr.-Ing. habil. K.-H. Lux</td>
</tr>
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<tr>
<td>Natural gas storage in rock caverns (2V)</td>
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<td>28/62</td>
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**Requirements:** Advanced Rock Mechanics

**Learning objectives / Skills:** Thermodynamic and geomechanic principles of gas storage in salt and rock caverns. Geomechanical stability criteria (Prof. Lux), design, construction and operation of cavern storages

**Course Outlines:**
- * introduction, media for storage and operation principles
- * gas storage in salt caverns: geological conditions, planning criteria for exploration and drilling, geomechanical conditions and design of caverns, thermodynamic conditions
- * operation fundamentals: leaching techniques/control, completion, surface facilities, storage operation, capacity characteristics, optimization strategies
- * field cases: selected examples
- * storage of liquids in mined caverns

**Assessments:** Class exercises or oral examinations

**Media:** Lecture, beamer presentation, lecture notes

**Literature:** given parallel to lecture, enclosed in lecture notes

**Additional Information:**
Module 18.7. Advanced Underground Mining

Degree Programme: M.Sc. Mining Engineering

Number of the Module: 18.7.

Name of the Module: Advanced Underground Mining

Course(s): Underground Mining – Special Applications

Term: 3

Responsible person for the module: Univ.-Prof. Dr.-Ing. Oliver Langefeld

Lecturer: Univ.-Prof. Dr.-Ing. Oliver Langefeld

Language: English

Position within the Curriculum: Compulsory optional subject (WPF)

<table>
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<td>3</td>
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</table>

Requirements: Tiefbau I and Tiefbau II

Learning objectives / Skills:
- Explaining the specialities of very deep mining and deep sea mining
- Designing a hard rock / soft rock application in a mine with all important items (road heading, extraction, infrastructure, equipment)
- Explaining sustainability and exercise in different issues

Course Outline:
- Special requirements to very Deep Mining
- Sustainability (I)
- Deep Sea Mining
- Hard Rock Project
- Soft Rock Project

Assessments: Oral or written examination

Media: Oral presentation with Power Point, Exercises and discussions

Literature:
- SME Mining Handbook
- Sustainable Management of Mining Operations
- Mining Engineering Analysis

Additional Information:
Module 18.8. Underground Emergency Response I

<table>
<thead>
<tr>
<th>Degree Programme:</th>
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<tbody>
<tr>
<td>Number of the Module:</td>
<td>18.8.</td>
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<tr>
<td>Name of the Module:</td>
<td>Underground Emergency Response I</td>
</tr>
<tr>
<td>Course(s):</td>
<td>Basics of Fire Protection and Mine Rescue</td>
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<td>Term:</td>
<td>4</td>
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<tr>
<td>Responsible Person for the Module:</td>
<td>Univ.-Prof. Dr.-Ing. Oliver Langefeld</td>
</tr>
<tr>
<td>Lecturer:</td>
<td>Dr. Walter Hermülheim</td>
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**Requirements:**
- Underground work experience (internship).
- Basic knowledge of mine layout, mineral extraction and ventilation methods in coal and non coal mining.

**Learning objectives/ Skills:**
- Develop an understanding for necessities, logical relations and methods concerning the prevention of catastrophic accidents in mining (FK/ SK).
- Enable a production engineer to act safely and properly in case of an unexpected mine emergency (MK/ SOK).

**Course Outline:**
- Basics of Fire Protection and Mine Rescue:
  - Fire prevention and detection, means of fire fighting, fires and ventilation, sealing off fires, fire fighting with inert gases, explosion risks.
  - Organization and training of mine rescue brigades, noxious gases underground, gas detection, breathing protection, equipping a mine rescue brigade, emergency and operational mine rescue work, incl. climate and explosive gases rules.
  - Underground self rescue and escape.
  - Group exercises: Basics of risk analysis, methane dilution in a blind drift, measures during the first hour of a mine emergency.

**Assessment:**
- Written examination

**Media:**
- Presentations, tuition talks, group exercises, sample tests.
- Lecture notes & selected current publications & bibliography as pdf-download.

**Literature:**
- Additional selected literature on mine safety, e. g. papers of the biennial conferences of the International Mines Rescue Body IMRB (www.minerescue.org).

**Additional Information:**
Module 18.9. Underground Emergency Response II

**Degree Programme:** M. Sc. Mining Engineering

**Number of the Module:** 18.9.

**Name of the Module:** Underground Emergency Response II

**Course(s):** Specific Topics of Fire Protection and Mine Rescue

**Term:** 4

**Responsible Person for the Module:** Univ.-Prof. Dr.-Ing. Oliver Langefeld

**Lecturer:** Dr. Walter Hermülheim

**Language:** English

**Position within the Curriculum:** Compulsory optional subject (WPF)

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<td>Specific Topics of Fire Protection and Mine Rescue (2V)</td>
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**Requirements:**
- Underground work experience (internship).
- Basic knowledge of mine layout, mineral extraction and ventilation methods in coal and non coal mining.

**Learning objectives/ Skills:**
- Develop an understanding for necessities, logical relations and methods concerning the prevention of catastrophic accidents in mining (FK/ SK).
- Enable a production engineer to act safely and properly in case of an unexpected mine emergency (MK/ SOK).

**Course Outline:**
- Specific Topics of Fire Protection and Mine Rescue:
  - Recap of basics lecture, designing and equipping a mine rescue station, breathing apparatus for special purposes, rescue of entrapped persons, communication and stress during mine rescue operations, public relations and press work.
  - Explosion protection and explosive dust control in collieries.
  - Spon com fire guideline, underground nitrogen and mortar matter supply, rigid foam processing, design of fire extinguishing systems, gas testing and gas analysis, Graham’s Ratio and Coward-Diagrams, control of explosion prone fires.
  - Tunnel fire safety, mine safety in developing countries.
  - Group exercises: Examples of operational mine rescue work, underground incident scenarios, fighting a spon com fire.
  - Visit to Clausthal mine rescue station.

**Assessment:**
- Written examination

**Media:**
- Presentations, tuition talks, group exercises, sample tests.
- Lecture notes & selected current publications & bibliography as pdf-download.

**Literature:**
- Additional selected literature on mine safety, e. g. papers of the biennial conferences of the International Mines Rescue Body IMRB (www.minerescue.org).

**Additional Information:**
Module 18.10 Sustainability in Underground Mining

<table>
<thead>
<tr>
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<td>2</td>
<td>28/62</td>
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Requirements: Basic lectures on surface and underground mining

Learning objectives / Skills: Understanding sustainability and the importance of it; Current state of art of sustainability in mining; Providing the basics to lead the students to think about sustainability in the mining industry; Improving presentation skills

Course Outline: Discussion of the concept of sustainability and the understanding of it; Overview of sustainability in the mining sector; Concepts related to sustainability; Case study with LCA (Life Cycle Assessment) based on social, environmental and economic factors and theoretical foundations; Current policy in Europe; Discussion of benefits and drawbacks of the development;

Assessment: Oral or written Examination

Media: lecture, projector-presentation, lecture notes

Literature: Will be given in the lecture

Additional Information: -