

# Opasraportti

## FTech - Courses in English for exchange students, Oulu Mining School (2018 - 2019)

### GENERAL INFORMATION: Courses in English for exchange students at the Oulu Mining School

This course catalogue lists the **geosciences and mining engineering and mineral processing courses** taught in English available for exchange students at the *Oulu Mining School*, Faculty of Technology, University of Oulu, during the academic year 2018-19.

**Course availability:** The listed courses are available for **the exchange students hosted by Oulu Mining School if the student has the required previous knowledge** (check that from the course description). **Exchange students hosted by other University of Oulu faculties** have to contact the Exchange Coordinator of the Faculty of Technology (see below) to ask if it is possible to participate to the courses, but also they must have the previous knowledge required for the course in question.

**Exchange application:** All exchange applicants must **submit their application through SoleMOVE by the deadline** (30.4. / 15.10.), and a **proposed study plan** (Learning Agreement signed by you and your home coordinator) is enclosed to the on-line application.

For information on the exchange application process please see [www.oulu.fi/university/studentexchange](http://www.oulu.fi/university/studentexchange).

**Study plan: When preparing your study plan** for your exchange application (in SoleMOVE: Proposed Study Plan tab = your **Learning Agreement**), please use the information provided here under the **Courses, Instruction and Examinations** tabs. Read carefully the information of each course you wish to take (language of instruction, target group, course content, timing, additional information etc.).

Please especially **check the requirements** of the course - see "Prerequisites and co-requisites" in the course's description, and the timing (autumn or spring term, or periods 1, 2 and 3, 4 respectively) of the course (Instruction tab).

**Work load:** Suggested work load is **30 ECTS credits** per term.

**Course levels:** Individual course codes include information on the **level of course**. There are 3 different levels of courses. The **levels are marked with a letter at the end of the course codes**, see explanations below. In WebOodi course descriptions the level is indicated in 'Type' section. In academic year 2018-2019 there are **intermediate (A) and advanced (S) level courses available in English**: A-courses are suitable for Bachelor's students and S-courses for Master's students with the required previous studies. **Basic (P) level courses are only available in Finnish**, and are therefore not available for exchange students.

**Grading scales:** In all courses student's performance is graded on a **passed scale of 1 to 5, 5 being the best grade, or failed (0)**. Detailed information on our academic system is available at <http://www.oulu.fi/english/studying/academic-system>.

**Language skills:** Required level of **English** skills is **minimally B2** (CEFR, Common European Framework of Reference for Languages).

**Course and exam registration:** Course registration takes place once you have been accepted to the exchange and have received your University of Oulu login information close to the start of your exchange period. When registering you will be able to find detailed information on teaching and schedule under **Instruction and Examinations** tab. Please note that it is **mandatory to register to all courses and exams** in WebOodi. If the student does not register

during the registration period, the student is not allowed to participate on the course. Teachers may also limit the number of participants in their courses, if necessary.

**Scheduling:** Our courses' timings are based on so-called **periodical schedules**. Courses which are organized during **periods 1-2** are given on the **autumn** term (September-December), and respectively the **periods 3-4** refer to courses given during the **spring** term (January-May).

### Teaching periods for 2018-2019

#### Autumn term 2018

Period 1: Sept 3 - Oct 26, 2018

Period 2: Oct 29 – Dec 21, 2018 (after period 2 there might be some exams until the end of January)

#### Spring term 2019

Period 3: Jan 7 – March 8, 2019

Period 4: March 11 – May 10, 2019 (after period 4 there might be some exams until the end of May)

For arrival and orientation dates see

<http://www oulu.fi/university/studentexchange/academic-calendar>

### CONTACT INFO

Any questions on courses at the OMS should be addressed to:

M.Sc. Marita Puikkonen

Faculty International Coordinator for Student Exchange

Incoming & Outgoing Mobility

Faculty of Technology, University of Oulu, Finland

Email: Study.Technology(at)oulu.fi fi

Further information on application process and services for incoming exchange students:

<http://www oulu.fi/university/studentexchange/> or international.office(at)oulu.fi

## Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

773633S: Advanced Course of Surficial Geology in Ore Exploration, 5 op

773616S: Aerial photo interpretation in surficial geology, 5 op

772699S: Bedrock geology of Fennoscandia, 5 op

900013Y: Beginners' Finnish Course 1, 3 op

900053Y: Beginners' Finnish Course 2, 5 op

773631S: Biostratigraphy, 5 op

900054Y: Conversational Skills in Finnish, 3 op

493608S: Development of beneficiation processes, 10 op

494601S: Electrical and EM-methods I, 5 op

494602S: Electrical and EM-methods II, 5 op

772640S: Excursion, 5 op

772691S: Exploration and mining - global to local perspectives, 5 op

492602S: Financial and Project valuation of mining, 5 op

494603S: GIS applications, 5 op

774636S: Geochemistry of Mining Environment, 5 op

772694S: Geometallurgy and mineral processing, 5 op

772675S: Geophysics in economic geology, 5 op

772698S: Gold and critical mineral deposits, 5 op

772692S: Hydrothermal ore deposits, 5 op

900015Y: Intermediate Finnish Course 1, 5 op

900016Y: Intermediate Finnish Course 2, 5 op

772335A: Introduction to ore mineralogy, 5 op

774639S: Isotope geochemistry for economic geologists, 5 op

772695S: Magmatic ore deposits, 5 op

772697S: Microscopic study of rocks, 5 op  
 493606S: Mine Geology, 5 op  
 492600S: Mining Engineering, 10 op  
 492603S: Mining Project feasibility study, 5 op  
 493301A: Mining geophysics, 5 op  
 493609S: Mining, environment and society, 5 op  
 493605S: Ore beneficiation technologies, 5 op  
 494605S: Potential fields and airborne geophysics I, 5 op  
 494606S: Potential fields and airborne geophysics II, 5 op  
 493607S: Quality requirements for concentrate, 5 op  
 772696S: Quantitative Evaluation of Minerals in Sediments and Rocks, 5 op  
 773630S: Quaternary geology of Fennoscandia, 5 op  
 772632S: Regional ore geology of Fennoscandia, 5 op  
 492608S: Rock blasting, 5 op  
 772693S: Sedimentary ore deposits, 5 op  
 773655S: Sedimentology, 5 op  
 494604S: Seismic soundings, 5 op  
 772667S: Seminar in ore geology, 5 op  
 900027Y: Special Course in Finnish: Writing Skills, 3 op  
 773656S: Special field course in Quaternary geology, 5 op  
 773632S: Special issues in geoscience, 5 op  
 771660S: Special issues in geosciences, 5 op  
 492607S: Stress wave theory and applications, 5 op  
 772683S: Structural geology for economic geologists, 5 op  
 900017Y: Survival Finnish, 2 op

## Opintojaksojen kuvaukset

### Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

#### **773633S: Advanced Course of Surficial Geology in Ore Exploration, 5 op**

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pertti Sarala

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS.

**Language of instruction:**

English or Finnish.

**Timing:**

4th or 5th year.

**Learning outcomes:**

Upon completion of the course, the student knows and understand:

Mode of the element occurrence in surficial sediments

Research methods of the element occurrences

Analytical techniques: chemical and mineralogical

Mineral fractions and different concentration techniques

Heavy minerals and indicator minerals in ore exploration

Advanced surficial geochemical and biogeochemical sampling and analysis methods

**Contents:**

To describe and explain broadly and analytically the modes of element occurrence in surficial sediments (mainly in glaciated terrain), their analysis methods and the use of indicator minerals and advanced surficial geochemical techniques in ore exploration with an emphasis of conventional and modern approach.

**Mode of delivery:**

Face to face teaching.

**Learning activities and teaching methods:**

The implementation methods of the course vary and will be agreed on together with the students for each course. There will be 24 hours of guided teaching and visits, and about 20 hours of teaching without guidance either privately or in groups.

**Target group:**

Students in the 4th or 5th (periods 1 or 2) year, international students.

**Prerequisites and co-requisites:**

The prerequisite is the completion of the following courses prior to enrolling for the course: Geologian peruskurssi II (771114P), Johdatus Suomen maaperägeologiaan ja maaperän raaka-ainevaihtoihin (771116P) and Maaperägeologinen malminetsintä (773322A) or similar knowledge.

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

McClenaghan, M., Bobrowsky, P.T., Hall, G.E.M. & Cook, S.J., (2001) Drift Exploration in Glaciated Terrain, Geological Society Special Publication N:o 185, 350 p., Other materials delivered during the course.

The availability of the textbooks can be checked [via this link](#).

**Assessment methods and criteria:**

Participation in the lectures, activity in private or group works, final examination. The assessment of the course is based on the learning outcomes of the course. The more detailed assessment criteria are available on the Noppa Study Portal. Read more about assessment criteria at the University of Oulu webpage.

**Grading:**

Grading 1-5/fail.

**Person responsible:**

Pertti Sarala

**Working life cooperation:**

The course could include visits to the companies or guest lectures of the course's subject.

## 773616S: Aerial photo interpretation in surficial geology, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 ECTS / 133 hours of work

**Language of instruction:**

Finnish or English

**Timing:**

4th or 5th study year ( IV period)

**Learning outcomes:**

Upon completion of the course, students should be able to identify and interpret basic landforms from air photographs.

**Contents:**

Introduction to the principles of remote sensing techniques. Geomorphological mapping using Digital elevation models (DEMs). In practicals students produce surficial geological and glaciodynamic maps based on DEM interpretation of landforms.

**Mode of delivery:**

Face to face in class

**Learning activities and teaching methods:**

20 h lectures, 30 h exercises

**Target group:**

Master's level geoscience students

**Prerequisites and co-requisites:**

Quaternary geology of Finland (773306A), Basics of glacial geology (773344A)

**Assessment methods and criteria:**

Pre-examination, exercises and written examination

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**772699S: Bedrock geology of Fennoscandia, 5 op**

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 ECTS.

**Language of instruction:**

The language of instruction is Finnish or English, depending on the participants.

**Timing:**

The course is held in the autumn semester, during period II. It is recommended to complete the course at the 4th or 5th autumn semester.

**Learning outcomes:**

Upon completion of this course, the student will:

have a good overview of the Finnish Precambrian bedrock and its evolution through time.

**Contents:**

The main geological units of the Finnish bedrock as part of the evolution of the Fennoscandian Shield.

Magmatism, sedimentology and metamorphism and geochronology of the Finnish bedrock.

**Mode of delivery:**

Face to face teaching.

**Learning activities and teaching methods:**

36 h lectures.

**Target group:**

All students in geosciences.

**Prerequisites and co-requisites:**

It is recommended that the student has completed studies equivalent to the Bachelor's degree in geology.

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

Lehtinen, M., Nurmi, P. and Rämö, T. (2005) Precambrian Geology of Finland. 736 p. Elsevier. Additional material delivered during the course.

The availability of the textbooks can be checked via [this link](#).

**Assessment methods and criteria:**

Written essay.

**Grading:**

In the theory exam grade and final grade, the course utilizes a numerical grading scale of 1-5. Zero stands for a fail.

**Person responsible:**

Eero Hanski.

**Working life cooperation:**

No.

**900013Y: Beginners' Finnish Course 1, 3 op**

Voimassaolo: 01.08.1995 -

**Opiskelumuuoto:** Language and Communication Studies**Laji:** Course**Vastuuyksikkö:** Languages and Communication**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

ay900013Y Beginners' Finnish Course 1 (OPEN UNI) 2.0 op

**Proficiency level:**

A1.2

**Status:**

The course is intended for the international students in every faculty of Oulu University.

**Required proficiency level:**

A1.1, Completion of the Survival Finnish course (900017Y) or the equivalent language skills.

**ECTS Credits:**

3 ECTS credits

**Language of instruction:**

As much Finnish as possible; English will be used as a help language.

**Timing:**

-

**Learning outcomes:**

By the end of the course the student can understand and use some familiar and common everyday expressions relating to her/himself and everyday situations. S/he can interact in a simple way provided the other person talks slowly and clearly and is willing to help. The student is able to read short simple texts and messages dealing with familiar topics. S/he also deepens her/his understanding of the Finnish language and communication styles.

**Contents:**

This is lower elementary course which aims to help students to learn communication skills in ordinary everyday situations. During the course, students broaden their vocabulary and knowledge of grammar and principles of pronunciation. They also practise to understand easy Finnish talk about everyday subjects, and reading and writing short and simple texts/messages.

The topics and communicative situations covered in the course are: talking about oneself, one's family, studies and daily routines, as well as asking about these things from other person, expressing opinions, describing people and things, talking about weather and seasons, the names of the months and colours.

The structures studied are: verb types, basics of the change of the consonants k, p and t in verbs and nouns, the genitive and partitive cases, possessive structure, some declension types for nouns (word types) and the basics of the local cases.

**Mode of delivery:**

Contact teaching and guided self study

**Learning activities and teaching methods:**

Lessons 2 times a week (26 h, including the final exam) and guided self study (55 h)

**Target group:**

International degree and post-graduate degree students and exchange students of the University

**Prerequisites and co-requisites:**

Completion of the Survival Finnish Course

**Recommended optional programme components:**

-

**Recommended or required reading:**

Gehring, S. &amp; Heinzmann, S. Suomen mestari 1 (chapters 3 - 5)

**Assessment methods and criteria:**

Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Grading scale is 1-5.

**Person responsible:**

Anne Koskela

**Working life cooperation:**

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**Other information:**

Sign-up in WebOodi. The course will start right after the Survival Finnish course.

**900053Y: Beginners' Finnish Course 2, 5 op**

**Voimassaolo:** 01.08.1995 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay900053Y Beginners' Finnish Course 2 (OPEN UNI) 4.0 op

**Proficiency level:**

A1.3

**Status:**

The course is intended for the international students in every faculty of Oulu University.

**Required proficiency level:**

A1.2, completion of the Beginners' Finnish course 1 (900013Y) or the equivalent language skills.

**ECTS Credits:**

5 ECTS credits

**Language of instruction:**

As much Finnish as possible; English will be used as a help language.

**Timing:**

-

**Learning outcomes:**

By the end of the course the student can understand and use some very common everyday expressions and sentences. S/he can communicate in easy and routine tasks requiring a simple and direct exchange of information on familiar everyday matters. The student understands different kinds of short texts. S/he can for example locate important information in them. In addition, s/he has acquired more detailed knowledge of the language and culture.

**Contents:**

This is a post-elementary course. During the course students learn more about communication in ordinary everyday situations in Finnish. They also extend their vocabulary and knowledge of grammar. Students practise understanding simple Finnish talk and short texts.

The topics and communicative situations covered in the course are: asking for and giving directions, asking for help/favours, carrying out transactions in shops and restaurants, talking about the past, asking for and expressing opinions and feelings, accommodation, travelling, vehicles, work, professions, food, drink and parties.

The structures studied are: the local cases, nominative plural (basic form plural), imperfect (past tense of verbs), part of the imperative, more declension types for nouns (word types), more about the change of the consonants k, p and t in verbs and nouns, declension of the demonstrative pronouns and personal pronouns, more about the partitive case, basics of the object cases, postpositions and some sentence types in Finnish.

**Mode of delivery:**

Contact teaching and guided self study

**Learning activities and teaching methods:**

Lessons 2 times a week (52 h, including the tests) and guided self study (83 h)

**Target group:**

International degree and post-graduate degree students and exchange students of the University

**Prerequisites and co-requisites:**

Completion of the Beginners' Finnish Course 1

**Recommended optional programme components:**

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**Recommended or required reading:**

Gehring, S. & Heinzmann, S.: **Suomen mestari 1** (kappaleet 6-9)

**Assessment methods and criteria:**

Regular and active participation in the weekly lessons (twice a week), homework assignments and tests will be taken into consideration in the assessment.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Grading scale is 1-5.

**Person responsible:**

Anne Koskela

**Working life cooperation:**

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**Other information:**

Sign-up in WebOodi. The lessons will be held **twice a week** during a 13-week period.

**773631S: Biostratigraphy, 5 op**

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tiina Eskola

**Opintokohteen kielet:** English

**900054Y: Conversational Skills in Finnish, 3 op**

**Voimassaolo:** 01.08.1995 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Proficiency level:**

B1/B2 , according to the Common European Framework.

**Status:**

The course is intended for the international students in every faculty of University of Oulu.

**Required proficiency level:**

Completion of the Finnish course for advanced students (900020) or of Intermediate Finnish 2 (900016Y) at a high level or the equivalent language skills.

**ECTS Credits:**

3 ECTS credits

**Language of instruction:**

Finnish

**Timing:**

-

**Learning outcomes:**

By the end of the course the student can interact with a degree of fluency (and spontaneity) that makes regular interaction with native speakers quite possible. S/he can describe and explain (clearly and in detail) on a wide range of objects, experiences and events, dreams, hopes and ambitions. The student can bring out opinions, give reasons and explanations for them and explain a viewpoint on a topical issue giving the advantages and disadvantages of various options. S/he is also able to give a (clear) prepared presentation and answer the questions posed by the audience.

**Contents:**

During the course students strengthen their communication skills in formal and informal situations. The goal is to activate the student's Finnish skills and encourage him/her to use them in different situations. There will be



various types of situational dialogue, conversation and listening exercises in the course. In addition, students will conduct a short survey which will also be reported to other students in the class.

**Mode of delivery:**

Contact teaching and guided self study

**Learning activities and teaching methods:**

Lessons once a week (28-30 h), group work (15 h) and guided self study (36 h)

**Target group:**

International degree and post-graduate degree students, exchange students and the staff members of the University

**Prerequisites and co-requisites:**

Completion of the Finnish course for advanced students (900020) or of Intermediate Finnish 2 (900016Y) at a high level

**Recommended optional programme components:**

-

**Recommended or required reading:**

Will be provided during the course.

**Assessment methods and criteria:**

To pass the course, students must attend class on a regular basis and complete group work tasks and homework assignments.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Grading is on a pass/fail basis.

**Person responsible:**

Anne Koskela

**Working life cooperation:**

-

**Other information:**

Sign-up in WebOodi.

## 493608S: Development of beneficiation processes, 10 op

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**ECTS Credits:**

10 ECTS /266 hours of work

**Language of instruction:**

English

**Timing:**

2<sup>nd</sup> year in Master's degree 1<sup>st</sup> and 2<sup>nd</sup> period

**Learning outcomes:**

Upon completion of the course student is able to 1) describe the development of the mineral processing chain starting from mineralogy and laboratory scale tests, proceeding to pilot and industrial scale process and 2) describe the essential parameters from process development and optimization points of view. 3)\_analyse reasons for selection of processes based on raw material properties 4) develop a process for the selected raw material 5) evaluate the results obtained from the experimental work

**Contents:**

The course includes both theoretical and practical studies. Characterization of feed material, selection of the process, optimization of the process in laboratory scale, process scale-up factors, test trials in continuous mode.

**Mode of delivery:**

Lectures, exercises and practical work in groups

**Learning activities and teaching methods:**

Lectures and practical work during two periods

**Target group:**

Mineral processing majors

**Prerequisites and co-requisites:**

Chemical phenomena in mineral processing, Ore beneficiation technologies, Introduction to ore mineralogy, Requirements for the concentrate

**Recommended or required reading:**

Wills, B. & Napier-Munn, T. (2006) Wills' Mineral Processing Technology, Elsevier Science & Technology Books, ISBN:

0750644508. Mular, Habe, Barrat; (2002) Mineral processing plant design, practice and control, Vol. 1 and 2, SME Proceedings. Articles and references given during the course.

**Assessment methods and criteria:**

Continuous evaluation and group exercise

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Maria Sinche Gonzalez, Saija Luukkanen

**Working life cooperation:**

No

## 494601S: Electrical and EM-methods I, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS / 133 hours of work

**Language of instruction:**

Finnish/English

**Timing:**

Every 2nd year (odd years) on autumn semester, period 1. Recommended at 1st or 2nd year of the Master's studies.

**Learning outcomes:**

Upon completion of the course student will be able to explain the basis of the electrical resistivity methods, theory, application and usage and knows how to adapt, analyse and interpretate measured data from different methods in order to investigate near surface structure.

**Contents:**

The basic concepts of the electrical resistivity methods, their theoretical background and adaptation to the investigation of near surface structure.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures and exercises 40 h, independent work and self study.

**Target group:**

Students of the Oulu Mining School and those interested in electrical research methods.

**Prerequisites and co-requisites:**

No specific prerequisites

**Recommended optional programme components:**

The course is an independent entity, does not require additional studies carried out at the same time.

**Recommended or required reading:**

Lecture materials

**Assessment methods and criteria:**

Variable grading and evaluation methods

**Grading:**

1-5/fail

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No

**Other information:**

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**494602S: Electrical and EM-methods II, 5 op****Voimassaolo:** 01.08.2017 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Elena Kozlovskaya**Opintokohteen kielet:** English

Ei opintojaksokuvauksia.

**772640S: Excursion, 5 op****Voimassaolo:** 01.08.2010 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

The objective is to widen the student's field experience. Through exposure to novel geologic environments, students will have learnt to appreciate the diversity of geologic processes and environments on Earth.

**Contents:**

Introduction to Finnish or foreign geological field targets. Excursions typically last 1-2 weeks and consist of visits to field outcrops, as well as discussion of exposed structures and rocks. Past excursions went to Finland, Spain, South Africa, Norway and Iceland.

**Mode of delivery:**

Face to face in field or mine.

**Learning activities and teaching methods:**

Pre-excursion seminar, field techniques, excursion.

**Target group:**

Master students and PhD students in geology.

**Recommended or required reading:**

Other reading will be informed separately depending on excursion destination.

**Assessment methods and criteria:**

Pre-excursion seminar, field protocol.

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

Pass/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No

## 772691S: Exploration and mining - global to local perspectives, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

### **ECTS Credits:**

5 cr

### **Language of instruction:**

English

### **Timing:**

4th or 5th year

### **Learning outcomes:**

Upon completion of the course the students should know the structure of the mining and exploration industry. This includes the major players in a variety of commodity spaces, such as copper, gold, iron ore, base metals, etc., the concepts of value chain and variable business models. In particular, the differences between resources and reserves and economic drivers of the industry (demand and supply, changes in applications, commodity speculation) will be discussed. Furthermore, strategies and methods for exploration suitable for certain ore deposits types will be reviewed.

### **Contents:**

Based on global and regional scale examples and developments an understanding will be developed for the dynamics of the business cycle in the raw materials industry.

### **Mode of delivery:**

Face to face

### **Learning activities and teaching methods:**

Lectures 30 h, hand-specimen examination, home work on reserve and resource calculations, and ore values. Also, group assignment and presentations on a subject such as mining company profiles, exploration methodologies etc.

### **Target group:**

Masters students and PhD students in geoscience or related fields. Course is also suitable for interested geography or economics students with a background/interest in geosciences and natural resources.

### **Prerequisites and co-requisites:**

Ore geology and society (Intermediate level course: 772386A)

### **Recommended optional programme components:**

493301A Mining geophysics

774636S Geochemistry of mining environment

772632S Regional Ore Geology of Fennoscandia

774637S Isotope geochemistry for economic geologists

772694S Geometallurgy and mineral processing

### **Recommended or required reading:**

Crowson, P. (2008) Mining unearthed. Aspermont, 423 p.

Wellmer, F.W., Dalheimer, M., Wagner, M. (2008) Economic valuations in exploration. Springer 174 p.

Eilu P (Ed.) (2012) Mineral deposits and metallogeny of Fennoscandia. Geological Survey of Finland, Special Paper 53, 401 p.,

Maier, W., O'Brien, H., Lahtinen, R. (Eds.) (2015) Ore Deposits of Finland. Elsevier, 792 p.

The availability of the literature can be checked from [this link](#).

### **Assessment methods and criteria:**

Examination

### **Grading:**

5-1/fail

### **Working life cooperation:**

No

### **Other information:**

The study module can be replaced by the study module 493609S Mining environment and society.

## 492602S: Financial and Project valuation of mining, 5 op

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

English

**Timing:**

4th year 2nd period

**Learning outcomes:**

After completion of the course the student should be able to understand how to finance a mining project. What are requirements of venture capital financing and other type of financing? What are the sources of mining financing and how to seek financing? What are the sources of financing? The student understands the importance of cash flow, NPV and IRR calculations. The student will even understand what kind of parameters impacts the value of a mining project. The aim of the course is to provide a guide to understanding the main factors involved in financing of mining projects through equity and debt. The student will be able to prepare a simple valuation model of exploration properties and companies.

**Contents:**

Different tools for analyzing financial information, problems in analyzing financial information, and the use of financial and mineral resource information in project valuation.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

Lectures 24 hr

**Target group:**

Master/ mining technology

**Prerequisites and co-requisites:**

Courses on economy and mining engineering, and course "Mining project – feasibility study" are suggested

**Recommended optional programme components:**

-

**Recommended or required reading:**

Course materials and literature list will be delivered at the lectures

**Assessment methods and criteria:**

Exercises and final exam, or participation to the lectures plus exercises and literature summary

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Prof. Timo Lindborg

**Working life cooperation:**

No

**Other information:**

-

## 494603S: GIS applications, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** English

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

4th or 5th autumn

**Learning outcomes:**

After the course, students can use GIS-software, he can identify, apply and modify different types of spatial data and analyze them with spatial analysis tools. He can also create understandable and clear visual presentations from the spatial data.

**Contents:**

This course focuses more on the capabilities of the GIS-software and the possibilities they offer in presenting and analyzing spatial data in practical exercises.

**Mode of delivery:**

Face to face teaching and exercises.

**Learning activities and teaching methods:**

Lectures and practicals totalling 30 h, plus independent study. Course is passed by returning exercise reports

**Target group:**

Students of Oulu Mining School and Faculties of science and technology etc

**Prerequisites and co-requisites:**

Course GIS and spatial data 1 or equivalent, basics of GIS

**Recommended optional programme components:**

-

**Recommended or required reading:**

Will be informed separately.

**Assessment methods and criteria:**

Assessment is based on the evaluation of the written reports of exercises

**Grading:**

Numerical grading scale 0 – 5, where 0 = fail

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No

**Other information:**

-

**774636S: Geochemistry of Mining Environment, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Kari Strand

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 ECTS.

**Language of instruction:**

The language of instructions is Finnish or English, depending on the participants.

**Timing:**

The course is held in the spring semester, during period IV. It is recommended to complete the course at the 4th or 5th spring semester.

**Learning outcomes:**

Upon completion of this course, the student will:

can describe and assess environmental problems associated with metal mining

are familiar with the chemical and mineralogical phenomena related to acid mine drainage

know how to test the acid-producing or acid-neutralizing capacity of rock types.

**Contents:**

Oxidation of sulphidic ores, formation of secondary minerals, water chemistry in mining environment, acid neutralisation capacity of rocks waste and its determination, factors involved in acid mining drainage (AMD) and its mitigation.

**Mode of delivery:**

Face to face teaching.

**Learning activities and teaching methods:**

28 h lectures.

**Target group:**

All students in geosciences.

**Prerequisites and co-requisites:**

Completion of 774301A Basic Course in Geochemistry and other studies equivalent to Bachelor's degree are recommended.

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

Articles (informed separately) from the following books: Jambor, J. L., Blowes, D. W., Ritchie, A. I. M. (Eds.) (2003) Environmental Aspects of Mine Wastes, Mineralogical Association of Canada, Short Course Series, Vol. 31, 430 s., Plumlee, G.S., Logsdon, M.J. (Eds.) (1999) The Environmental Geochemistry of Mineral Deposits. Reviews in Economic Geology, Vol. 6A., Blowes et al. (2014) The Geochemistry of Acid Mine Drainage, Treatise in Geochemistry, Vol. 9. The availability of the textbooks can be checked via [this link](#).

**Assessment methods and criteria:**

Written essay.

**Grading:**

In the theory exam grade and final grade, the course utilizes a numerical grading scale of 1-5. Zero stands for a fail.

**Person responsible:**

Prof. Eero Hanski

**Working life cooperation:**

No.

**772694S: Geometallurgy and mineral processing, 5 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pertti Lamberg

**Opintokohteen kielet:** English

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

Upon completion of the course students should be able to: 1) Describe the principles of different areas of Geometallurgy (ore geology, process mineralogy, minerals processing, modeling and simulation) and how they are linked in a geometallurgical concept. 2) Use different research and analytical methods of importance for Geometallurgy and interpret the results. 3) Evaluate, analyze and interpret the geometallurgical data in a quantitative way. 4) Design a geometallurgical sampling, analysis and research campaign. 5) Design a geometallurgical program.

**Contents:**

The course will introduce main parts of the Geometallurgy: 1) ore geology, 2) process mineralogy and 3) minerals processing. The focus is in process mineralogy, mineral processing and in assimilating the geometallurgical concept. Exercises, assignments and seminars concentrate on practical aspects of Geometallurgy needed in mining industry.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures and PC classes with assignments 33 h.

**Target group:**

geology majors, minor subject students. Prerequisites and co-requisites: Ore geology (772385A), Introduction to Ore mineralogy (772335A).

**Prerequisites and co-requisites:**

Ore geology (772385A), Ore microscopy (772335A).

**Recommended optional programme components:**

ü Petruk, W. (2000) Applied Mineralogy in the Mining Industry, Elsevier Science B.V., Amsterdam.

ü Wills, B. & Napier-Munn, T. (2006) Wills' Mineral Processing Technology, Elsevier Science & Technology Books, ISBN: 0750644508.

ü Becker et al. (2016) Process Mineralogy, JKMRRC Monograph Series in Mining and Mineral Processing: No. 6, ISBN: 978-1-74272-171-2

**Recommended or required reading:**

Petruk, W. (2000). Applied Mineralogy in the Mining Industry, Elsevier Science B.V., Amsterdam.

Will, B. & Napier-Munn, T. (2006) Wills' Mineral Processing Technology, Elsevier Science & Technology Books, ISBN: 0750644508.

The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Laboratory classes, Geometallurgical investigations (for the seminar) and the seminars are compulsory.

Seminars, the investigation and the opposition are each awarded points based on the attained level. Assignments and reports must be delivered in time or there will be an automatic deduction of points. The total points production determines the grand grade of the course, and it is given on the scale Fail-1-5.

. For grade 1, the student must be able to describe different parts and procedures of Geometallurgy and to conduct a routine geometallurgical analysis.

. For grade 2, the student must be able to collect geometallurgical data and perform an analysis with interpretation.

. For grade 3 the student must be able to evaluate and interpret geometallurgical data provided by different analytical and research techniques and to report the results.

. For grade 4, the student must be able to design geometallurgical campaign, interpret the result and establish a geometallurgical program.

. For grade 5, the student must be able to apply the acquired skills to a new geometallurgical case, interpret, report and present the results and to defend the conclusions.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Jussi Liipo

**Working life cooperation:**

No

**772675S: Geophysics in economic geology, 5 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Elena Kozlovskaya

**Opintokohteen kielet:** English

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

The students comprehend the main techniques used in exploration geophysics and have become familiar with a number of case studies. They should be able to interpret basic geophysical data and their importance in target evaluation.

**Contents:**

Geophysical methods in exploration and their use in exploration targeting.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures, data interpretation exercises.

**Target group:**



Master's students and PhD students in geology.

**Prerequisites and co-requisites:**

Bachelor's degree.

**Recommended or required reading:**

Reynolds, J.M. (2011) An Introduction to Applied and Environmental Geophysics, Wiley-Blackwell  
 Everett M.E. (2013) Near-Surface Applied Geophysics. Cambridge University Press.  
 Kearey, P., Brooks, M., Hill, I. (2002) An Introduction to Geophysical Exploration. Blackwell Science.  
 Geophysical methods, in: Moon et al. (2009) Introduction to Mineral Exploration, Blackwell  
 The availability of the literature can be checked from "[this link](#)".

**Assessment methods and criteria:**

Examination

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

Elena Kozlovskaya

**Working life cooperation:**

No

**Other information:**

-

## 772698S: Gold and critical mineral deposits, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

## 772692S: Hydrothermal ore deposits, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**ECTS Credits:**

5 cr

**Language of instruction:**

English

**Timing:**

4<sup>th</sup> or 5<sup>th</sup> year

**Learning outcomes:**

At the end of the course, students should have knowledge of the formation of the main hydrothermal and magmatic-hydrothermal ore deposit types, their characteristics and global distribution. Different principles covering evolution of hydrothermal, and magmatic-hydrothermal fluids, importance of different fluid reservoirs, interaction of hydrothermal fluids with host-rocks and the mechanism leading to the precipitation of metals and gangue minerals. Case studies from the representative type deposits will be presented.

**Contents:**

Global distribution and ore formation processes of hydrothermal ore deposits.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures and practicals 30 h

**Target group:**

Master's students and PhD students in geology

**Prerequisites and co-requisites:**

Ore Geology and society or other introductory ore geology course

**Recommended optional programme components:**

Other courses in the International Master programme

**Recommended or required reading:**

Piranjo, F. 2009. Hydrothermal Processes and Mineral Systems

Robb, 2005. Introduction to ore-forming processes

Deposit related research/review papers (e.g. Hedenquist JW et al., 2005. Economic Geology 100<sup>th</sup> Anniversary volume, Society of Economic Geologists, 1136 p.)

**Assessment methods and criteria:**

Examination

**Grading:**

5–1/fail

**Person responsible:**

Jukka-Pekka Ranta

**Working life cooperation:**

no

## 900015Y: Intermediate Finnish Course 1, 5 op

**Voimassaolo:** 01.08.1995 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay900015Y Intermediate Finnish Course 1 (OPEN UNI) 4.0 op

**Proficiency level:**

A2.1

**Status:**

The course is intended for the international students in every faculty of University of Oulu.

**Required proficiency level:**

A1.3, Completion of the Beginners' Finnish course 2 (900053Y) or the equivalent language skills.

**ECTS Credits:**

5 ECTS credits

**Language of instruction:**

Mainly Finnish

**Timing:**

-

**Learning outcomes:**

By the end of the course the student can communicate in ordinary everyday situations when the topics are familiar or connected with everyday matters. S/he can search for and locate key informational content in different kinds of texts. The student can also identify the topic and some details of the discussion around her/him. S/he can

describe activities and personal experiences both orally and in writing and s/he also knows the difference between spoken/colloquial and written/standard language. The student knows how things can be expressed with different degrees of politeness and can apply that information in her/his own communication.

**Contents:**

The course is a lower intermediate course. During the course students strengthen their communication skills in ordinary everyday situations and acquire a wider vocabulary and more thorough knowledge of grammar. In addition, students practise understanding and producing Finnish talk and reading newspaper articles.

The topics and communicative situations covered in the course are: requesting different kinds of requests, expressing politeness, making appointments with friends, giving directions, doing the shopping, talking about the past and talking about his/her future plans, hobbies, transactions e.g. in the doctor's and post office.

The structures studied are: more about the imperative, the verb rections, the deverbal noun (-minen), passive present tense, part of the plural declension of nouns, the third infinitive (ma-infinitive), more about sentence types, perfect tense, more about object cases.

**Mode of delivery:**

Contact teaching and guided self study

**Learning activities and teaching methods:**

Lessons 2 times a week (52 h, including the tests) and guided self study (83 h)

**Target group:**

International degree and post-graduate degree students, exchange students and the staff members of the University

**Prerequisites and co-requisites:**

Completion of the Beginners' Finnish Course 2

**Recommended optional programme components:**

-

**Recommended or required reading:**

Gehring, S. & Heinzmann, S.: **Suomen mestari 2**, (chapters 1 - 5)

**Assessment methods and criteria:**

Regular and active participation in the weekly lessons (twice a week), homework assignments and the tests will be taken into consideration in the assessment.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Grading scale is 1-5.

**Person responsible:**

Anne Koskela

**Working life cooperation:**

-

**Other information:**

Sign-up in WebOodi. The lessons will be held twice a week during a 13-week period.

## 900016Y: Intermediate Finnish Course 2, 5 op

**Voimassaolo:** 01.08.1995 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Proficiency level:**

A2.2

**Status:**

The course is intended for the international students in every faculty of University of Oulu.

**Required proficiency level:**

A2.1, Completion of the Intermediate Finnish course 1 (900015Y) or the equivalent language skills.

**ECTS Credits:**

5 ECTS credits

**Language of instruction:**

Finnish

**Timing:**

**Learning outcomes:**

By the end of the course the student can communicate in various informal situations in Finnish. The student understands the main points of messages and talk around her/him. S/he can produce simple connected text on topics which are familiar or of personal interest and describe experiences and also report heard content to others.

**Contents:**

The course is an upper intermediate course. During the course students learn the necessary written and oral skills to be able to cope in informal situations arising during everyday life, work and study. In the course, students practise understanding more Finnish talk and newspaper articles, and finding information and talking about it to other people. In the classes the main stress is on oral exercises and group work.

The topics and communicative situations covered in the course are: transactions e.g. in clothes shops, at the doctor's and on the phone, Finnish small talk, reacting in different situations, planning a trip and booking e.g. a flight, information and facts about Finland and its history, telling about one's home country and home town, features of colloquial/spoken language.

The structures studied are: the perfect and pluperfect, revision of all the verb tenses, comparison of adjectives, conditional, more about the plural declension of nouns (particularly the plural partitive case), more about object and predicative cases, the passive imperfect.

**Mode of delivery:**

Contact teaching and guided self study

**Learning activities and teaching methods:**

Lessons once a week (52 h, including the tests) and guided self study (83 h)

**Target group:**

International degree and post-graduate degree students, exchange students and the staff members of the University

**Prerequisites and co-requisites:**

Completion of the Intermediate Finnish Course 1

**Recommended optional programme components:**

-

**Recommended or required reading:**

Gehring, S. & Heinzmann, S.: **Suomen mestari 2 (chapters 6 - 9)**

**Assessment methods and criteria:**

Regular and active participation in the weekly lessons (twice a week), homework assignments and the tests will be taken into consideration in the assessment.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Grading scale is 1-5.

**Person responsible:**

Anne Koskela

**Working life cooperation:**

-

**Other information:**

Sign-up in WebOodi. The lessons will be held **once a week** during a 13-week period.

**772335A: Introduction to ore mineralogy, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** English

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

5 ECTS

**Language of instruction:**

The language of instruction is Finnish or English, depending on the participants.

**Timing:**

The course is held in the autumn semester, during period I. It is recommended to complete the course at the 2nd or 3rd autumn semester.

**Learning outcomes:**

Upon completion of this course, the student will:

obtain basic knowledge on ore minerals and their mode of occurrence

learn to recognise the most common ore minerals and textures under the ore microscope.

**Contents:**

Division and structure of ore minerals, composition and texture, phase diagrams and their applications. Ore microscope and how it is used, microscopic properties of ore minerals. Identification of ore minerals and ore mineral assemblages.

**Mode of delivery:**

Face to face teaching.

**Learning activities and teaching methods:**

14 h lectures, 21 h exercises.

**Target group:**

All students in geosciences and mineral processing and mining technology.

**Prerequisites and co-requisites:**

The recommended prerequisite is the completion of the following courses prior to enrolling for the course:

771102P Basic mineralogy, 772339A Optical mineralogy.

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

Textbook: Craig, J.P. & Vaughan, D.J. (1994) Ore Microscopy and Ore Petrography. Wiley & Sons, 2nd ed. 434 p.

Other handbook-type literature supporting the microscope exercises: Wiley & Sons, 2nd ed. 434 p. Ramdohr, P.

(1980) The Ore Minerals and their Intergrowths, vol. 1 and 2. Pergamon Press, 1205 p. Spry P.G. & Gedlinski B.

L. (1987) Tables for Determination of Common Opaque Minerals. Economic Geology Publishing Co. 52 p. Barnes

H.L. (1997) Geochemistry of Hydrothermal Ore Deposits. John Wiley & Sons, Inc., New York, 3rd ed. 992 p.

Nesse W.D. (2012) Introduction to Mineralogy, Oxford University Press. 480 p. Pracejus B. (2008) The ore

minerals under the microscope – An optical guide. Atlases in Geosciences 3, Elsevier, 875 p.

The availability of the textbooks can be checked via [this link](#).

**Assessment methods and criteria:**

Examination in both theory and calculations.

**Grading:**

In the theory exam grade and final grade, the course utilizes a numerical grading scale of 1-5. Zero stands for a

fail. In the microscope exam, the course utilizes verbal grading pass/fail.

**Person responsible:**

Shenghong Yang

**Working life cooperation:**

No.

## 774639S: Isotope geochemistry for economic geologists, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 ECTS.

**Language of instruction:**

The language of instruction is Finnish or English, depending in the participants.

**Timing:**

The course is held in the spring semester, during period III. It is recommended to complete the course at the 4th or 5th spring semester.

**Learning outcomes:**

Upon completion of this course, the student will:

can interpret and assess geological literature where isotopes have been utilized, is able to calculate ages of rocks using given isotope measurements of different isotopic systems, can make inferences on the origin of different rocks types, including ore deposits, based on measured isotope ratios.

**Contents:**

Mechanisms of radioactive disintegration; mass spectrometry; different radiogenic and stable isotope systems (e. g., Rb-Sr, Sm-Nd, Re-Os, Lu-Hf, Sm-Nd and U-Pb and Pb-Pb; S and C isotopes); examples of the use of isotopes in the research of ore deposits.

**Mode of delivery:**

Face to face teaching.

**Learning activities and teaching methods:**

32 h lectures, 16 h computer exercises.

**Target group:**

All students in geosciences.

**Prerequisites and co-requisites:**

It is recommended that the student has completed studies equivalent to the Bachelor's degree in geology.

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

White, W.M. (2015) *Isotope Geochemistry*. Wiley-Blackwell, 496 p. or Dickin, A.P. (2005) *Radiogenic Isotope Geology*, 2nd edition, Cambridge University Press, 492 p. Journal articles given during the course.

The availability of the textbooks can be checked via [this link](#).

**Assessment methods and criteria:**

Theory exam and excel calculations made at home.

**Grading:**

In the theory exam grade and final grade, the course utilizes a numerical grading scale of 1-5. Zero stands for a fail. Calculations are graded as pass/fail.

**Person responsible:**

Eero Hanski.

**Working life cooperation:**

No.

**772695S: Magmatic ore deposits, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Shenghong Yang

**Opintokohteen kielet:** English

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

After completion of the course students should have knowledge of the occurrence of the most important magmatic ore deposits, including PGE- Ni-Cu, Cr, V-Ti, apatite, and diamond deposits. Students are familiar with the geology, and can comprehend the petrogenesis, of the main Finnish and global magmatic mineral deposits, including the deposits at Kemi (Cr), Portimo and Penikat (PGE), and Kevitsa (Ni-Cu-PGE), Mustavaara (Fe-Ti-V) and Otanmäki (Fe-Ti-V) as well as global deposits including the Bushveld (PGE, Cr, V), Pechenga (Ni), Monchegorsk (PGE), Noril'sk (Ni-Cu-PGE), Sudbury (Ni-Cu-PGE), Kambalda (Ni), Jinchuan (Ni-Cu-PGE) and Panzhihua (Fe-Ti-V). Students will thus have gained an improved capability to contribute to exploration for magmatic ore deposits in Finland.

**Contents:**

Global distribution, geology and petrogenesis of magmatic ore deposits.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 30 h, hand-specimen examination, microscopy sessions, exploration modelling.

**Target group:**

Masters students and PhD students in geology.

**Prerequisites and co-requisites:**

Igneous Petrology (772341A).

**Recommended optional programme components:**

Other courses in the International Master's course.

**Recommended or required reading:**

Li C and Ripley EM (2011) Magmatic Ni-Cu and PGE deposits: geology, geochemistry, and genesis. Reviews in Economic Geology, vol. 17, Society of Economic Geologists; Hedenquist JW et al. (2005) Economic Geology 100<sup>th</sup> Anniversary volume, Society of Economic Geologists, 1136 p.

**Assessment methods and criteria:**

Examination

**Grading:**

5-1/fail

**Person responsible:**

Sheng-Hong Yang

**Working life cooperation:**

No

**772697S: Microscopic study of rocks, 5 op**

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 ESTC /40 h face to face + 40 students own work

**Language of instruction:**

Finnish or English

**Timing:**

spring semester period 3 or 4

**Learning outcomes:**

Upon completion of the course the student will:

have a competence to study major rock types with petrographic microscope and has a good understanding on their classification and textures

**Contents:**

classification of major rock types, their textures and their study with petrographic microscope

**Mode of delivery:**

Face to face and self-acting studies of samples (thin sections)

**Learning activities and teaching methods:**

face to face practicals 40 h and self-acting microscopy 40 h

**Target group:**

all students in geosciences

**Prerequisites and co-requisites:**

Petrology of Igneous rocks, Petrology of Sedimentary Rocks, Petrology of Metamorphic Rocks, Optical Mineralogy

**Recommended optional programme components:**

The course does not require other studies to be carried simultaneously

**Recommended or required reading:**

Handbooks situated in the course room according to separate list

**Assessment methods and criteria:**

report of the practical studies of given samples

**Grading:**

pass/fail

**Person responsible:**

Pekka Tuisku

**Working life cooperation:**

not currently

**493606S: Mine Geology, 5 op**

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

English

**Timing:**

4<sup>th</sup> year 1<sup>st</sup> period

**Learning outcomes:**

Upon completion of the course the students should know about the principle activities along the mineral value chain in the mining environment (exploration, mining, mineral processing, environmental management). The course is given at the active Pyhäsalmi mine to optimize interaction with professionals and working live experience.

**Contents:**

Based on the processes in an active mine environment (Pyhäsalmi mine) various aspects of the development and operation of mines will be investigated. This includes the ore exploration and mine development, rock mechanics and mining technologies, mineral processing principles, and environmental management. Face to face teaching and mine visit

**Mode of delivery:**

Face to face teaching and mine visit

**Learning activities and teaching methods:**

Lectures, interaction with professionals at the Pyhäsalmi mine, and exercises (e.g. drill core logging).

**Target group:**

Masters students in the mining engineering and mineral processing study programme (compulsory course) and Masters students in Geosciences (optional course to fulfill the obligation of 10 ECTS in mining engineering and mineral processing study programme courses)

**Prerequisites and co-requisites:**

Introduction to Geology I and II; Basic course in mineralogy; Principles of mineral processing, Rock mechanics (BSc level courses) or completed BSc degree

**Recommended optional programme components:**

493301A Mining geophysics

774636S Geochemistry of mining environment

772632S Regional Ore Geology of Fennoscandia

772694S Geometallurgy and mineral processing

**Recommended or required reading:**

Abzalov, M. (2016) Applied Mining Geology, Springer, Modern approaches in solid Earth sciences 12, 448 p

**Assessment methods and criteria:**

Learning diary and report

**Grading:**

pass/fail

**Person responsible:**

Holger Paulick, Zongxian Zhang

**Working life cooperation:**

Course will be conducted in co-operation with partners from the Pyhäsalmi mine.

**Other information:**

Location of instruction is Pyhäsalmi mine

## 492600S: Mining Engineering, 10 op

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail



**Opettajat:** Zongxian Zhang

**Opintokohteen kiellet:** English

**ECTS Credits:**

10 ECTS /266 hours of work

**Language of instruction:**

English

**Timing:**

Spring term of the 4<sup>th</sup> academic year

**Learning outcomes:**

Upon completion of the course students should be able to: 1) use the knowledge of rock mechanics, rock drilling and blasting to make mining planning and mine designs; 2) perform better operations or improve current operations in drilling, blasting, extraction, tunnelling, and comminution; 3) understand the effect of ore recovery on mining economy and resource recovery; 4) gain knowledge on how to improve recovery; 5) gain the knowledge of reducing the damage to the environment due to mining activities.

**Contents:**

The course will first give a compact introduction to basic rock mechanics, rock drilling, rock blasting and ventilation, and then introduce basic principles for mining planning and operation design such as development and different excavations. After these, the course will introduce each mining method in detail, including mass mining methods such as sublevel caving and block caving and other common mining methods such as cut-and-fill, room-and-pillar, shrinkage, open stope, etc. In the last part of the course, mining economy related to mining operation and mining technology will be discussed, optimum fragmentation aiming to save energy will be described, and then vibration control will be introduced.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures, seminars, written reports, and assignments (mine visit if available).

**Target group:**

Students from mining and mineral processing, geophysics and geology

**Prerequisites and co-requisites:**

Bachelor degree in mining or mineral processing or geology or other civil engineering.

**Recommended optional programme components:**

-

**Recommended or required reading:**

**Recommended materials to read:**

Zhang ZX. Mining Science and Technology. Compendium for course Mining Technology, University of Oulu, 2017.  
Hamrin H. Underground mining methods and applications. In: Underground mining methods—engineering fundamentals and international case studies, eds. By WA Hustrulid and RL Bullock. Littleton (Colorado): Society for mining, metallurgy, and exploration, Inc, (SME), 2001, p.3-14.

Hustrulid WA, Bullock RL. Underground mining methods—engineering fundamentals and international case studies. Littleton (Colorado): Society for mining, metallurgy, and exploration, Inc, (SME), 2001.

Vergne J. Hard Rock Miner's Handbook, Edition 5. Edmonton: Stantec Consulting Ltd, 2008.

Zhang ZX. Rock fracture and blasting: theory and applications. Oxford: Elsevier, 2016 (Chapters 1, 3-7, 10, 17-19, 21-24).

**Assessment methods and criteria:**

Assessment methods include oral presentations, written reports, seminars, assignments and written examination. The total points gained from the above determine the final grade of the course, and it is given on the scale Fail-1-5.

- For grade 1, the student must be able to know and understand the basic knowledge in this course.
- For grade 2, the student must know how to make a preliminary plan for mining and rock support by using the knowledge in rock mechanics and mining science.
- For grade 3 the student must be able to make a plan for mining and rock support and evaluate such a plan
- For grade 4, the student must be able to make a plan for mining and rock support and evaluate such a plan. In addition, the student should be able to improve any current plan for mining and rock support by using his/her knowledge in mining science.
- For grade 5, the student must be able to apply the acquired knowledge to make a very good plan for mining and rock support. He or she must do an outstanding design in at least one aspect, e.g. he/she can find a problem in one operation or one design and know how to solve the problem or how to make improvement.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Zongxian Zhang

## 492603S: Mining Project feasibility study, 5 op

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Saija Luukkanen

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

English

**Timing:**

1<sup>st</sup> year in Master's degree, 4<sup>th</sup> period

**Learning outcomes:**

After completion of the course the student should be able to understand the content of feasibility study, calculate economical conditions and profitability for mining project, describe and explain differences in feasibility studies of different project stages. The student also understands and is able to evaluate the quality of feasibility studies. This involves addressing the underlying technical principles, applying these to mineral projects and demonstrating how these influence the financial modelling. The student will be able prepare an economical calculation for feasibility study of the mining project and calculate free cash flow to it.

**Contents:**

Role of different feasibility studies; Guidelines and criteria for resource and reserve classification. Sources of technical information for feasibility study industry-level information; Quality requirements of technical and economical

information; Pre-production planning and optimization of the rate of mining in relation to the size of the resource; Mining methods; Importance of dilution, waste rock ratio, recovery and net smelter return; Estimation of operating and capital costs.

**Mode of delivery:**

Lectures and exercises

**Learning activities and teaching methods:**

Lectures and exercises during two periods

**Target group:**

Mineral processing majors, minor subject students

**Prerequisites and co-requisites:**

Courses on economy and mining engineering are suggested

**Recommended or required reading:**

Course materials and literature list will be delivered at the lectures.

**Assessment methods and criteria:**

Exercises and final exam, or participation to the lectures plus exercises and literature summary

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Working life cooperation:**

No

## 493301A: Mining geophysics, 5 op

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Elena Kozlovskaya

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

English

**Timing:**

In first period

**Learning outcomes:**

The students got familiar with geophysical methods and instrumentation used to solve practical problems arising at all stages of mine life cycle.

**Contents:**

The course is intended for geophysicists, geologist and mining and rock mechanics engineers working at mines. The basic techniques of applied geophysics are introduced and explained with application to problems of exploration, development, planning, operation, closure and reclamation of open and underground mines. For each method, principles, instrumentation, field procedures, interpretation and case histories are discussed. The students get familiar with the geophysical instrumentation used in specific mining environment. A part of the course is introduction to mining seismology and the modern methods and techniques used to monitor and study seismicity and rock bursts in underground mines.

**Target group:**

geophysics, geology, mining engineering students

**Assessment methods and criteria:**

continuous assessment (home work), final exam

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Elena Kozlovskaya

**Working life cooperation:**

No

## 493609S: Mining, environment and society, 5 op

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

English

**Timing:**

During period 3

**Learning outcomes:**

After completion of this course the student is able to develop, apply and assess the targets, practices and methods of environmentally and socially responsible mining in practice.

**Mode of delivery:**

Implemented as distance learning

**Learning activities and teaching methods:**

Lectures and exercises by distance learning & learning diaries.

**Target group:**

The students of the Mineral Processing study option in the study programmes Process Engineering or Environmental Engineering, etc. and the students of Luleå University of Technology (LTU) within the Nordic Mining School (NMS) agreement between LTU and the University of Oulu.

**Prerequisites and co-requisites:**

The Bachelor level studies of the process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge.

**Recommended optional programme components:**

The other courses of the Master's phase curriculum.

**Recommended or required reading:**

Lectures + articles delivered during lectures

**Assessment methods and criteria:**

Participation to the lectures & learning diary.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Rauno Sairinen (University of Eastern Finland)

**Working life cooperation:**

No

## 493605S: Ore beneficiation technologies, 5 op

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English, Finnish

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

English

**Timing:**

The course is held in the autumn semester, during period II. It is recommended to complete the course at the 1<sup>st</sup> autumn semester

**Learning outcomes:**

Upon completion of the course students should be able to:

- Describe the principles and applications of the main mineral processing technologies
- Describe the variables effecting on the selection of the process technique and evaluate the most suitable technique for processing different types of materials based on their composition
- Understand the nature of the feed material and its influence in process selection, mineral processing technologies used in selected cases and process optimization
- Use design and optimization methods for applying in beneficiation plants

**Contents:**

**Contents:**

- Module 1: Introduction to minerals and mineralogy
- Module 2: Introduction to Mineral Processing Technology
- Module 3: Comminution - Size reduction
- Module 4: Beneficiation Technologies - Physical separation techniques
- Module 5: Physic-chemical separation techniques
- Module 6: Solid Liquid Separation
- Module 7 Case study of optimization
- Module 8: Seminar (assignment, laboratory work and findings in paper review)

Additionally it is included

Practice Ore characterization in optical microscopy

Laboratory test in crushing and grinding, PSD

Laboratory test of flotation

Laboratory test of sedimentation

**Mode of delivery:**

Classroom education, face to face teaching

**Learning activities and teaching methods:**

Lectures during one period.

Lectures 36 h / Laboratory tests 8 h/Group work 16 h/Self-study includes exercises and assignments 75 h

**Target group:**

Mineral processing majors, minor subject students and other form Oulu Mining School and Technology

**Prerequisites and co-requisites:**

493300A Principles in Mineral Processing, 493302A Chemical Phenomena in Mineral processing

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies out at the same time

**Recommended or required reading:**

Wills & Napier-Munn: Mineral processing technology; Elsevier Science & Technology Books, ISBN: 0750644508  
 Gupta, A., Yan, D.S. (2006). Mineral Processing Design and Operation and Introduction  
 Articles and references given during the course

**Assessment methods and criteria:**

Continuous assessment during lectures, exercises, seminar, reports, papers review. Major students participate in a seminar peer review as the assessment method.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Maria Sinche Gonzalez

**Working life cooperation:**

No

**Other information:**

Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture.

## 494605S: Potential fields and airborne geophysics I, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS credits

**Language of instruction:**

Finnish/English

**Timing:**

Autumn semester every other year (odd years), period 1. Recommended at 1st or 2nd year of the Master's studies.

**Learning outcomes:**

Upon completion of the courses student identifies the special characteristics of airborne geophysical measurements and knows how to process and interpret airborne geophysical data. In addition student can explain the major physical properties of rocks and rock forming minerals and their mutual dependence.

**Contents:**

The course provides basic knowledge on airborne geophysical investigation methods and also on the petrophysical properties of rocks and minerals. Course focuses on the airborne geophysical mapping made by the Geological Survey of Finland including magnetic, electromagnetic and radiometric measurements, and their characteristics. On behalf of petrophysics the physical properties of rocks and minerals including density, magnetic, elastic, electric, thermal and radiometric properties are considered.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures and exercises 40 h, independent work and self study.

**Target group:**

Students of the Oulu Mining School and those interested in airborne geophysics and petrophysics.

**Prerequisites and co-requisites:**

No specific prerequisites

**Recommended optional programme components:**

The course is an independent entity, does not require additional studies carried out at the same time.

**Recommended or required reading:**

Lecture materials

**Assessment methods and criteria:**

Variable grading and evaluation methods

**Grading:**

1-5/fail

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No working life cooperation

**Other information:**

-

**494606S: Potential fields and airborne geophysics II, 5 op**

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Oulu Mining School

Arvostelu: 1 - 5, pass, fail

Opettajat: Elena Kozlovskaya

Opintokohteen kielet: English

Ei opintojaksokuvauksia.

**493607S: Quality requirements for concentrate, 5 op**

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Oulu Mining School

Arvostelu: 1 - 5, pass, fail

Opettajat: Saija Luukkanen

Opintokohteen kielet: English

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

English

**Timing:**1<sup>st</sup> year in Master's degree 3<sup>rd</sup> period**Learning outcomes:**

After finishing this course student understands the main quality requirements of the final mineral processing concentrate which effect on further processing in each selected case. The student knows the main economic and technical factors and limitations related to the successful process.

**Contents:**

Quality requirements for selected concentrates, Distribution of penalty elements in final concentrates, Calculation of Net Smelter Return, Price variation, Typical pricing clauses, Exercises

**Learning activities and teaching methods:**

Lectures and exercises

**Target group:**

Mineral processing majors, minor subject students

**Prerequisites and co-requisites:**

Principles of mineral processing

**Recommended optional programme components:**

Ore beneficiation technologies

**Assessment methods and criteria:**

Continuous evaluation based on the course lectures and exercises participation

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Saija Luukkanen, Maria Sinche Gonzalez

**Working life cooperation:**

No

**772696S: Quantitative Evaluation of Minerals in Sediments and Rocks, 5 op****Voimassaolo:** 01.08.2017 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

5 cr

**Language of instruction:**

English

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course, the student will be able to do quantitative mineral evaluations for sediments and rocks. Optical microscopy, electron microprobe (EMPA), scanning electron microscopy (SEM) and QEMSCAN studies of specific samples are learned to identify useful minerals e.g. ore indicator minerals and quantify their relative abundances especially when looking for base metals or critical metals and minerals. Automated mineralogy systems are introduced to let you obtain data about your samples, such as mineralogical composition, mineral grain`s composition, rock minerals distribution, minerals elements distribution and includes in minerals.

**Contents:**

The topics that are introduced in the course are: what is a quantitative mineral evaluation, what materials can be studied and for what purposes, analytical equipments needed, examples of research results and own learning exercise.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

24 h lectures and exercise

**Target group:**

Advance level geoscience students

**Prerequisites and co-requisites:**

Bachelor of Science degree

**Recommended or required reading:**

Announced separately

**Assessment methods and criteria:**

Attending lectures and written examination

**Grading:**

5-1/fail

**Person responsible:**

Kari Strand

**Working life cooperation:**

No

**773630S: Quaternary geology of Fennoscandia, 5 op****Voimassaolo:** 01.08.2017 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

5 p

**Language of instruction:**

English or Finnish

**Timing:**

4<sup>th</sup> (periods 3 or 4) or 5<sup>th</sup> year

**Learning outcomes:**

Upon completion of the course, the student knows and understand:

- Main glacial-interglacial phases during Quaternary in Fennoscandia
- Key stratigraphy sections in Nordic countries
- Main marginal deposits and their regional existence
- Main glaciogenic morphology areas and their indication to glaciers' development
- Age and stages of the last deglaciation
- The development of Baltic Sea and Holocene sedimentary deposits

**Contents:**

After the course students can describe and explain Quaternary history of Fennoscandia including main glacial phases and Late Pleistocene glacial-interglacial cycles, main marginal and morphological deposition areas, key sites of the Quaternary stratigraphy, development of the Baltic Sea and marine coastlines and Holocene sedimentary deposits.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

24 hours of guided teaching, and about 20 hours of teaching without guidance either privately or in groups.

**Target group:**

Students in the 4<sup>th</sup> or 5<sup>th</sup> (periods 1 or 2) year, international and PhD students in geology

**Prerequisites and co-requisites:**

The prerequisite is the completion of the following courses prior to enrolling for the course: Kvartääristratigrafia (773300A) and Glasiaaligeologian perusteet (773344A) or similar knowledge.

**Recommended optional programme components:**

The course is an independent entity and does not require additional studies carried out at the same time.

**Recommended or required reading:**

Required reading:

Donner, J. (1995) The Quaternary History of Scandinavia. World and Regional Geology 7. Cambridge University Press, 200 pp.; Ehlers et al. (2011) Developments in Quaternary Science, Vol. 15, Elsevier Amsterdam, The Netherlands: Glacial History of Finland, Norway and Denmark; Ehlers & Gibbard (2004) Quaternary Glaciations – Extent and Chronology, Elsevier: Glacial history of Sweden. Other materials delivered during the course.

Additional reading:

Svendsen et al. (2004) Late Quaternary ice sheet history of northern Eurasia. Quaternary Science Reviews 23, 1229-1271; Kleman et al. (2008) Patterns of Quaternary ice sheet erosion and deposition in Fennoscandia and a theoretical framework for explanation. Geomorphology 97, 73-90., Olsen et al. (2013) Quaternary glacial, interglacial and interstadial deposits of Norway and adjacent onshore and offshore areas. Geological Survey of Norway Special Publication, 13, pp. 79–144.

The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Participation in the lectures, activity in private or group works, final examination. The assessment of the course is based on the learning outcomes of the course. The more detailed assessment criteria are available on the Noppa Study Portal. Read more about assessment criteria at the University of Oulu webpage.

**Grading:**

1-5/fail

**Person responsible:**

Pertti Sarala

**Working life cooperation:**

No

## 772632S: Regional ore geology of Fennoscandia, 5 op

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail



**Opettajat:** Shenghong Yang

**Opintokohteen kielet:** English

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

After the course students should have an understanding of the occurrence and petrogenesis of the most important ore deposits in Fennoscandia, and their main analogues in a global context. Students will thus have gained an improved capability to contribute to mineral exploration in Finland.

**Contents:**

Factors that control temporal and spatial distribution of ores, with particular focus on Finnish and Fennoscandian ore deposits, including the Finnish VMS (Pyhäsalmi, Outokumpu), chromite (Kemi), PGE (Portimo, Penikat, Konttijärvi), vanadium (Mustavaara, Koitelainen), Fe (Kolari district, Otanmäki), gold (Suurikuusikko, Pahtavaara, Pampalo), and Ni deposits (Kevitsa, Talvivaara, Vammala-Kotalahti belt), the Swedish Kiruna and Skelefteå districts, the Pechenga deposit of Russia, and the Norwegian Fe-Ti deposits.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 30 h, handspecimen examination

**Target group:**

Masters students and PhD students in geology.

**Prerequisites and co-requisites:**

Ore Geology (772385A), Igneous Petrology (772341A), Metamorphic Petrology (772345A), Introduction to Ore Mineralogy (772335A).

**Recommended optional programme components:**

Other courses of the International Master programme.

**Recommended or required reading:**

Eilu P (Ed.) (2012) Mineral deposits and metallogeny of Fennoscandia . Geological Survey of Finland, Special Paper 53. 401 p., Maier, W., O'Brien, H., Lahtinen, R. (Eds.) (2015) Ore Deposits of Finland. Elsevier. The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Examination

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No

## 492608S: Rock blasting, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Zongxian Zhang

**Opintokohteen kielet:** English

Ei opintojaksokuvauksia.

## 772693S: Sedimentary ore deposits, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Kari Strand

**Opintokohteen kielet:** English

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

Upon completion of the course the students should know the distribution of the main sedimentary ore deposits in Finland and globally, as well as their geology and petrogenesis.

**Contents:**

Global distribution and petrogenesis of sedimentary ore deposits, including Witwatersrand gold deposits, Ti beach sand deposits, and Western Australian and Brazilian BIFs as well as typical SEDEX deposits.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 30 h, hand-specimen examination, microscopy sessions.

**Target group:**

Masters students and PhD students in geology.

**Prerequisites and co-requisites:**

Sedimentary petrology (772344A).

**Recommended optional programme components:**

Other courses in the International Master programme.

**Recommended or required reading:**

Hedenquist JW et al. (2005) Economic Geology 100<sup>th</sup> Anniversary volume, Society of Economic Geologists, 1136 p.

Eilu P (Ed.) (2012) Mineral deposits and metallogeny of Fennoscandia. Geological Survey of Finland, Special Paper 53, 401 p.

**Assessment methods and criteria:**

Examination

**Grading:**

5-1/fail

**Person responsible:**

Kari Strand

**Working life cooperation:**

No

## 773655S: Sedimentology, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Kari Strand

**Opintokohteen kielet:** Finnish, English

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish (optionally English)

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course, the student will be able to explain how different sediment bedforms and sedimentary associations are related to different sedimentary environments. The student will also be able link individual observations to various sedimentary processes and their products, understand facies analysis method and explain the fundamental concepts used in sequence stratigraphy.

**Contents:**

The topics that are introduced in the course are: sedimentary environments their processes and products, basin analysis and sequence stratigraphy.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures

**Target group:**

Advanced-level geology students.

**Prerequisites and co-requisites:**

Bachelor of Science degree

**Recommended or required reading:**

Applicable parts of Reading, H.G. (1996) Sedimentary Environments. Blackwell Science Ltd. 688 s. and Coe, A.L. (2005) The Sedimentary Record of Sea-level Change. Cambridge University Press. 287 p. Lecture notes.

**Assessment methods and criteria:**

Examination

**Grading:**

5-1/fail

**Person responsible:**

Kari Strand

**Working life cooperation:**

No

**494604S: Seismic soundings, 5 op**

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS credits

**Language of instruction:**

Finnish/English

**Timing:**

Spring semester, period 4. Recommended at 1st or 2nd year of the Master's studies.

**Learning outcomes:**

Upon completion of the course student will be able to use and adapt seismic methods in studying the structure of the bedrock and soil. Student can explain and justify theoretical background of the seismic methods, and the limitations and error sources involved in them. Student can also make measurements in the field, produce seismic data, interpretate and analyse it and summarize the results.

**Contents:**

The basic concepts of seismic refraction and reflection soundings and surface wave methods and their interpretation. Physical background of the seismic methods, theory, interpretation and processing methods together with field measurement layouts.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures and exercises 40 h, independent work and self study.

**Target group:**

Students of the Oulu Mining School and those interested in seismic research methods.

**Prerequisites and co-requisites:**

No specific prerequisites

**Recommended optional programme components:**

The course is an independent entity, does not require additional studies carried out at the same time.

**Recommended or required reading:**

Lecture materials

**Assessment methods and criteria:**

Variable grading and evaluation methods

**Grading:**

1-5/fail

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No working life cooperation

**Other information:**

-

## 772667S: Seminar in ore geology, 5 op

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

The course will enhance students' ability to construct and deliver a scientific presentation and deepen their knowledge on different ore types. Students will be able to summarize the geology and petrogenesis of selected ore deposits and present these data to a specialist audience.

**Contents:**

Students write a 20-page paper on a subject in the field of ore geology. The paper is presented in a seminar meeting with someone acting as an opponent. Each student acts as an opponent to a paper in their turn.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Independent literature studies, oral presentations by students, seminars c. 20 h.

**Target group:**

Masters and PhD students.

**Prerequisites and co-requisites:**

Bachelor,s degree.

**Recommended or required reading:**

Journal papers and Eilu P (Ed.) (2012) Mineral deposits and metallogeny of Fennoscandia. Geological Survey of Finland, Special Paper 53. 401 p

The availability of the literature can be checked from "[this link](#)".

**Assessment methods and criteria:**

Oral presentation and acting as an opponent.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

**900027Y: Special Course in Finnish: Writing Skills, 3 op**

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

**Proficiency level:**

B1/B2, according to the Common European Framework.

**Status:**

The course is intended for the international students in every faculty of University of Oulu.

**Required proficiency level:**

A2.2 Completion of the Finnish for Advanced Students (900020Y) or the equivalent language skills.

**ECTS Credits:**

3 ECTS credits

**Language of instruction:**

Finnish

**Timing:**

-

**Learning outcomes:**

By the end of the course the student can write coherent and detailed descriptions and summaries about various matters. S/he is able to summarize text and justify his/her own statements of opinions. In addition, the student knows the steps of the writing process and understands the significance of a text's function and target audience. S/he can also differentiate between formal and informal writing styles.

**Contents:**

During the course students develop their writing skills in Finnish and are guided in the drafting of different text types and documents needed in studies and work. In the course students learn how to write informal and formal letters, an argument-essay, a summary, a job application and a report.

**Mode of delivery:**

One contact lesson at the beginning of the course and guided independent studying using online

**Learning activities and teaching methods:**

The course will be held online using an Optima environment.

**Target group:**

International degree and post-graduate degree students, exchange students and the staff members of the University

**Prerequisites and co-requisites:**

Completion of the Intermediate Finnish Course 2

**Recommended optional programme components:**

-

**Recommended or required reading:**

Web based material.

**Assessment methods and criteria:**

To pass the course, the student must complete all the required writing assignments.

Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

Grading is on a pass/fail basis.

**Person responsible:**

Anne Koskela

**Working life cooperation:**

-

**Other information:**

Sign-up in WebOodi or by emailing the contact teacher.

**773656S: Special field course in Quaternary geology, 5 op**

Voimassaolo: 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

## **773632S: Special issues in geoscience, 5 op**

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**ECTS Credits:**

1-9 cr

**Language of instruction:**

English

**Timing:**

4<sup>th</sup> or 5<sup>th</sup> year

**Learning outcomes:**

The objective of the course is to provide the students with knowledge on the current developments in a special topic in geoscience and economic geology

**Contents:**

The students will have gained a deeper understanding of specific aspects of the subject.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Teaching can include lectures and laboratory exercises (incl. hand-specimen examination, microscopy exercises and modelling). Amount of hours will be informed separately.

**Target group:**

Master's and PhD students in geoscience

**Prerequisites and co-requisites:**

Bachelor's degree

**Assessment methods and criteria:**

Examination

**Grading:**

5-1/fail

**Person responsible:**

Kari Strand

**Working life cooperation:**

No

## **771660S: Special issues in geosciences, 5 op**

**Voimassaolo:** 01.01.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**ECTS Credits:**

5 credits

**Contents:**

The software package Surpac is one of the world's most popular geology and mine planning software, supporting open pit and underground operations and exploration projects. It is widely used by mining companies in Fennoscandia and worldwide. Exposure and basic competence in this software package are important factors that will help geology and mining engineering students to find their first employment after graduation.

**Mode of delivery:**

Face to face

**Grading:**

1-5/fail

**Person responsible:**

Marko Moilanen

**Other information:**

Surpac course

## 492607S: Stress wave theory and applications, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Zongxian Zhang

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

English

**Timing:**

1st year 1st period

**Learning outcomes:**

Upon completion of the course students should: (1) know the basic theory on shock waves; (2) understand stress wave theory, especially one-dimensional elastic wave theory; (3) be able to apply some shock wave principles to civil engineering, particularly rock engineering; (4) be able to apply stress wave theory to general engineering practices such as rock drilling, rock blasting, rock support (especially dynamic rock support), excavation /tunnelling, testing or measuring dynamic behaviour or properties of general solids, controlling or reducing vibrations, safety engineering, material development, and other applications in rock and mining engineering.

**Contents:**

The course will: (1) introduce basic characteristics of shock waves and stress waves; (2) introduce shock wave collision and its applications in engineering; (3) present basic theory on stress waves, focusing on one-dimensional waves; (4) introduce wave reflection and transmission; (5) introduce spalling theory and its engineering applications; (6) present wave attenuation and dispersion in solids, focusing on rock mass; (7) introduce typical examples from engineering, focusing on rock, mining and mineral processing.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures, seminars, written reports, and assignments (lab testing if the instruments are ready).

**Target group:**

Students from civil engineering, material science, mechanical engineering, mining and mineral processing, geophysics and geology

**Prerequisites and co-requisites:**

Bachelor degree in engineering such as civil engineering, mining or mineral processing or geology.

**Recommended optional programme components:**

-

**Recommended or required reading:**

**Book used in teaching:**

Zhang ZX. Rock fracture and blasting: theory and applications. Oxford: Elsevier, 2016 (Chapters 1 and 2 will be main contents for teaching, and some other chapters are for reading only).

**Recommended materials to read:**

Kolsky H. Stress waves in solids. New York: Dover Publications; 1963.  
 Johnson W. Impact strength of materials. London: Edward Arnold; 1972.

**Assessment methods and criteria:**

Assessment methods include oral presentations, written reports, seminars, assignments and written examination. The total points gained from the above determine the final grade of the course, and it is given on the scale Fail-1-5.

- For grade 1, the student must be able to know and understand the basic knowledge in this course.
- For grade 2, the student must know how to make stress wave analysis.
- For grade 3 the student must be able to use the theory to analyse a problem related to stress waves.
- For grade 4, the student must be able to solve a problem by using the theory.
- For grade 5, the student must be able to apply the acquired knowledge to solve a wave problem and to do improvement on a current practical operation if it is not perfect design.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Zongxian Zhang

**Working life cooperation:**

No

**Other information:**

-

## 772683S: Structural geology for economic geologists, 5 op

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

Upon completion the course, students should be able to carry out structural geological observation, to identify and describe different structural elements. In addition, they are able to use needed statistical methods and analyze structural data. They can exploit computer-aided methods in structural interpretation and are able to perform structural interpretation based on given source data.

**Contents:**

Methods of geometrical analysis, structural geological data and data management, projections and diagrams, practical strain analysis, fold shape analysis, petrographic identification of pervasive structural elements, regional fold and fault systems, structural geological maps and structural interpretation

**Mode of delivery:**

Face to face teaching in the classroom and field.

**Learning activities and teaching methods:**

Lectures 8 h, field practicals 32 h, exercises 40 h and writing a report in Finnish or English.

**Target group:**

Master students in geology and mineralogy.

**Other information:**

The study module will be arranged later.

## 900017Y: Survival Finnish, 2 op

**Voimassaolo:** 01.08.1995 -

**Opiskelumuoto:** Language and Communication Studies



**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay900017Y Survival Finnish Course (OPEN UNI) 2.0 op

**Proficiency level:**

A1.1

**Status:**

The course is intended for the international students in every faculty of Oulu University.

**Required proficiency level:**

No previous Finnish studies.

**ECTS Credits:**

2 ECTS credits

**Language of instruction:**

Finnish and English

**Timing:**

-

**Learning outcomes:**

By the end of the course the student can understand and use some very common everyday expressions and phrases, and s/he can locate informational content in simple texts and messages. The student also knows the basic characteristics of Finnish language and Finnish communication styles.

**Contents:**

This is an introductory course which aims to help students to cope with the most common everyday situations in Finnish. During the course, students learn some useful everyday phrases, some general features of the vocabulary and grammar, and the main principles of pronunciation.

The topics and communicative situations covered in the course are: general information about the Finnish language, some politeness phrases (how to greet people, thank and apologize), introducing oneself, giving and asking for basic personal information, numbers, some time expressions (how to tell and ask the time, days of the week, time of day), food, drink and asking about prices.

The structures studied are: personal pronouns and their possessive forms, forming affirmative, negative and interrogative sentences, the conjugation of some verbs, the basics of the partitive singular and some local cases for answering the 'where'-question.

**Mode of delivery:**

Multi-modal teaching (Contact teaching, on-line teaching and independent work)

**Learning activities and teaching methods:**

Lessons 1–2 times a week (14 h, including the final exam) and guided self study (40 h)

**Target group:**

International degree and post-graduate degree students and exchange students of the University

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Will be provided during the course.

**Assessment methods and criteria:**

Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.

Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Grading scale is 0-5.

**Person responsible:**

Anne Koskela

**Working life cooperation:**

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**Other information:**

Sign-up in WebOodi.

