Opasraportti

OMS - Courses in English for exchange students (2017 - 2018)

General information: Courses in English for exchange students at the Oulu Mining School

This Course Catalogue lists the courses taught in English that are available for exchange students at the ***Oulu Mining School***, the Faculty of Technology (from 1.1.2018-), University of Oulu, during the academic year 2017-18. The courses are in the study fields of ***mining engineering and mineral processing***, and ***geosciences*** (geology, geophysics).

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 Liaison 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.

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 on the Courses tab, 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 2017-2018 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 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' timing 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 2017-18

Autumn term 2017

Orientation: Sept 1-2, 2017
Period 1: Sept 4 - Oct 27, 2017
Period 2: Oct 30 – Dec 22, 2017 (after period 2 there can be some final exams, until the end of January - check the exam timetables in WebOodi).

Spring term 2018

Orientation: Jan 4-5, 2018
Period 3: Jan 8 – March 9, 2018
Period 4: March 12 – May 11, 2018 (after period 4 there can be some final exams, until the end of May - check the exam timetables in WebOodi)

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: Study.OMS(at)oulu.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
773631S: Biostratigraphy, 5 op

493608S: Development of benefication 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
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 benefication 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
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

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-ainevaroihin (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 in 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.

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

Ei opintojaksokuvauksia.

493608S: Development of benefication 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:
2nd year in Master's degree 1st and 2nd 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:
Saija Luukkanen, Maria Sinche Gonzalez
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:
-

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
Person responsible:
Prof. Holger Paulick
Working life cooperation:
No

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 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

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 in 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:
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, JKMRC 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 casa 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^{th} or 5^{th} year

Learning outcomes:
4^{th} or 5^{th} year Students have a knowledge of the distribution of the main hydrothermal ore deposits in Finland, including the Finnish VMS belt, the Kolari Fe-Au skarn deposits, Talvivaara Ni deposit, and Suurikuusikko Au deposit, as well as the most important hydrothermal ore deposits globally, e.g. the porphyry Cu-Mo deposits of the Cordillera, orogenic gold deposits of the Yilgarn craton, Carlin-type gold deposits, MVT deposits.

Contents:
Global distribution and petro-genesis of hydrothermal ore deposits.

Mode of delivery:
Face to face
Learning activities and teaching methods:
Lectures 30 h, hand-specimen examination and microscopy exercises 6 h
Target group:
Master's students and PhD students in geology

Prerequisites and co-requisites:
Igneous Petrology (772341A), Metamorphic petrology (772345A)

Recommended optional programme components:
Other courses in the International Master programme
Recommended or required reading:
Hedenquist JW et al. (2005) Economic Geoogy 100th Anniversary volume, Society of Economic Geologists, 1136 p.
Mineralium Deposita, Vol. 46, Nr. 5–6 (A thematic issue on the Geological setting and genesis of VMS deposits)
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:
Holger Paulick
Working life cooperation:
no

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 in 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 excercises: 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:
Eero Hanski, Marko Moilanen
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 utilizedis 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 in 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 th 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 understandin 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 studends 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 cours edoes not require other studies to be carries 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/fall
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:
4th year 1stperiod
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 kielet: English

ECTS Credits:
10 ECTS /266 hours of work
Language of instruction:
English
Timing:
Spring term of the 4th 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:
1st year in Master's degree, 4th 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 al
stages of mine life circle.
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 benefication 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 1st 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 tudent 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:
1st year in Master's degree 3rd 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:
Exam and exercises
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

Opettajat: Kari Strand

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 quantitive mineral evaluation, what materials can be studies 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

Opettajat: Pertti Sarala

Opintokohteen kielet: Finnish

ECTS Credits:
5 p
Language of instruction:
English or Finnish
Timing:
4^{th} (periods 3 or 4) or 5^{th} 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 4th or 5th (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
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 th 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:
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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

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

Ei opintojaksokuvauksia.

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
Opettajat: Kari Strand
Opintokohteen kielet: English

ECTS Credits:
1-9 cr
Language of instruction:
English
Timing:
4th or 5th 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

Ei opintojaksokuvauksia.

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:
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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 is 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:
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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 exercises 32 h, exercises 40 h and writing a report in Finnish or English.
Target group:
Master students in geology and mineralogy.
Prerequisites and co-requisites:
Structural geology (772316A), Digital modelling and geological information systems in geosciences (771302A) or corresponding knowledge and intermediate studies for the Bachelor's degree.
Recommended or required reading:
McClay (1991) The Mapping of Geological Structures. Open University Press, Milton Keynes, 168 p. Rowland (1986) Structural Analysis and Synthesis. Blackwell Sci. Publ. 208 p. Lisle (1985) Geological Strain Analysis, Pergamon Press, 99 p.
The availability of the literature can be checked from this link.
Assessment methods and criteria:
Report
Read more about assessment criteria at the University of Oulu webpage.
Grading:
5-1/fail
Person responsible:
N.N.
Working life cooperation:
No
Other information:
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