

# Opasraportti

## Oulu Mining School - 2015-16 (2015 - 2016)

### OULU MINING SCHOOL

There are two degree programmes in Oulu Mining School:

- \* Mining Technology and Mineral Processing (technical studies)
- \* Geosciences

Contact us: [study.oms@oulu.fi](mailto:study.oms@oulu.fi)

### THE DEGREE PROGRAMME IN MINING TECHNOLOGY AND MINERAL PROCESSING

You will find more information of degree programme from website "Studies at university of Oulu": <http://www.oulu.fi/education/5-6-year-degree-programmes/mining-technology-and-mineral-processing#content-top>

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### THE DEGREE PROGRAMME IN GEOSCIENCES

The geosciences include all branches of science that study the structure, composition, evolution and dynamics of the planet Earth and its natural mineral and energy resources. The social significance of geoscientific research has increased recently due to many factors, including the growing world population and the expanding global economy, resulting in an increasing demand for new raw materials and, at the same time, the enhanced awareness of the significance of environmental protection, mitigation of natural and anthropogenic hazards and sustainable development of the society.

The main aim of geoscientific research is to understand the Earth's ancient and current geological processes and related factors affecting the well-being of humankind. Geologists and geophysicists study different geological processes operating within and on the Earth, such as magmatism, metamorphism, deformation, erosion and sedimentation, and geological formations which are and were generated by these processes. Earth materials are constantly processed and recycled by physical, chemical and biological processes of our dynamic planet and anthropogenic activities, which provides investigators with many challenging questions.

Fundamental research focusing on the origin and evolution of the bedrock and its sedimentary cover provides a scientific basis for the research of renewable and non-renewable natural resources. Environmental research and environmental monitoring has recently attracted much attention along with the more traditional research fields such as mineral exploration and geological mapping. Also, the interest in the environment and natural resources of Arctic areas is currently strongly growing.

**The degree programme in Geosciences** is the other of the two degree programmes in Oulu Mining School. The other one is the degree programme in Mining Technology and Mineral Processing. The aim of the degree programme in Geosciences is to provide students with the competence to work as experts in different fields of geosciences in the public and private sector. It guides them to understand the action of geological processes and the mechanisms of formation of different geological formations. Teaching helps to develop skills that are needed in mineral exploration, mapping and exploitation of natural resources and also in their protection. More and more geological and geophysical information is needed in environmental planning and research and solution of environmental problems. The research field is multidisciplinary and therefore useful minor subjects include Chemistry, Physics, Geography, Biology, Mathematics, Information Sciences, Process, Water and Environmental Technology, and especially Mining Technology and Mineral Processing.

Field and laboratory training and summer work form an important component of geological and geophysical education, complementing theoretical studies. Among the general learning outcomes are various communicational and problem solving skills. Other typical competences in the field are: 1) adoption of four-dimensional time-spatial visualisation skills in understanding processes that deform rocks, 2) capability to integrate versatile information obtained from the field or laboratory, and skills to synthesise and perform modelling, 3) ability to acquire diverse and

comprehensive information on currently operating environmental processes, and 4) ability of develop a profound understanding on the needs of the society to exploit and protect natural resources. Internationalisation is a self-evident part of the training and future work relations, as the boundaries of geological formations do not follow those between countries or linguistic regions. The education thus creates good possibilities for the graduated student to move abroad either to continue his/her studies at other universities or work for international exploration and mining companies.

In Oulu Mining School, teaching and research of geosciences is distributed amongst the following four main subjects:

Geology and Mineralogy  
 Quaternary Geology  
 Geochemistry  
 Geophysics

**Geology and Mineralogy** is the study of the solid Earth, the materials which it is made of, including minerals, rocks and geological formations, and the physical, chemical and biological processes responsible for their generation. *Mineralogy* focuses on the structure, composition, occurrence and utilisation of minerals and forms the foundation to geological research. *Regional Geology* deals with general characteristics of a given area and the evolution of the bedrock. Using field studies and geochronological tools, geologists determine and date the time sequences of events in the *Earth's history*, from the beginning to the present time. In *igneous petrology*, the focus is on understanding the nature and origin of rocks crystallised from molten rock or magma, while *sedimentary and metamorphic petrology* deal with the nature and origin of sedimentary and metamorphic rocks, respectively. *Structural Geology* is the study of mechanical deformation of the bedrock and the resultant three-dimensional structural forms. An important branch of Geology and Mineralogy is *Ore Geology* dealing with the characteristics and genesis of different ore deposits, forming a basis for mineral exploration. Metals and minerals are essential for the sustainable development of the society, and their geological occurrence and exploitation have been chosen as one of the key topics in our department.

In Quaternary Geology, the focus is on the surface of the Earth's crust, which largely comprises different types of sediments. These were mainly formed during the youngest geological time period of the Earth's history, the Quaternary period, explaining the name given to this field of research. The sub-fields of Quaternary Geology include *Physical Geology* and, especially in Finland, its branch dealing with *Glacial Geology*, and *Historical Geology*, *Palaeontology* and many other fields (e.g., *Ore Prospecting*, *Hydrogeology*, *Environmental Geology* and *Peat Geology*). The aim of *Historical Geology* is to unravel the chronology of geological events, age relations of different geological formations and the evolution of life and climate on Earth. *Physical Sedimentology* is the study of sediments, their characteristics and depositional environments, and geomorphological landforms which they form. This is an economically important sub-field, because the information is used, for example in mineral exploration, environmental and regional planning, groundwater research, agricultural and forestry research and study of peat resources.

Geochemistry is the study of the source and fate of chemical species in natural environments, using chemical analysis of minerals, rocks, soils and waters. One of the aims is to describe and quantify the processes that control the recycling of elements and isotopes in nature. The main applications are geochemical exploration, environmental issues, and determining the age and genesis of different rock types. There are several subfields in Geochemistry. In *Isotope Geochemistry*, radiogenic and stable isotopes are analysed in order to perform age determinations and make inferences on the mechanisms and conditions of rock formations or other research targets. In *Environmental Geochemistry*, geochemists try to identify natural and anthropological chemical changes in the environment. *Geochemical Exploration* utilises geochemical properties of the bedrock and its Quaternary cover for discovering new ore deposits.

**Geophysics** is a natural science that involves the study of the physical structure and physical properties of the Earth and its surrounding space environment, and related physical processes. At the Oulu University, teaching and research in Geophysics are focused on *Applied Geophysics*, with emphasis on the use of geophysical methods in exploration, mapping and management of natural resources and in environmental and engineering studies. In the life cycle of a mine, Geophysics plays an important role in all stages: before opening the mine in mineral exploration and resource assessment, during active mining operations in exploration for additional resources and environmental monitoring, and after the closure of the mine, in environmental monitoring and mapping of potentially contaminated areas.

Students graduated as **geologists** from geosciences have been employed by public sector organisations, such as the Geological Survey of Finland, Finland's environmental administration, ELY Centres (Centres for Economic Development, Transport and the Environment) and universities. In the private sector, significant employers are domestic and foreign exploration companies, mining industry, and companies providing environmental consulting and

construction services. The main duties of geologists in these organisations are research and the mapping of bedrock and Quaternary deposits, studying ore deposits, carrying out mineral exploration projects and inventories of sediment and peat resources, groundwater investigations, and various environmental research and administrative tasks.

Students graduated as **geophysicists** work as researchers in various research institutes such as universities, the Geological Survey of Finland, Finnish Meteorological Institute, Finnish Environmental Institute, and geophysical observatories. Experts of Applied Geophysics are employed by domestic and foreign companies for research and instrumental development related to exploration and exploitation of geological raw materials (groundwater, dimension stones, ore deposits, minerals, oil). Geophysicists also apply their skills in various construction projects and environmental studies to identify potential environmental and anthropogenic hazards.

### Major subjects, structure of the degrees and lines of specialisation

In the degree programme of geosciences, it is possible to obtain a lower university degree, Bachelor's degree (B. Sc.), in Geosciences amounting to 180 credits. After the Bachelor's degree, students have the possibility to continue to study for a higher university degree, the Master's degree (M.Sc.), which can be done in three major subjects: Geology and Mineralogy, Quaternary Geology, and Geophysics. The Master's degree consists of a total of 120 credits of intermediate- and advanced-level studies. The amount of advanced studies in the chosen major subject must be at least 60 credits including the 35 credits of the Master's thesis. The post-graduate degrees are the Licentiate of Philosophy degree and the Doctor of Philosophy degree, of which the latter can be obtained without the former.

The basic and intermediate level studies of Geophysics can be done in the degree programme of Physics. After completing a BSc degree in Physics with a sufficient amount of courses in Geophysics and Geology, students can apply for transfer to Oulu Mining School for studying Geophysics as their major subject.

Students can graduate from the degree programme of Geosciences via three lines of specialisation:

- Master of Science degree in Geology and Mineralogy with specialisation in Economic Geology
- Master of Science degree in Quaternary Geology
- Master of Science degree in Geophysics with specialisation in Applied Geophysics

It is recommended that the decision on the major subject is made during the second year and not later than during the third year. The choice is not binding, as the line of specialisation can be changed within the degree programme still later through bridging studies. Differing from Geology and Mineralogy and Quaternary Geology, admission to the Geophysics Master's studies in Oulu Mining School takes place after a Bachelor degree in Physics and a minor subject entity of 25 ECTS credits in Geophysics in the degree programme of Physics have been completed.

In addition to the educational programme described above, Oulu Mining School offers students the International Master's Programme in Economic Geology. For these students, Geology and Mineralogy is the major subject. All courses in the programme are given in English.

The emphasis of the advanced-level teaching in Geology and Mineralogy is on courses which lead to specialisation in **Economic Geology**. The goal is that after obtaining a M.Sc. degree, students are sufficiently competent to cope with duties requiring detailed knowledge of the bedrock and its resources. The prime purpose of the education is to meet the need for experts in the growing ore exploration and mining industry. An important aspect of the teaching is to make students familiar with the occurrence, characteristics and genesis of different metallic ore deposits. Other topics include the evolution of the Finnish bedrock, isotope geochemistry, applied geophysics, geometallurgy, GIS applications, and geochemistry of mining environment.

The M.Sc. degree programme in **Quaternary Geology** offers the student high level education to understand how exogenic processes operate in different sedimentary environments and what is the human impact on these natural processes today. The core issue in the Quaternary research and education is to understand glacial sedimentology and stratigraphy. This knowledge on the mechanisms that operate in natural sedimentary environments is vital, for example in ore exploration and can also be utilised in many fields ranging from sustainable use of groundwater resources to various environmental issues such as climate change.

**In Applied Geophysics**, teaching and research are focused on using of geophysical methods in exploration and mapping of natural resources and in environmental and engineering studies. The teaching comprises a number of core courses, a selection of specialised courses and a final thesis project. The core courses provide the students with fundamental information about physical backgrounds of basic geophysical techniques and instrumentation essential for practicing applied geophysics. The specialised courses provide more detailed information about geophysical

techniques applied at different stages of the mine life circle. They prepare the students for choosing a thesis research area that best suits their interests. The thesis project involves the integration of theory with data derived from geophysical field observations obtained in cooperation with a suitable industrial, governmental or research partner.

Because the candidate-level teaching is given in the degree programme of Physics, course descriptions and requirements are available in the study guide of the degree programme of Physics, whereas the Master's level studies in Geophysics are described below together with the studies in Geology and Mineralogy, Quaternary Geology and Geochemistry.

### **General aspects of the studies**

The education in geosciences is given in the form of lecture courses, practical exercises, seminars, workshops and field courses. The amanuensis of the department will guide students with regard to general questions on the studies in the department and help students to compile a personal study plan (PSP). Students sketch a preliminary PSP in the first autumn during their orientation studies and will design a more precise PSP for the entire study period later on. Persons who help in detailed questions related to each subject are: Eero Hanski in Geology and Mineralogy and Geochemistry, Tiina Eskola in Quaternary Geology, and Kari Moisio in Geophysics.

The geosciences courses are divided into basic studies (code P), intermediate studies (code A) and advanced studies (code S). In addition, language studies and orientation studies (code Y) are part of the curriculum. The geologic education begins with basic studies in geosciences, which are completed during the first academic year. During the first spring semester it is possible to conduct the first compulsory intermediate-level studies. It is advised to start compulsory minor subject studies for the B.Sc. degree as early as possible, especially a basic chemistry course, which is recommended to be taken during the first autumn semester.

Geology students study for a joint Bachelor's degree in Geosciences, but they can already prepare themselves for the future decision on their line of specialisation by choosing Geology and Mineralogy or Quaternary Geology as one of their minor subjects in their B.Sc. degree. Other minor subjects are also needed to widen students' possibilities to carry out duties in their future work life. Appropriate minor courses include those given in Chemistry, Information Processing Science, Geophysics, Physics, Mathematics, and technical sciences. The Bachelor level studies described below concern geology students and corresponding studies for future geophysics students are described in the study guide of the degree programme of Physics.

### **BACHELOR'S DEGREE IN GEOSCIENCES (B.Sc.), 180 ECTS credits**

The Bachelor's degree in geology, which is normally completed within three years, constitutes the following studies:

- **General studies, 8 credits**
- **Basic studies in geology, 36 credits**
- **Compulsory intermediate studies in geosciences, 48 credits**
- **Bachelor's thesis and maturity test, 9 credits**
- **Optional intermediate courses in Geosciences**
- **Compulsory minor subject studies**
- **Optional minor subject studies**

## **Tutkintorakenteet**

### **MASTER OF SCIENCE (M.Sc.)**

Tutkintorakenteen tila: published

Lukuvuosi: 2015-16

Lukuvuoden alkamispäivämäärä: 01.08.2015

### **MASTER OF SCIENCE IN GEOLOGY AND MINERALOGY, SPECIALIZATION IN ECONOMIC GEOLOGY (vähintään 120 op)**

For Finnish students, completion of the Master's degree requires that the student has completed at least 60 credits of advanced studies in his/her major subject, including a 35-credit Master's thesis and related maturity test and other studies amounting to minimum 60 credits. Below is a list of courses in Geology and Mineralogy for your selection. Choose the other studies in such a way that they support your field specialisation. In addition, it is required that an entity of at least 25 ECTS credits of the following intermediate-level courses has been completed: 772347A Petrology of Igneous Rocks, 772344A Petrology of Sedimentary Rocks, 772346A Petrology of Metamorphic Rocks, 772310A General Mineralogy, 772316A Structural Geology, 772335A Introduction to Ore Mineralogy and 772334A Bedrock Mapping.

For students in the International Master's Programme in Economic Geology, The Master's degree requires that the student has completed at least 85 credits of advanced studies in his/her major subject, including a 35-credit Master's thesis and related maturity test, and other studies amounting to a minimum of 35 credits. Below is a list of courses in Geology and Mineralogy for your selection. Choose the other studies in such a way that they support your field of specialization. Some bridge studies at the intermediate level may be required, especially in ore geology and ore mineralogy, if needed to supplement the background knowledge.

### **Advanced studies , min. 60 ects.**

A325603: Geology and Mineralogy, advanced studies, 60 - 85 op

### **Optional studies**

#### **Optional minor subject entity**

#### **Other studies**

## **MASTER OF SCIENCE IN QUATERNARY GEOLOGY (vähintään 120 op)**

Completion of the master's degree requires that the student has completed at least 60 credits of advanced studies in his/her major subject, including a 35-credit Master's thesis and related maturity test and other studies amounting to a minimum of 60 credits. Below is a list of courses in Quaternary Geology for your selection. Choose the other studies in such a way that they support your field of specialization. In addition, it is required that an entity of at least 25 ECTS credits of the following intermediate-level courses has been completed: 773306A Surficial Geology of Finland, 773316A Technical Properties of Sediments, 773322A Surficial Geology in Ore Exploration, 773300A Quaternary Stratigraphy, 762306A Hydrology in Geosciences and 773324A Field Mapping of Quaternary Deposits.

### **Optional studies**

A326103: Surficial Geology, advanced studies, 60 op

*engl*

773601S: Glacial Geology II, 5 op

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

773641S: Surficial geology in ore exploration, advanced course 1, 5 op

773642S: Surficial geology in ore exploration, advanced course 2, 5 op

773646S: Advanced field techniques, 3 op

773648S: Sedimentary Structures, 5 op

773613S: Literature essay, 5 op

773607S: Literature study, 5 op

773608S: Special questions in Quaternary geology, 5 op

773612S: Excursion on regional surficial geology, 3 - 6 op

773619S: Quaternary geology seminar II, 5 op

773673S: Environmental geology and geophysicfield course, 3 op

773679S: Studies in other universities, 0 op

773615S: Studia Generalia -lectures, 2 op

773650S: Biostratigraphy: Pollen and spores, 5 op

773654S: Biostratigraphy: Diatoms, 5 op

773627S: Global environmental and climate change during the Cenozoic, 5 op

773655S: Sedimentology, 5 op

773657S: Pro gradu thesis, 30 op

770690S: Maturity test, 0 op

**Optional minor subject entity****Other studies****MASTER OF SCIENCE IN GEOPHYSICS (vähintään 120 op)**

Completion of the Master's degree requires that the student has completed at least 60 credits of advanced studies in his/her major subject, including a 35-credit Master's thesis and related maturity test, and other studies amounting to a minimum of 60 credits. Below is a list of courses in Geophysics for your selection, divided into compulsory and elective courses. Choose the other studies in such a way that they support your field of specialization. Including optional advanced-level courses as much as possible in Geophysics. In addition, it is required that an entity of at least 25 ECTS credits of the following intermediate-level courses has been completed in the candidate stage or are completed during the Master's studies as bridge studies: Compulsory: 762104P Introduction to solid Earth Geophysics, 762306A Hydrology in geosciences, 762305A Geophysical research methods of rock and soil, 762107P Introduction to global environmental geophysics; Optional: 762108P GIS and spatial data 1, 762322A Geomagnetism, 762321A Seismology and the structure of the Earth.

**Compulsory advanced-level studies, major subject**

762608S: Airborne geophysics, 5 op  
 762615S: Borehole geophysics, 5 op  
 762604S: Geophysical field theory, 5 op  
 762681S: M.Sc. work (thesis and seminar), 30 op  
 762679S: Maturity test, 0 op  
 762609S: Modelling and inversion, 5 op  
 762610S: Physical properties of rocks, 5 op

**Optional advanced-level studies, major subject**

H325508: Optional advanced-level courses in Geophysics, 0 - 60 op

*Electives*

762627S: Time-domain electromagnetic research methods, 3 op  
 762620S: Computers in geophysics, 3 op  
 762662S: Special courses in geophysics, 0 op  
 762606S: GIS and spatial data 2, 3 op  
 762645S: Field course in bedrock mapping and applied geophysics, 3 op  
 762624S: Electrical research methods of rock and soil, 5 op  
 762628S: Thermal processes of the earth, 5 op  
 762616S: Ground Penetrating Radar Sounding, 5 op  
 762625S: Magnetotellurics, 5 op  
 762636S: Shallow seismic soundings, 6 op  
 762661S: An advanced level course from another Finnish university, 0 op  
 762663S: An advanced level course from another university abroad, 0 op  
 762684S: Excursion, 2 op  
 772684S: GIS applications, 5 op  
 762612S: Gravimetric and magnetic methods, 5 op  
 762630S: Modelling of electromagnetic fields, 5 op  
 762611S: Theory of electromagnetic methods, 5 op  
 762617S: VLF-method, 5 op  
 762646S: Field course in environmental geology and applied geophysics, 3 op

**Optional minor subject entity****Other studies****B.SC. IN GEOLOGY**

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Lukuvuosi: 2015-16

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## **Bs.C, OBLIGATORY GENERAL-, BASIC- AND INTERMEDIATE-LEVEL STUDIES**

The Bachelor of Science degree in geology is a joint degree for all geology students. It includes 80 credits of obligatory major subject studies, which are divided into basic studies (28 cr), intermediate-level studies (43 cr), and the Bachelor thesis (9 cr) and related maturity test. It is recommended that during the Bachelor studies, the student takes a sufficient amount of courses in his/her future majors subject to ensure that courses needed as pre-requirements for the Master's studies are done.

### **OBLIGATORY GENERAL- AND MINOR STUDIES**

- 902002Y: English 1 (Reading for Academic Purposes), 2 op
- 902004Y: English 2 (Scientific Communication), 2 op
- 030005P: Information Skills, 1 op
- 770001Y: Orientation course for new students, 1 op
- 901055Y: Second Official Language (Swedish), Oral Skills (OMS), 1 op
- 901054Y: Second Official Language (Swedish), Written Skills (OMS), 1 op

### **BASIC STUDIES IN GEOSCIENCES**

- 771102P: Basic course in mineralogy, 6 op
- 762108P: GIS and spatial data 1, 5 op
- 771113P: Introduction to Geology I, 5 op

#### *Compulsory*

- 771113P-02: Introduction to Geology I, Rock identification, 0 op
- 771113P-01: Introduction to Geology I, lectures, 0 op

- 771114P: Introduction to Geology II, 5 op
- 771116P: Introduction to Quaternary deposits of Finland and their resources, 5 op
- 771115P: Introduction to bedrock geology of Finland and ore geology, 5 op
- 762104P: Introduction to solid earth geophysics, 5 op

#### *Compulsory*

- 762104P-01: Introduction to solid earth geophysics (part 1): Introduction to geophysics, 0 op
- 762104P-02: Introduction to solid earth geophysics (part 2): Solid Earth geophysics, 0 op

### **OBLIGATORY INTERMEDIATE STUDIES IN GEOSCIENCES**

- 774301A: A Basic Course in Geochemistry, 6 op
- 771303A: Bachelor of Science thesis, 9 op
- 773344A: Basics of glacial geology, 5 op
- 773346A: Environmental geology, 5 op
- 762305A: Geophysical research methods of rock and soil, 6 op
- 770390A: Maturity test, 0 op
- 772339A: Optical mineralogy, 6 op
- 772385A: Ore geology, 5 op
- 773317A: Physical Sedimentology, 5 op
- 771304A: Practical training, 4 - 5 op
- 773343A: Quaternary Geology Seminar I, 5 op
- 772337A: Seminar in geology and mineralogy I, 5 op

### **MINOR SUBJECT STUDIES (10 - 16 op)**

The Bachelor of Science degree should include at least one 25 ECTS credit entity in an appropriate minor subject. This is recommended to be done in the subject (Geology and Mineralogy or Quaternary Geology) that the student will select his/her major subject in the Master's degree because the completion of this kind of entity is required in the Master's stage. In addition, 25 ECTS credit entities can be completed in other subjects such as Geophysics, Chemistry, Process Engineering, Mathematics, Basics of Environmental Protection etc. If you have done one 25 ECTS credit entity, you can also complete smaller 15 ECTS credit entities in a minor subject, entitled "studies in" the subject in question.

**MINOR SUBJECT ENTITY IN QUATERNARY GEOLOGY (25 ECTS)**

A326104: Surficial Geology Minor, 25 op

*E1*

- 773324A: Field mapping of Quaternary deposits, 5 op
- 773306A: Quaternary Geology of Finland, 5 op
- 773316A: Technical Properties of Sediments, 8 op
- 773322A: Surficial geology in ore exploration, 5 op
- 773300A: Quaternary Stratigraphy, 5 op
- 762306A: Hydrology in geosciences, 6 op
- 773345A: Work practice 2, 4 - 5 op

**MINOR SUBJECT ENTITY IN GEOLOGY AND MINERALOGY**

A325604: Geology and Mineralogy Minor, 25 op

*E2*

- 772334A: Bedrock mapping, 3 op
- 772344A: Sedimentary Petrology, 5 op
- 772335A: Introduction to ore mineralogy, 5 op
- 772310A: General mineralogy, 5 op
- 772316A: Structural geology, 5 op
- 772341A: Igneous Petrology, 7 op
- 772345A: Metamorphic Petrology, 6 op

**STUDIES IN QUATERNARY GEOLOGY (15 ECTS)**

A326108: Studies in Surficial Geology, 15 op

*E3*

- 773324A: Field mapping of Quaternary deposits, 5 op
- 773306A: Quaternary Geology of Finland, 5 op
- 773316A: Technical Properties of Sediments, 8 op
- 773322A: Surficial geology in ore exploration, 5 op
- 773300A: Quaternary Stratigraphy, 5 op
- 773650S: Biostratigraphy: Pollen and spores, 5 op
- 773654S: Biostratigraphy: Diatoms, 5 op
- 773345A: Work practice 2, 4 - 5 op

**STUDIES IN GEOLOGY AND MINERALOGY (15 ECTS)**

A325608: Studies in Geology and Mineralogy, 15 op

*E4*

- 772334A: Bedrock mapping, 3 op
- 772341A: Igneous Petrology, 7 op
- 772344A: Sedimentary Petrology, 5 op
- 772345A: Metamorphic Petrology, 6 op
- 772385A: Ore geology, 5 op
- 772335A: Introduction to ore mineralogy, 5 op
- 772310A: General mineralogy, 5 op
- 772338A: Work practice II, 4 - 5 op

**STUDIES IN GEOCHEMISTRY (10 ECTS)**

A323702: Studies in Geochemistry, 15 - 100 op

*E5*

- 774329A: Introduction to Environmental Geochemistry, 5 op
- 774304A: Analytical methods in geochemistry, 5 op

**OTHER MINOR SUBJECT**



## OTHER STUDIES

Other optional studies can include separate courses that are not part of the major and minor subject entities.

## Mining Technology and Mineral Processing, BSc(Tech)

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### Basic Studies (70 op)

A439101: Basic Studies, Mining Technology and Mineral Processing, 70 op

#### *Basic Studies*

- 477011P: Introduction to Process and Environmental Engineering I, 5 op
- 488010P: Introduction to Process and Environmental Engineering II, 5 op
- 031010P: Calculus I, 5 op
- 031075P: Calculus II, 5 op
- 031076P: Differential Equations, 5 op
- 031078P: Matrix Algebra, 5 op
- 031021P: Probability and Mathematical Statistics, 5 op
- 031022P: Numerical Analysis, 5 op
- 761113P: Electricity and magnetism, 5 op

#### *Compulsory*

- 761113P-01: Electricity and magnetism, lectures and exam, 0 op
- 761113P-02: Electricity and magnetism, lab. exercises, 0 op
- 461102A: Statics, 5 op
- 780117P: General and Inorganic Chemistry A, 5 op
- 780123P: Introductory Laboratory Works in Chemistry, 5 op
- 491100P: Orientation to OMS studies, 1 op
- 030005P: Information Skills, 1 op
- 902011P: Technical English 3, 6 op
- 901008P: Second Official Language (Swedish), 2 op

### Intermediate Studies (60 op)

A439102: Intermediate Studies, Mining Technology and Mineral Processing, 60 op

#### *Intermediate Studies*

- 477121A: Particle Technology, 5 op
- 477122A: Bulk Solids Handling, 5 op
- 461103A: Strength of materials I, 5 op
- 461106A: Dynamics, 5 op
- 477401A: Thermodynamic Equilibria, 5 op
- 477201A: Material and Energy Balances, 5 op
- 477222A: Reactor Analysis, 5 op
- 477052A: Fluid Mechanics, 5 op
- 477501A: Process dynamics, 5 op
- 477502A: Experiment design and analysis, 5 op
- 493300A: Principles of mineral processing, 5 op
- 477716A: Surface Chemistry Principles and Applications in Mineral and Mining Technology, 5 op

### Geology (25 op)

A439125: Supplementary Studies, Mining Technology and Mineral Processing, 25 op

#### *Geology*

- 771113P: Introduction to Geology I, 5 op

*Compulsory*

- 771113P-02: Introduction to Geology I, Rock identification, 0 op  
 771113P-01: Introduction to Geology I, lectures, 0 op  
 771114P: Introduction to Geology II, 5 op  
 774301A: A Basic Course in Geochemistry, 6 op  
 771102P: Basic course in mineralogy, 6 op  
 492300A: Rock mechanics, 5 op

**Working Life Studies (25 op)**

A439124: Working Life Studies, Mining Technology and Mineral Processing, 25 op

*Working Life Studies*

- 555225P: Basics of industrial engineering and management, 5 op  
 555265P: Occupational Safety and Health Management, 5 op  
 491300A: Practical Training, 5 op  
 900060A: Technical Communication, 2 op  
 491302A: Bachelor's thesis, 8 op  
 491303A: Maturity test, 0 op

**Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot**

- 762361A: An intermediate level course from another Finnish university, 0 op  
 762363A: An intermediate level course from another university abroad, 0 op  
 772682S: Applied Field Techniques in Economic Geology, 5 op  
 772631S: Archean Geology, 5 op  
 772613S: Bedrock geology of Finland, 6 op  
 772640S: Excursion, 5 op  
 774636S: Geochemistry of Mining Environment, 5 op  
 772621S: Geology of alkaline rocks, carbonatites and kimberlites, 5 op  
 762322A: Geomagnetism, 5 op  
 772694S: Geometallurgy and mineral processing, 5 op  
 772675S: Geophysics in economic geology, 5 op  
 772687S: Gold deposits, 5 op  
 772692S: Hydrothermal ore deposits, 5 op  
 762103P: Introduction to geophysics, 2 op  
 762107P: Introduction to global environmental geophysics, 5 op  
 762193P: Introduction to hydrology and hydrogeophysics, 4 op  
 774637S: Isotope geochemistry for economic geologists, 6 op  
 772628S: Layered intrusions and their ore deposits, 5 op  
 774629S: Literature essay, 4 - 5 op  
 772615S: Literature study, 5 op  
 772695S: Magmatic ore deposits, 5 op  
 772666S: Master's thesis, 30 op  
 772608S: Mining geology, 3 op  
 772689S: Nickel deposits of the Fennoscandian Shield, 5 op  
 762352A: Practical training, 5 op  
 772632S: Regional ore geology of Fennoscandia, 5 op  
 772693S: Sedimentary ore deposits, 5 op  
 762321A: Seismology and the structure of the earth, 5 op  
 772667S: Seminar in ore geology, 5 op  
 762192P: Solid Earth Geophysics, 3 op  
 772658S: Special issues in geology and mineralogy, 1 - 9 op  
 772683S: Structural geology for economic geologists, 5 op  
 772690S: Studies in other universities and colleges, 0 op

# Opintojaksojen kuvaukset

## Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

### A325603: Geology and Mineralogy, advanced studies, 60 - 85 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

### A326103: Surficial Geology, advanced studies, 60 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

*engl*

### 773601S: Glacial Geology II, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course the student will be able to explain the physical properties of glaciers and the genesis of glacial sediments and glacial landforms.

**Contents:**

Dynamics and hydrology of glaciers; erosion and sedimentation processes in glacial environment; basics of glaciology; subglacial, englacial and supraglacial processes. Origin of different glacial sediments and landforms and modelling of paleoice sheets.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

26 h lectures

**Target group:**

Geology students

**Prerequisites and co-requisites:**

Bachelor of Science degree

**Recommended or required reading:**

Handouts given during lectures and applicable parts of Benn, D.I. & Evans, D.J.A. (1988) *Glaciers & Glaciation*, 734 p.

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

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**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 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th year

**Learning outcomes:**

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

**Contents:**

Basics of air photograph interpretation; identification of landforms from air photographs and topographical maps; mapping based on air photograph interpretation and the necessary field research. Students compile a map of a small area.

**Mode of delivery:**

Face to face

**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 (773303A).

**Assessment methods and criteria:**

Pre-examination, exercises and written examination.

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka and Tiina Eskola

**Working life cooperation:**

No

**Other information:**

Obligatory in Master of Science degree in Quaternary geology.

**773641S: Surficial geology in ore exploration, advanced course 1, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course, students have gained knowledge of the mode of occurrence of elements in surficial deposits, research methods of heavy minerals and their use in ore exploration.

**Contents:**

Mode of occurrence of elements in surficial deposits; research methods of occurrence of elements; using partial extraction methods; separating different fractions from a sample; heavy mineral prospecting; mineral determinations and analysis; defining mechanisms of dispersion.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures

**Target group:**

Master's level geoscience students.

**Prerequisites and co-requisites:**

Surficial geology in ore exploration (73322A).

**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.

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

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773642S: Surficial geology in ore exploration, advanced course 2, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course students have knowledge on the use of organic sediments, waters, snow and air in ore exploration.

**Contents:**

Dispersion in organic material, waters, snow and in air and there use in ore exploration.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures

**Target group:**

Master's level geoscience students.

**Prerequisites and co-requisites:**

Advanced course of surficial geology in ore exploration I (773641S).

**Recommended or required reading:**

Selected articles.

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773646S: Advanced field techniques, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Juha Pekka Lunkka**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course the student will be able to use a range of field techniques required in Quaternary Geology research projects (e.g. aerial image, sedimentological, drilling, ground penetrating techniques).

**Contents:**

Field course comprises planning and implementation of geological methods to collect geological data (sedimentological, geomorphological and geophysical data) from a preselected field area.

**Mode of delivery:**

Face to face in class and field.

**Learning activities and teaching methods:**

Field course, 40 h teaching and exercise in the field.

**Target group:**

Advanced-level geology students.

**Prerequisites and co-requisites:**

Bachelor of Science degree.

**Assessment methods and criteria:**

Participation in the field course.

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

Pass/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773648S: Sedimentary Structures, 5 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Juha Pekka Lunkka**Opintokohteen kielet:** 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 is able to identify various sedimentary structures and facies associations and use them for palaeoenvironmental reconstructions.

**Contents:**

The course introduces the sedimentary structures, the physical background of their genesis and the occurrence of these structures in different sedimentary environments. The course also includes exercises to identify different sedimentary structures.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

24 h lectures, 15 h exercises

**Target group:**

Advanced-level geology students.

**Prerequisites and co-requisites:**

Bachelor of Science degree.

**Recommended optional programme components:**

No

**Recommended or required reading:**

Reineck, H-E. & Singh, I. B. (1980) Depositional Sedimentary Environments. Springer-Verlag, p. 1-176. 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:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773613S: Literature essay, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**



Students search for relevant literature on given topic and write an essay with proper reference procedure.

**Contents:**

Student searches literature on the given topic and writes an essay.

**Mode of delivery:**

Independent working

**Learning activities and teaching methods:**

Reading literature and writing an essay.

**Target group:**

Master's level geoscience students.

**Prerequisites and co-requisites:**

Introduction to geology II (771114P), Quaternary geology of Finland (773306A), Basics of glacial geology (773344A).

**Recommended or required reading:**

Will be informed separately.

**Assessment methods and criteria:**

Writing an essay

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

**Grading:**

Pass/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773607S: Literature study, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Students acquire deep knowledge on a particular surficial geology topic.

**Contents:**

Independent literature search and construction of a report on a given theme.

**Mode of delivery:**

Independent work.

**Learning activities and teaching methods:**

Essay writing.

**Target group:**

Advanced-level students in Quaternary geology.

**Prerequisites and co-requisites:**

Introduction to geology II (771114P), Quaternary geology of Finland (773306A), Basics of glacial geology (773344A).

**Recommended or required reading:**

Will be informed separately.

**Assessment methods and criteria:**

Essay

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

**Grading:**

Pass/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773608S: Special questions in Quaternary geology, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course, the student will be able to critically assess and analyze recent research results of the chosen topic lectured.

**Contents:**

Guest lecture course on recent advances in Quaternary Geology.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures

**Target group:**

Master's level Quaternary geology students.

**Prerequisites and co-requisites:**

Bachelor of Science degree.

**Recommended or required reading:**

Announced separately.

**Assessment methods and criteria:**

Attending lectures and written examination.

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773612S: Excursion on regional surficial geology, 3 - 6 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Juha Pekka Lunkka**Opintokohteen kielet:** Finnish**ECTS Credits:**

3-6 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

After the course, students are able to recognize Quaternary deposits that are typical for different areas.

**Contents:**

Several-day excursion in Finland or abroad, during students will be introduced to Quaternary deposits and stratigraphic type sections in different areas.

**Mode of delivery:**

Face to face in the field.

**Learning activities and teaching methods:**

Excursion

**Target group:**

Quaternary geology students.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P), Quaternary geology of Finland (773306A), Basics of glacial geology (773344A).

**Recommended or required reading:**

Selected separately for each excursion.

**Assessment methods and criteria:**

Written report

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

Pass/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773619S: Quaternary geology seminar II, 5 op****Opiskelumuoto:** Advanced Studies**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

The objective is to enhance students' ability to construct and give a scientific presentation on a subject of their field.

**Contents:**

Students prepare and give an oral presentation (about 30 minutes) on a subject that has required independent work and judgement. Each participant acts once as an opponent. Active class participation required.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Seminar

**Target group:**

Master's students in Quaternary geology.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P), Quaternary geology of Finland (773306A), Basics of glacial geology (773344A).

**Recommended or required reading:**

Will be informed separately.

**Assessment methods and criteria:**

Oral presentation and acting as an opponent and an essay.

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

**Grading:**

Pass/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773673S: Environmental geology and geophysicfield course, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

After conducted the course student can well-founded choose and specify which kind geophysical measurements must be used in different surficial environments.

**Contents:**

Course gives basic knowledge and skills for studying Quaternary landforms, their consistency, ground water questions and environmental issues with geological and geophysical methods.

**Mode of delivery:**

Face to face in the field.

**Learning activities and teaching methods:**

8 h lectures, 32 h exercises in the field.

**Target group:**

Students majoring in Quaternary geology.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P), Quaternary geology of Finland (773306A), Basics of glacial geology (773344A).

**Recommended or required reading:**

Material delivered during the course.

**Assessment methods and criteria:**

Attending lectures and written report.

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

**Grading:**

Pass/fail

**Person responsible:**

Kari Moisio, Juha Pekka Lunkka

**Working life cooperation:**

No

**773679S: Studies in other universities, 0 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

Varies depending on the original course.

**Learning outcomes:**

Depend on the course.

**Contents:**

Courses taken in international exchange programmes (Erasmus, Nordplus) or courses taken in other Finnish universities.

**Assessment methods and criteria:**

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

**Person responsible:**

Professor responsible of the subject in question.

**773615S: Studia Generalia -lectures, 2 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Language of instruction:**

Finnish/English

**Timing:**

4th or 5th study year

**Learning outcomes:**

Students will acquire information on the current duties and special fields of geologists working in different sectors of the society and they will learn to gather the most essential points from lectures.

**Contents:**

Students attend lectures given by external visitors having different types of careers as geologists.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Attendance of at least four lectures.

**Target group:**

All intermediate- and advanced-level geology students.

**Recommended or required reading:**

Material presented during lectures.

**Assessment methods and criteria:**

Circa 2-page reports on each lecture.

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

**Grading:**

Pass/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No

**773650S: Biostratigraphy: Pollen and spores, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Tiina Eskola

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course, students should be able to prepare pollen samples in the laboratory and identify the most common pollen types and spores in Finland.

**Contents:**

Theory of the pollen analysis and laboratory methods, the most common pollen and spore types, manufacturing preparations, sediment analysis.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 20 h/ exercises 38 h/ independent work 40 h.

**Target group:**

The course unit is aimed primarily at major subject students.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P).

**Recommended or required reading:**

Handouts and Bennett, K.D. & Willis, K.J. (2001) Pollen. In: Smol, J.P., Birks, H.J.B., Last, W.M. (Eds.). Tracking Environmental Change Using Lake Sediments. Volume 3: Terrestrial, Algal, and Siliceous Indicators. Kluwer, Dordrecht, The Netherlands, pp. 5 - 32. Berglund, B. (Ed.) (1988) Handbook of Holocene Palaeoecology and Palaeohydrology. Wiley & Sons, p. 455-484.

**Assessment methods and criteria:**

Students participate actively in teaching, written report and an examination.

**Grading:**

Pass/fail

**Person responsible:**

Tiina Eskola

**Working life cooperation:**

No

**773654S: Biostratigraphy: Diatoms, 5 op****Voimassaolo:** 01.08.2015 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Tiina Eskola**Opintokohteen kielet:** Finnish**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course, students should be able to prepare diatom samples in the laboratory and identify some of the most general diatoms in Finland.

**Contents:**

Theory of the diatom analysis and laboratory methods, the most general diatom genera and species, manufacturing preparations, sediment analysis.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 22 h/ exercises 42 h/ independent work 30 h.

**Target group:**

The course unit is aimed primarily at major subject students.

**Prerequisites and co-requisites:**

Basic studies in geosciences.

**Recommended or required reading:**

Handouts and Battarbee, R.W., Jones, V.J., Flower, R.J., Cameron, N.g., Bennion, H., Varvalho, L., Juggins, S. (2001) Diatoms. In: Smol, J.P., Birks, H.J.B., Last, W.M. (Eds.). Tracking Environmental Change Using Lake Sediments. Volume 3: Terrestrial, Algal, and Siliceous Indicators. Kluwer, Dordrecht, The Netherlands, pp. 155 - 202. Berglund, B. (Ed.) (1988) Handbook of Holocene Palaeoecology and Palaeohydrology. Wiley & Sons., p. 527-570. Forsström, L. (1999) Piikuoiset levät. Opintomoniste, Oulun yliopisto Geotieteiden laitos, 104 p.

**Assessment methods and criteria:**

Students participate actively in teaching, written report.

**Grading:**

Pass/fail

**Person responsible:**

Tiina Eskola

**Working life cooperation:**

No

**773627S: Global environmental and climate change during the Cenozoic, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskeluoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** English, Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course the student will be able to explain the mechanisms behind the natural climate and environmental change and relate that to the ongoing changes in climate and environment.



**Contents:**

Mechanisms and rates of environmental and climate change during the past 100 million. The course introduces, for example the influence of orbital cycles, tectonics, ocean currents and ice sheets on the environmental and climate change during the deep past.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

24 h lectures

**Target group:**

Advanced-level geology students.

**Prerequisites and co-requisites:**

No

**Recommended optional programme components:**

No

**Recommended or required reading:**

Lunkka, J.P. (2008) Maapallon ilmastohistoria. Gaudeamus, Helsinki University Press, 286 s.

**Assessment methods and criteria:**

Attending lectures and written examination.

**Grading:**

5-2/fail

**Person responsible:**

Juha Pekka Lunkka

**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 beds and sediment associations are related to different sedimentary environments. The student will also be able link individual observations to various sedimentary processes and their products 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:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773657S: Pro gradu thesis, 30 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

35 credits

**Language of instruction:**

Finnish/English

**Timing:**

5th study year

**Learning outcomes:**

Upon completing their Master's thesis, students will gain advanced understanding on a subject belonging to two of the four specializations: Quaternary geology and geoenvironment. They will be able to use and apply pertinent research methods and theoretical knowledge of their research field, make independent inferences from their observations and measurements, and utilize effectively scientific literature.

**Contents:**

Independent research and literature study and production of scientific text.

**Mode of delivery:**

Personal supervision.

**Learning activities and teaching methods:**

Students carry out a personal research project, which is normally based field and/or laboratory work, and they write a Master's thesis (pro gradu) on the results. The topic of the thesis is agreed with the supervisor from the department and with other potential internal or external supervisors. Personal guidance is given by the supervisor(s) during the research and writing stage.

**Target group:**

Advanced-level geology students.

**Prerequisites and co-requisites:**

A sufficient amount of intermediate- and advanced-level courses has to be done to enable the student to start independent research work

**Recommended or required reading:**

Is decided separately in each case.

**Assessment methods and criteria:**

Thesis

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

**Grading:**

5-1/fail

**Person responsible:**

Professors and lecturers

**Working life cooperation:**

Yes (commonly)

**770690S: Maturity test, 0 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

0 credits

**Language of instruction:**

Finnish or English

**Timing:**

5th year

**Learning outcomes:**

The student can write an informative abstract on his/her M.Sc. thesis.

**Contents:**

The student describes and analyses the material, research methods, and results of his/her M.Sc. thesis.

**Mode of delivery:**

Independent work

**Learning activities and teaching methods:**

Independent work

**Target group:**

Compulsory for all M.Sc. students in geosciences.

**Prerequisites and co-requisites:**

Written after the completion of the Master's thesis.

**Recommended optional programme components:**

No alternative course units.

**Recommended or required reading:**

No special reading (material of the M.Sc. thesis).

**Assessment methods and criteria:**

One-page abstract, which is written on a special form provided by the faculty.

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

**Grading:**

Pass/fail

**Person responsible:**

Supervisor of the Master's thesis.

**Working life cooperation:**

No work practise.

**762608S: Airborne geophysics, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** English, Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish (optionally English)

**Timing:**

2nd or 3rd spring term

**Learning outcomes:**

After completion the student identifies the special characteristics of airborne geophysical measurements, and knows how to process and interpret airborne geophysical data in various different ways.

**Contents:**

The course provides basic knowledge on airborne geophysical investigation methods. The course focuses on the airborne geophysical mapping made by the Geological Survey of Finland. The course considers the theoretical principles of the magnetic, electromagnetic and radiometric measurements, practical measurement arrangements, auxiliary measurements, navigation and positioning, data processing and interpretation and the special characteristics of magnetic and electromagnetic anomalies. Modelling and interpretation software are used in computer exercises to emphasise the lectures.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures and demonstrations 30 h, independent study 100 h

**Target group:**

Primarily for the students of the degree programme in Oulu Mining School. Compulsory for geophysics students in M. Sc studies.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes and Peltoniemi, M. (1998) Aerogeofysikaaliset menetelmät.

**Assessment methods and criteria:**

Examination

**Grading:**

5-1/fail

**Person responsible:**

Toivo Korja

**Working life cooperation:**

No work practice.

**Other information:**

<https://wiki.oulu.fi/display/762332A/>

**762615S: Borehole geophysics, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** Finnish, English

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Students will be familiar with various geophysical borehole measurement techniques, their results and interpretation.

**Contents:**

Magnetic, gravimetric, electric, electromagnetic, radiometric, seismic and other methods applicable in borehole measurements.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures and exercises totalling 30 h, additional independent study.

**Target group:**

Students of Oulu Mining School, and the Faculties of Science and Technology. Obligatory to geophysics students in M.Sc. degree.

**Prerequisites and co-requisites:**

Prior completion of course 762305A (earlier 762302A) Geophysical research methods of rock and soil.

**Recommended or required reading:**

Material given during lectures.

**Assessment methods and criteria:**

Examination

**Grading:**

5-1/fail

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No work practise

## **762604S: Geophysical field theory, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** English, Finnish

## **762681S: M.Sc. work (thesis and seminar), 30 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

35 credits

**Language of instruction:**

Finnish or English

**Timing:**

5th study year

**Learning outcomes:**

The student can define and describe the background and methods for the research field of his/her thesis, and is able to perform relatively large research project as well as to handle reporting of the results. Finally the student can give a seminar talk based on his/her thesis.

**Contents:**

The student must demonstrate ability to scientific thinking, to define a research problem, choose the research methods and be able to use to methods to solve the problem. In addition the student must show adequate familiarity with the literature related to the subject of thesis and skills in scientific writing. The subject must be chosen with the professor of geophysics.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Writing a thesis, giving a seminar talk, and participating in the seminars during one term. Self-study 933 h.

**Target group:**

Compulsory for students of geophysics in the M.Sc. degree.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Selected case by case.

**Assessment methods and criteria:**

Thesis, seminar talk.

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

**Grading:**

5-1/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No work practise

**Other information:**

<https://wiki oulu.fi/display/762681S/>

**762679S: Maturity test, 0 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

0 credits

**Language of instruction:**

Finnish or English

**Timing:**

5th study year

**Learning outcomes:**

The student can independently produce text from the research field of his/her thesis using the language of the thesis (762681S).

**Contents:**

If a student has written a maturity test for his/her Bachelor degree, showing a good command of Finnish or Swedish, the maturity test for the M.Sc. degree is an abstract of his/her Master's thesis, written as regulated by the faculty.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Independent work

**Target group:**

Compulsory for Master of Science in geophysics.

**Prerequisites and co-requisites:**

Written after the completion of the Master's thesis.

**Recommended optional programme components:**

No alternative course units.

**Recommended or required reading:**

No reading

**Assessment methods and criteria:**

The test event

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

**Grading:**

Pass/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No work practise

**762609S: Modelling and inversion, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Elena Kozlovskaya

**Opintokohteen kielet:** Finnish, English

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

After passing the course the student can describe essential things of geophysical interpretation methods, can define and explain geophysical tomography, the theoretical basics of non-linear optimisation and inversion and is able to apply them in interpretation of geophysical data.

**Contents:**

Systematic introduction to inversion of geophysical field data. Principles of inversion, selecting inversion models and methods. Inversion nomograms. Linear parameter inversion: genuine linear parameters, linearisation, generalised inversion, principles of tomographic nonlinear inversion: one- and multidimensional optimisation. Special methods of inversion: analytic inversion, function theoretical methods, statistical methods. Principles of probability density and entropy maximum. Error analysis.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures and exercises totalling 55 h, self-study 105 h.

**Target group:**

Compulsory for students of geophysics in the M.Sc. degree.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes and lecture material. Parts of the following: Hjelt, S.E. (1992) Pragmatic inversion of geophysical data and selected parts: Menke, W. (1989) Geophysical data analysis: discrete inverse theory; Sen, M. & Stoffa, P.L. (1995) Global optimisation methods in geophysical inversion; Scales, J.A., Smith, M.L. & Treitel, S. (2001) Introductory geophysical inverse theory.

**Assessment methods and criteria:**

One written examination and accepted report of an independent exercise.

**Grading:**

5-1/fail

**Person responsible:**

Elena Kozlovskaya

**Working life cooperation:**

No work practise.

**762610S: Physical properties of rocks, 5 op**

Voimassaolo: 01.08.2015 -

**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Elena Kozlovskaya**Opintokohteen kielet:** Finnish, English**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year for students in geophysics.

**Learning outcomes:**

Upon the completion of the course, a student

- can define the position, role and significance of petrophysics (rock property analysis) in geophysical and geological research
- can explain the physical properties of major rocks and rock forming minerals and their mutual dependence
- can describe how the temperature and pressure affect the physical properties of rocks
- can relate the structure of the rocks with the physical properties of the rocks
- can use petrophysical data in the geological interpretation of geophysical models
- is able to measure the major petrophysical properties of rock samples

**Contents:**

Physical properties of rocks and minerals including density, magnetic, elastic, electric, thermal and radiometric properties, their mutual dependence and behaviour as a function of temperature and pressure. In practical exercises the students will e.g. carry out rock property analysis for a given set of samples using the facilities at the faculty.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 30 h, exercises 14 h, homework exercise, self-study 116 h.

**Target group:**

Compulsory for M.Sc. students in geophysics and recommended for those who work with the geological interpretation of geophysical models.

**Prerequisites and co-requisites:**

It is recommended that the course Geophysical research methods of rock and soil (762305A) has been attended.

Courses of basics of geology (mineralogy, petrology) are also essential.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes. Handouts. Schön, J.H. (1998) Physical Properties of Rocks, Volume 18: Fundamentals and principles of petrophysics (Handbook of geophysical exploration: Seismic exploration).

**Assessment methods and criteria:**

Examination (form to be selected during the course) and completion of the report on homework exercise.

**Grading:**

5-1/fail

**Person responsible:**

Toivo Korja

**Working life cooperation:**

No work practice.

**Other information:**



<https://wiki.oulu.fi/display/762607S/>

## H325508: Optional advanced-level courses in Geophysics, 0 - 60 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

### *Electives*

#### **762627S: Time-domain electromagnetic research methods, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

#### **ECTS Credits:**

3 credits

#### **Language of instruction:**

English (or Finnish depending on participants)

#### **Timing:**

4th or 5th study year

#### **Learning outcomes:**

After completion the student identifies the special characteristics of time-domain electromagnetic methods, recognizes the anomalies of various geological targets and knows how to make measurements and interpret data using computer software based on layered earth model.

#### **Contents:**

The course gives detailed information about time-domain electromagnetic (TEM) methods. Unlike in frequency-domain methods, where time-harmonic current are used, an electromagnetic pulse is generated by an abrupt change of direct current in a wire loop in TEM. The course considers the physical background, various measurement systems, response for various earth models, processing and interpretation methods for TEM methods. The course includes computer exercises, field work and data interpretation.

#### **Mode of delivery:**

Face to face

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

30 h lectures and demonstrations, self-study 50 h

#### **Target group:**

Primarily for MSc students of geophysics. Also for the other students of the University of Oulu.

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

No specific prerequisites.

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

No alternative course units or course units that should be completed simultaneously.

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

Lecture notes, selected articles from geophysical journals and Nabighian M.N. & Macnae J.C. (1991) Time domain electromagnetic prospecting methods, In: Nabighian M.N. (ed.) (1993) Electromagnetic methods in applied geophysics, Volume II.

Course material availability can be checked [here](#).

**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 work practise

**Other information:**

<https://wiki oulu.fi/display/762627S/>

**762620S: Computers in geophysics, 3 op**

**Voimassaolo:** 01.08.2009 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

After completion the student can make a computer program that does file I/O and data handling and numerical computations related to geophysics.

**Contents:**

The solution of geophysical problems often requires writing own computer programs. The course applies Fortran programming language to solve some geophysical problems and tasks such as reading from file, formatted writing, numerical computations and data visualization. The course consists of practical computer exercises and compulsory tasks related to them.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h exercises, approved tasks, self-study 50 h

**Target group:**

Primarily for the students of the degree programme in geosciences and physics. Also for the other students of the University of Oulu.

**Prerequisites and co-requisites:**

Prior knowledge on computer programming (e.g. 763114P, 763315A or 763616S).

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Excercise material and Haataja J., Rahola J. & Ruokolainen J. (1998) Fortran 90/95 and Press W.H., Flannery B.P., Teukolsky S.A & Vetterling W.T. (1988) Numerical recipes in Fortran.  
Course material availability can be checked [here](#).

**Assessment methods and criteria:**

Participation and approved project work.

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

**Grading:**

Pass/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No work practise

**Other information:**

<https://wiki oulu.fi/display/762620S/>

**762662S: Special courses in geophysics, 0 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

1-9 credits

**Language of instruction:**

Usually English.

**Contents:**

Credit points according to the course. Lectures given by visiting scientists. Contents and assessment will be negotiated with the professor in advance. These courses are usually held in English and they will cover topical issues of current geophysical research.

**Learning activities and teaching methods:**

According to the course.

**Target group:**

Optional for students of geophysics.

**Recommended or required reading:**

According to the course.

**Assessment methods and criteria:**

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

**Person responsible:**

N.N.

**762606S: GIS and spatial data 2, 3 op**

**Voimassaolo:** 01.08.2009 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish (optionally English)

**Timing:**

3th to 5th study year

**Learning outcomes:**

After this course student 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.

**Contents:**

In this course student familiarizes to GIS-software and the possibilities they offer in presenting and analyzing spatial data in practical exercises.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Exercises and exercises totalling 50 h, self-study 50 h. The course is passed by returning exercise report.

**Target group:**

Students of Oulu Mining School, and the Faculties of Science and Technology.

**Prerequisites and co-requisites:**

Course GIS and spatial data 1 or equivalent knowledge is recommended before participation.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Exercise material.

**Assessment methods and criteria:**

In this course assessment is based on the evaluation of the written reports of exercises. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No work practise.

**Other information:**

<https://wiki oulu.fi/display/762606S/>

**762645S: Field course in bedrock mapping and applied geophysics, 3 op**

**Voimassaolo:** 01.08.2009 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

After completion the student know how to make field measurements related to geological mapping and know better the requirements of data processing, interpretation, and reporting.

**Contents:**

The course introduces the students of geophysics with geological bedrock mapping and gives the students of geology practical information about the methods of applied geophysics. The geophysical methods include magnetic, electrical, electromagnetic profiling. The course starts with four days of field work, after which the student groups process and interpret the collected geological and geophysical data themselves and report their results.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

32 h field work, 20 h processing and interpretation of measured data, approved written report, 28 h self-study.

**Target group:**

Compulsory in MSc studies of geophysics.

**Prerequisites and co-requisites:**

Geophysical research methods of rock and soil (762305A) (earlier 762302A or 762102P).

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Peltoniemi, M. (1988) Maa- ja kallioperän geofysikaaliset tutkimusmenetelmät.

**Assessment methods and criteria:**

Participation and approved written report.

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

**Grading:**

Pass/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No work practise.

**Other information:**

<https://wiki oulu.fi/display/762645S/>

**762624S: Electrical research methods of rock and soil, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

3rd - 5th study year

**Learning outcomes:**

After passing the course the student can explain the theoretical basics and use of electric methods based on the DC theory, can use in practice the measuring instruments of different electric methods and is able to analyse and interpret measured data in near-surface geophysical surveys.

**Contents:**

The course familiarizes students with the electric methods based on direct current theory in surveying the near-surface earth. Electric methods in surveying the earth. Electric properties of rocks and sediments. Electrical resistivity methods. Self-potential method. Charged-body potential (mise-à-la-masse) method. Induced polarization method. Multiple electrode measurements. Electric surveying in boreholes. Interpretation. About software for interpretation. Case studies.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 30 h, an independent exercise (field measurement and its interpretation), self-study 103 h.

**Target group:**

Optional for M.Sc students of geophysics.

**Prerequisites and co-requisites:**

Geophysical research methods of rock and soil (762305A) (earlier 762302A or 762102P).

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes and lecture material. Parts of the following: Telford, W.M., Geldart, T.M. & Sheriff, R.E. (1990) Applied geophysics; Zhdanov, M.S. & Keller, G.V. (1994) The geoelectrical methods in geophysical exploration; Reynolds, J.M. (2011) An introduction to applied and environmental geophysics (2nd ed.); Sharma, P.V. (1997) Environmental and engineering geophysics. Course material availability can be checked [here](#).

**Assessment methods and criteria:**

One written examination and accepted report of an independent exercise. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No work practise.

**Other information:**

<https://wiki.oulu.fi/display/762624S/>

**762628S: Thermal processes of the earth, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish (optionally English)

**Timing:**

4th or 5th year

**Learning outcomes:**

After this course student can define and explain the most important factors affecting heat transport and heat generation below the Earth's surface. Student can define and calculate basic equations describing thermal distribution in the Earth's crust and mantle. He can apply and use analytical solutions of certain thermal processes. He can describe fundamentals of the heat flow determination and the error sources related to them.

He also has knowledge of the global heat flow distribution and he can define and explain different thermal processes occurring in the Earth.

**Contents:**

This course focuses in the fundamentals of the thermal phenomena in the Earth, thermal processes in the crust and the mantle and their consequences. Contents; means of heat transport. Rheology. Sources of heat. Thermal history of the Earth. Heat flow, measuring and error sources.

Analytical solutions of thermal mechanisms. Thermal processes on the continents, the oceans and the lithosphere. Thermal phenomena in the mantle.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures 24 h, exercises 15 h, an independent exercise, self-study 94 h

**Target group:**

Optional for students of Geophysics. Recommend for everyone interested in thermal phenomena in the earth.

**Prerequisites and co-requisites:**

No specific prerequisites

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously

**Recommended or required reading:**

Lecture notes and Jaupart C. & Mareschal J-C., 2011: Heat Generation and Transport in the Earth . Selected parts: Turcotte, D. L. & Schubert, G., 2002 (2nd Ed.): Geodynamics; Turcotte, D. L. & Olson, P., 2001. Mantle Convection in the Earth and Planets; Ranalli, G., 1995: Rheology of the Earth; Cermak, V. & Rybach, L., (eds.), Terrestrial heat flow and the lithosphere structure.

**Assessment methods and criteria:**

One written examination and accepted report of an independent exercise  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Numerical grading scale 0 – 5, where 0 = fail

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No work placement period

**Other information:**

<https://wiki oulu.fi/display/762628S/>

**762616S: Ground Penetrating Radar Sounding, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

After completion the student identifies the special characteristics of GPR soundings and can process and interpret GPR data using modern computer software.

**Contents:**

Ground penetrating radar (GPR) is a high frequency (20-2000 MHz) electromagnetic research instrument that is widely used in surficial and environmental geology and geotechnical and geophysical investigations. The course provides students with the basic knowledge and skills on GPR as a geophysical investigation method. The course deals with theoretical background, practical measurement arrangements, data processing, presentation and analysis. The course includes exercises, where basic mathematics and data processing are introduced, and a compulsory practical work, where the students process and interpret GPR data from their own measurements.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 20 h and 20 h demonstrations and practical work, self-study 93 h.

**Target group:**

MSc students of geophysics, students of surficial and environmental geology, and students of water resources and environmental engineering. Also for the other students of the University of Oulu.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes, selected articles from geophysical journals and Jol, H.M (Ed.) (2009) Ground penetrating radar theory and applications.

**Assessment methods and criteria:**

Examination and approved report.

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

**Grading:**

5-1/fail

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No work practise.

**Other information:**

<https://wiki oulu.fi/display/762616S/>

**762625S: Magnetotellurics, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Korja, Toivo Johannes

**Opintokohteen kielet:** Finnish



**ECTS Credits:**

5 credits

**Language of instruction:**

English (or Finnish depending on participants and lecturer).

**Timing:**

4th or 5th study years

**Learning outcomes:**

Upon the completion of the course, a student

- can explain the bases of magnetotelluric methods
- is able to plan and carry out magnetotelluric survey
- is able to use numerical tools for the time series processing and the analysis of the magnetotelluric impedance tensor, modelling and inversion
- can use geophysical, petrophysical and geological data in the tectono-geological interpretation of the conductivity models
- can describe the major targets of the applications of the magnetotelluric method and list the major research groups

**Contents:**

The magnetotelluric method is one of a few geophysical methods suited to investigate crustal and upper mantle structure. Recently, due to methodological and instrumental improvements, the magnetotelluric method is coming common in the studies of near-surface targets. In these cases, the method is usually called a radiomagnetotelluric or audiomagnetotelluric method.

The Course deals with the theoretical background of magnetotelluric method. Survey design. Instruments. Time series processing. Impedance tensor and its internal properties. Distortions. Inversion in 1D-, 2D- and 3D-environment. Electrical anisotropy. Visualisation of data and results. Conductivity mechanisms. Interpretation of conductivity models. Examples

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures and computer exercises 40 h, homework exercise coevally with lectures; includes field measurements, self-study 93 h.

**Target group:**

Recommended for the students interested in lithospheric research as well as applied work. Also for the other students of the University of Oulu.

**Prerequisites and co-requisites:**

It is recommended that the lectures of the courses "Theory of electromagnetic methods" (762611S) and "Modelling of electromagnetic fields" (762630S) have been attended.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Handouts. Simpson, F. & Bahr, K. (2005) Practical magnetotellurics; Vozoff, K. (ed.) (1986) Magnetotelluric methods.

Course material availability can be checked [here](#).

**Assessment methods and criteria:**

Examination (form to be selected during the course) and the completion of the report on homework exercise.

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

**Grading:**

5-1/fail

**Person responsible:**

Toivo Korja

**Working life cooperation:**

No work practise.

**Other information:**

<https://wiki oulu.fi/display/762625S/>

**762636S: Shallow seismic soundings, 6 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish (optionally English)

**Timing:**

4th or 5th study year

**Learning outcomes:**

After this course student knows how to apply and use seismic methods to investigate soil and bedrock structure. Student can explain theoretical background, limitations and error sources of the seismic methods. Student knows how use seismic equipment in the field, measure seismic data, interpretate and analyze measured data and he can also create a summary of the measurement.

**Contents:**

This course gives basic knowledge required for seismic refraction-, reflection soundings and surface wave studies and their interpretation. Contents of the course; Physical principles and theory of the seismic soundings, interpretation, seismic tomography, mining seismology and seismic monitoring, processing and measurement in practice. Case histories. Independent work includes refraction or reflection seismic sounding in the field.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 30 h, exercises 15 h, an independent exercise, self-study 115 h.

**Target group:**

Optional for students of Geophysics. Recommend for everyone interested in shallow seismic soundings especially for groundwater investigations.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes. Selected parts: Burger, H.R. (2006) Introduction to Applied Geophysics: Exploring the Shallow Subsurface; Sjögren, B. (1984) Shallow refraction seismics; Palmer, D. (1986) Refraction seismics; Al-Sadi, H.N. (1982) Seismic exploration.

**Assessment methods and criteria:**

One written examination and accepted report of an independent exercise. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No work practise.

**Other information:**

<https://wiki oulu.fi/display/762636S/>

**762661S: An advanced level course from another Finnish university, 0 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

Variable credits

**Contents:**

Courses taken at other Finnish universities.

**Assessment methods and criteria:**

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

**Person responsible:**

N.N.

**762663S: An advanced level course from another university abroad, 0 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

Variable credits, depending of the course.

**Contents:**

Courses taken in international exchange programs (Erasmus, Nordplus, etc.) for example in universities abroad.

**Assessment methods and criteria:**

Depend of the course.

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

**Person responsible:**

Professors and lecturers.

**762684S: Excursion, 2 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Korja, Toivo Johannes

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Language of instruction:**

Finnish

**Timing:**

2th to 5th year. Arranged on demand.

**Learning outcomes:**

After the excursion, a student can list some of the employers in the field of geosciences and the work done there. After the excursion, the student can list the role of geophysicist in companies and other organizations and analyze the skills and knowledge needed to successfully complete the work of a geophysicist. After the excursion, the student can create a generalized profile of a geophysicist working in a company or in other organization.

**Contents:**

The students at their final stage of studies make a guided excursion and visit companies and research institutions applying geophysical techniques.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Two to three days long excursion arranged by teachers. After the excursion participants write a common report or prepare a poster.  
Participation in the excursion and completion of the report.

**Target group:**

M.Sc. students in geophysics.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

The list of stops is delivered to students prior to excursion. Based on the list, students collect information on the stops in advance as well as collect the material delivered in stops.

**Assessment methods and criteria:**

Participation in the excursion and the completion of a written report/poster prepared together by all participants.

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

**Grading:**

Pass/fail

**Person responsible:**

Toivo Korja

**Working life cooperation:**

No work practise.

**Other information:**

Travel costs and major part of accommodation costs are covered by the section of geophysics. Participants cover other costs (e.g. meals).

<https://wiki oulu.fi/display/762684S/>

**772684S: GIS applications, 5 op**

**Voimassaolo:** 01.08.2012 -

**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:**

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

**Learning outcomes:**

After the course, students can utilise the possibilities of the geographic information system in geological research and specific methods of spatial data analyses.

**Contents:**

Spatial data analyses as a component of the geographical information system (GIS).

**Mode of delivery:**

Face to face teaching and exercises.

**Learning activities and teaching methods:**

8 h lectures and demonstrations and 32 h exercises.

**Target group:**

Master's student in geology and mineralogy.

**Prerequisites and co-requisites:**

Studies equivalent to Bachelor's degree, Basics of GIS.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Will be informed separately.

**Assessment methods and criteria:**

Computer test

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

**Grading:**

Pass/fail

**Person responsible:**

Elena Kozlovskaya

**Working life cooperation:**

No

**Other information:**

-

**762612S: Gravimetric and magnetic methods, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Elena Kozlovskaya

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish or English

**Timing:**

4th or 5th study year

**Learning outcomes:**

After completion the student identifies the special characteristics of geophysical gravimetric and magnetic methods, recognizes anomalies of various sources, and knows how to apply data processing and interpretation methods to example data.

**Contents:**

Because the variations of density and magnetization create changes in Earth's gravity and magnetic field, the measurements of these fields can be used in geological bedrock mapping and mineral exploration. The course provides knowledge about the geophysical gravity and magnetic field measurements including physical and theoretical background, practical measurement arrangement, data processing and principles of interpretation. Modelling and interpretation software are used in computer exercises to study the generation of gravity and magnetic anomalies of various kinds.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 20 h and 20 h demonstrations and practical work, self-study 93 h.

**Target group:**

MSc students of geophysics. Also for the other students of the University of Oulu.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes, selected articles from geophysical journals and Blakely, R.J. (1995) Potential theory on gravity and magnetic applications.

**Assessment methods and criteria:**

Examination and approved report.

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

**Grading:**

5-1/fail

**Person responsible:**

Elena Kozlovskaya

**Working life cooperation:**

No work practise.

**762630S: Modelling of electromagnetic fields, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

After passing the course the student can justify and explain how to find out theoretical electromagnetic responses of the earth model either by electromagnetic scale modelling or by analytical solution or by numerical modelling. The student can use different numerical methods and is able to apply them in solving electromagnetic field equations.

**Contents:**

To familiarize students with methods in getting the theoretical anomalies for one- or multidimensional earth structures. Electromagnetic fields: field equations, boundary conditions. Layered model. Multidimensional model: physical modelling, integral equation method, transmission surface analogy, finite-difference method, finite-element method. Thin sheet approximation. Solving the set of linear equations. On the errors.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 30 h, demonstrations 10 h, an independent work, self-study 93 h

**Target group:**

Optional for students of geophysics in the M.Sc. degree.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes and lecture material. Selected papers. Parts of the following: Nabighian, M. N. (ed.) (1988) Electromagnetic methods in applied geophysics, Volume 1, Theory, p. 313-363 ja 365-441. Course material availability can be checked [here](#).

**Assessment methods and criteria:**

A final examination and an independent exercise work.  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No work practise

**Other information:**

<https://wiki oulu.fi/display/762630S/>

**762611S: Theory of electromagnetic methods, 5 op**

**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 (or Finnish depending on participants and lecturer)

**Timing:**

4th or 5th study year

**Learning outcomes:**

After completion the student knows how to link electromagnetic theory with its many applications, identifies the basic characteristics of the most common geophysical electromagnetic methods and the anomalies of various geological targets and knows how to interpret data visually and computationally.

**Contents:**

Electromagnetic (EM) measurements are used to provide information about the subsurface variations of electrical conductivity that can be used in geological mapping of soil and bedrock, environmental studies and mineral exploration. The course provides knowledge on the theory and applications of the geophysical EM methods including electromagnetic induction, quasi-static approximation, attenuation of the fields, time and frequency domain measurements, electric and magnetic dipole source in free-space, conductive whole space, above layered earth, and near two- and three-dimensional targets. In addition the various electromagnetic systems for near-surface investigations, their responses and anomalies and the effect of conductive host medium and overburden layer and data interpretation are studied. Modelling and interpretation software are used in computer exercises to emphasize the lectures.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 20 h, demonstrations 20 h and practical work, self-study 93 h

**Target group:**

MSc students of geophysics. Also for the other students of the University of Oulu.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes and Ward, S.H. & Hohmann, G.W. (1988) Electromagnetic theory for geophysical applications; Frischknecht, F.C., Labson, V.F., Spies, B.R. & Anderson, W.L. (1991) Profiling methods using small sources; Spies, B.R. & Frischknecht, F.C. (1991) Electromagnetic sounding, In: Nabighian, M. N. (ed.) (1988 & 1991) Electromagnetic methods in applied geophysics. Volumes 1 and 2. Course material availability can be checked [here](#).

**Assessment methods and criteria:**

Examination and approved report.

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

**Grading:**

5-1/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No work practise.

**Other information:**

<https://wiki oulu.fi/display/762611S/>

**762617S: VLF-method, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits



**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

After passing the course the student can explain thoroughly the theoretical basics of the VLF-method, its operation and measuring practice and is able to analyse and interpret VLF data in near-surface geophysical research.

**Contents:**

Deep orientation on VLF method, which is one of the most popular electromagnetic methods used to investigate the near-surface earth. Source field: transmitter stations and aerials, distant transmitters, local transmitters, propagation, polarization, attenuation. Tilt-angle measurements (VLF): tilt-angle, ellipticity, measuring principle. Resistivity measurements (VLF-R): apparent resistivity, phase, measuring principle. Basic anomalies: homogeneous earth, two-layered earth, plate conductor, prismatic body. Special anomalies. Interpretation: general remarks, qualitative interpretation, visual interpretation, filtering, quantitative interpretation, nomograms, numerical modelling, inversion, effects of different model parameters. Examples of VLF-measurements.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 35 h, an independent work (field measurement and its interpretation), self-study 98 h.

**Target group:**

Optional for students of geophysics in the M.Sc. degree.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes and lecture material. Selected papers. Parts of the following: Nabighian, M. N. (ed.) (1991) Electromagnetic methods in applied geophysics, Volume 2, Part B, s. 521-640.

**Assessment methods and criteria:**

One written examination and accepted report of an independent exercise.  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No work practise.

**Other information:**

<https://wiki oulu.fi/display/762617S/>

**762646S: Field course in environmental geology and applied geophysics, 3 op****Voimassaolo:** 01.08.2009 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

After completion the student know how to make field measurements related to environmental research and know better the requirements of data processing, interpretation and reporting.

**Contents:**

The course introduces the students of geophysics with various geological problems and gives the students of geology practical information about the methods of applied geophysics. The geological problems include peat bog, esker, hummocky moraine, clay layers and thick overburden. The geophysical methods include ground penetrating radar method and seismic, electrical and electromagnetic soundings. The course starts with four days of field work, after which the student groups process and interpret the collected geological and geophysical data themselves and report their results.

**Mode of delivery:**

Face to face teaching. The course is arranged every two or three years.

**Learning activities and teaching methods:**

32 h field work, 20 h processing and interpretation of measured data, approved written report, self-study 28 h.

**Target group:**

Compulsory in MSc studies of geophysics.

**Prerequisites and co-requisites:**

Prior completion of course 762305A (earlier 762302A) Geophysical research methods of rock and soil.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Peltoniemi, M. (1988) Maa- ja kallioperän geofysikaaliset tutkimusmenetelmät.

**Assessment methods and criteria:**

Participation and approved written report.

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

**Grading:**

Pass/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No

**902002Y: English 1 (Reading for Academic Purposes), 2 op**

**Voimassaolo:** 01.08.1995 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Negotiated Education

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

**Opintokohteen kielet:** English

**Proficiency level:**

B2/C1 on the [Common European Framework of Reference](#) scale.

**Status:**

This course is mandatory for students of the following degree programmes:

**Faculty of Science**

- Biology
- Chemistry
- Mathematical Sciences
- Physics

**Oulu Mining School**

- Geosciences degree programme

**Faculty of Information Technology and Electrical Engineering**

- Department of Information Processing Science

Students in the Department of Geography take English 3.

Engineering students in the following programmes take their English courses in the Faculty of Technology:

Oulu Mining School:

- Mining Technology and Mineral Processing degree programme

Faculty of Information Technology and Electrical Engineering

- Department of Electrical Engineering
- Department of Communications Engineering
- Department of Computer Science and Engineering

Please consult the Faculty Study Guide to establish the language requirements for your own degree program.

**Required proficiency level:**

English must have been the A1 or A2 language at school or equivalent English skills should have been acquired otherwise.

**ECTS Credits:**

2 ECTS credits (total work load 54 hours including classroom meetings.)

**Language of instruction:**

English

**Timing:**

Biology: 1st year spring term

Chemistry: 1st year autumn term

Geology: 1st year spring term

Information Processing Science: 1st year spring term

Mathematical Sciences (pedagogy): 1st year spring term

Mathematical Sciences: 2nd year autumn term

Physical Sciences: 1st year autumn term

**Learning outcomes:**

By the end of the course, you are expected to be able to

- have acquired effective vocabulary learning techniques
- be able to distinguish parts of words to infer meanings
- utilize your knowledge of text structure and cohesion markers to understand academic texts
- extract information and learn content from English readings in scientific and professional contexts

**Contents:**

The course will focus on reading strategies; these include recognizing how texts are organized, identifying key points in a text, and understanding words in context. Vocabulary work in the course will focus on a) academic vocabulary, as used in formal scientific writing, and b) using your knowledge of the meanings of parts of words (affixes) to infer meaning.

**Mode of delivery:**

Contact teaching

**Learning activities and teaching methods:**

The scope of the course is 2 op (54 hours student workload).

**Target group:**

1st year students of Biology, Chemistry, Geology, Information Processing Science, Physics, and Mathematics (pedagogy); 2nd year students of Mathematics

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

Students are also required to take 902004Y Scientific Communication, which is taken AFTER completion of this course.

**Recommended or required reading:**

Photocopies will be provided by the teacher and/or required texts will be accessible online or from the university library.

**Assessment methods and criteria:**

Student work is monitored by continuous assessment. You are required to participate regularly and actively in all contact teaching provided, and successfully complete all required coursework. There will be three monthly tests on material covered so far.

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

**Grading:**

Pass/Fail

**Person responsible:**

Karen Niskanen and Patrick Nesbitt

**Working life cooperation:**

-

**Other information:**

N.B. Students with grades *laudatur* or *eximia* in their A1 English school-leaving examination can be exempted from this course and will be granted the credits by the Faculty of Science.

**902004Y: English 2 (Scientific Communication), 2 op**

**Voimassaolo:** 01.08.1995 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Negotiated Education

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

**Opintokohteen kielet:** English

**Leikkaavuudet:**

ay902004Y English 2 (Scientific Communication) (OPEN UNI) 2.0 op

**Proficiency level:**

B2/C1 on the CEFR scales

**Status:**

This course is mandatory for all 2nd year students (except **geographers**) who will have English as their foreign language in their B.Sc. degree. This includes the students who were exempted from 'Reading for Academic Purposes'(902002Y). Please consult the faculty study guide to establish the language requirements on your own degree programme.

**Required proficiency level:**

Students taking this course must have had English as the A1 or A2 language at school or the equivalent English skills should have been acquired otherwise. The course 'Reading for Academic Purposes' (902002Y) is a pre-requisite, unless exempted.

**ECTS Credits:**

**The student workload is** 53 hrs work/ 2 ECTS credits.

**Language of instruction:**

English

**Timing:**

Biology: 2nd year autumn term

Chemistry: 2nd year spring term

Geology: 2nd year spring term

Information Processing Science : 2nd year autumn term

Mathematics: 2nd year spring term

Physics: 2nd year autumn term

**Learning outcomes:**

By the end of the course, you are expected:

1. to have demonstrated your use of appropriate strategies and techniques for communicating effectively in English in an academic context.
2. to have demonstrated the ability to prepare and present scientific subjects to your classmates, using appropriate field-related vocabulary.

**Contents:**

Skills in listening, speaking, and presenting academic topics are practised in the classroom, where there is an emphasis on working in pairs and small groups. Homework tasks include online lecture listening and reading, preparation for classroom discussions and written work to support the classroom learning.

**Mode of delivery:**

Contact teaching

**Learning activities and teaching methods:**

Contact teaching 28 hours, homework 28 hours

**Target group:**

2nd year students of Biology, Chemistry, Geology, Information Processing Science, Mathematics, Physics

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

Also required: [902002Y Reading for Academic Purposes Englannin kieli 1](#)

**Recommended or required reading:**

Course materials will be provided by the teacher.

**Assessment methods and criteria:**

Continuous assessment is based on regular attendance, active participation in all lessons and the successful completion of all homework tasks.

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

**Grading:**

Pass / fail.

**Person responsible:**

Karen Niskanen and Patrick Nesbitt

**Working life cooperation:**

-

**Other information:**

-

## 030005P: Information Skills, 1 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Faculty of Technology

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

**Opettajat:** Ursula Heinikoski, Sassali, Jani Henrik

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

030004P Introduction to Information Retrieval 0.0 op

**ECTS Credits:**

1 ECTS credit

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd year

**Learning outcomes:**

Students know the different phases of information retrieval process and basic techniques of scientific information retrieval. They will find the most important reference databases of their discipline and know how to evaluate information sources and retrieval results.

**Contents:**

Retrieval of scientific information, the retrieval process, key databases of the discipline, and evaluation of information retrieval and information sources.

**Mode of delivery:**

Blended teaching: classroom training, web-based learning material and exercises in Optima environment, a final assignment on a topic of the student's own choice

**Learning activities and teaching methods:**

Training sessions 8h, group working 7h, self-study 12h

**Target group:**

Compulsory for all students of the Faculty of Technology, the Faculty of Information Technology and Electrical Engineering and the Faculty of Architecture. In the Faculty of Science compulsory for students of biology, physics, geosciences, chemistry and geography. Optional for students of biochemistry and mathematics.

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Web learning material <https://wiki oulu.fi/display/030005P>.

**Assessment methods and criteria:**

Passing the course requires participation in the training sessions and successful completion of the course assignments.

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

**Grading:**

pass/fail

**Person responsible:**

Science and Technology Library Tellus, tellustieto (at) oulu.fi

**Working life cooperation:**

-

**Other information:**

-

**770001Y: Orientation course for new students, 1 op**

**Opiskelumuoto:** General Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1 credit

**Language of instruction:**

Finnish

**Timing:**

1st year autumn

**Learning outcomes:**

Students are familiar with the university environment and practical issues of their studies and are able find appropriate of advice if needed.

**Contents:**

Students are tutored to the study system of the university and given information on the contents and goals of the study programme of the Geosciences.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

15 to 18 h of tutoring

**Target group:**

1st year students

**Assessment methods and criteria:**

Participation in team tutoring.

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

**Grading:**

Pass/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No.

**901055Y: Second Official Language (Swedish), Oral Skills (OMS), 1 op**

**Voimassaolo:** 01.08.2014 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Negotiated Education

**Opintokohteen kielet:** Swedish

**901054Y: Second Official Language (Swedish), Written Skills (OMS), 1 op****Voimassaolo:** 01.08.2014 -**Opiskelumuoto:** Language and Communication Studies**Laji:** Course**Vastuuyksikkö:** Negotiated Education**Opintokohteen kielet:** Swedish**771102P: Basic course in mineralogy, 6 op****Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Pekka Tuisku**Opintokohteen kielet:** Finnish**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

1st year autumn

**Learning outcomes:**

Students obtain a basic knowledge on mineralogy.

**Contents:**

Crystal, crystal systems, mineral, rocks. Formation of minerals in geological processes, chemical and physical properties of minerals, occurrence and utilization.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

20 h lectures, 16 h exercises. Exercises are compulsory.

**Target group:**

1st year geosciences students.

**Prerequisites and co-requisites:**

No

**Recommended optional programme components:**

-

**Recommended or required reading:**Risto Piispanen ja Pekka Tuisku (2005) Mineralogian perusteet. <http://cc.oulu.fi/~petuisku/Mineralogia/MinPer.htm>**Assessment methods and criteria:**

Examination, compulsory exercises

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

1-5/fail

**Person responsible:**

Pekka Tuisku, Jukka Pekka Ranta

**Working life cooperation:**

No

**Other information:**

-

**762108P: GIS and spatial data 1, 5 op****Voimassaolo:** 01.08.2015 -**Opiskelumuoto:** Basic Studies**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2<sup>nd</sup> or 3<sup>rd</sup> autumn (continues to spring semester)

**Learning outcomes:**

After completion the student collects the basics of spatial data and geographical information systems (GIS) including especially the most important coordinate systems, map projections, Finnish map coordinates and satellite positioning, and knows how to visualise spatial data in various different ways.

**Contents:**

Geoscientific observations and measurements are always tied to spatial location of the data. The course provides basic information about the presentation and handling of spatially dependent geoscientific data and geographic information systems (GIS). The course considers the basics of spatial data, coordinate systems, map projections and map coordinates, satellite positioning, processing and visualisation of spatial data. Computer exercises demonstrate preparation and visualisation of geoscientific data in practice.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures and exercises totalling 40 h plus independent study.

**Target group:**

Students of Oulu Mining School, and the Faculties of Science and Technology. Obligatory to geosciences students in B.Sc. degree.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes and Löytönen, M., Toivonen, T. & Kankaanrinta, I., (Eds.) 2003: Globus GIS.

**Assessment methods and criteria:**

Examination and computer test.

**Grading:**

5-1/fail

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No work practise.

**Other information:**

<https://noppa oulu.fi/noppa/kurssi/762108P/etusivu>

## 771113P: Introduction to Geology I, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay771113P Introduction to Geology I (OPEN UNI) 5.0 op

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish



**Timing:**

1st year autumn

**Learning outcomes:**

Students have an understanding of the basic concepts of the Earth, from its composition and internal *structure* to the geological *processes* that has led to its evolution the present Earth as part of the solar system. They can tell how endogenic processes in the mantle and crust produce magmas and how magmas produce different igneous rock type upon emplacement below and on the Earth's surface. Students are able to recognise and classify common igneous rocks based on their mineral composition and are familiar with common metamorphic rocks and know the metamorphic facies concepts. They can relate deformation and metamorphism of the rocks to plate tectonic processes.

**Contents:**

Evolution of the Earth as part of the solar system, structure and composition of the Earth. Classification of igneous rocks, magmatism, origin and crystallisation of magmas, volcanism, metamorphism and formation of metamorphic rocks, plate tectonics and deformation structures.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

36 h lectures, 6 h exercises

**Target group:**

1st year geoscience students. The course is a good minor subject course for others.

**Prerequisites and co-requisites:**

Basic course in mineralogy (771102P) is parallel to this course.

**Recommended optional programme components:**

This course is intended as an introduction to the scope and methods of igneous and metamorphic petrology.

**Recommended or required reading:**

Martti Lehtinen, Pekka Nurminen and Tapani Rämö (1998) Suomen kallioperä – 3000 vuosimiljoonaa. Suomen Geologinen Seura, Gummerus Jyväskylä, ISBN 952-90-9260-1, Chapters 2-3. John Grotzinger & Thomas H. Jordan (2010 or 2014) Understanding Earth, 6<sup>th</sup> or 7<sup>th</sup> edition, Chapters 1-4, 6-7, 9-10, 12.

**Assessment methods and criteria:**

Written examination and identification test of rock types.

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

*Compulsory*

**771113P-02: Introduction to Geology I, Rock identification, 0 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

**771113P-01: Introduction to Geology I, lectures, 0 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish  
**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

## **771114P: Introduction to Geology II, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

1st year autumn

**Learning outcomes:**

Upon completion of the course, students should have acquired basic knowledge on the concepts and processes of surficial geology. Students should also be able to identify basic sediment types and soils.

**Contents:**

Basic concepts of surficial physical geology, weathering, erosion, sedimentation, and sediment types, soils and geological processes forming sedimentary deposits.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

16 h lectures, 8 h exercises

**Target group:**

1st year Geoscience students. The course is a good minor subject course for others.

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Handouts and John Grotzinger & Thomas H. Jordan (2010 or 2014) Understanding Earth, 6<sup>th</sup> or 7<sup>th</sup> edition, Chapters 5, 8, 15-21.

**Assessment methods and criteria:**

Obligatory exercises and written examination.

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka and Tiina Eskola

**Working life cooperation:**

No

## **771116P: Introduction to Quaternary deposits of Finland and their resources, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

1st year spring

**Learning outcomes:**

Students can describe the main features and raw material resources of the Finnish Quaternary deposits.

**Contents:**

Main features and raw material resources of the Finnish Quaternary deposits and their origin.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

22 h lectures. In addition, a one-day field trip is organized in May for major subject students.

**Target group:**

1st year geoscience students.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P) or equivalent knowledge.

**Recommended or required reading:**

Veli-Pekka Salonen, Matti Eronen, Matti Saarnisto (2002) Käytännön maaperägeologia, 236 p.

**Assessment methods and criteria:**

Written examination.

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**771115P: Introduction to bedrock geology of Finland and ore geology, 5 op****Voimassaolo:** 01.08.2015 -**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

1st year spring

**Learning outcomes:**

Students can describe and recognise the main geological units of the Finnish bedrock and name them based on their stratigraphic position and age relations. They can connect the major geological units to the main stages of the plate tectonic evolution. Students are familiar with most common ore types and industrial minerals occurring in the bedrock and the principal processes leading to their formation and how they are explored.

**Contents:**

Lithostratigraphical units, the Archaean and Palaeoproterozoic bedrock of Finland and younger rock formations. Mineral resources, their classification and origin, exploration methods.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

24 h lectures. In addition, a one-day field trip is organized in May for major subject students.

**Target group:**

Major and minor subject students starting studies in geology.

**Prerequisites and co-requisites:**

Basic course in mineralogy (771102P), Introduction to Geology I (771113P), Introduction to Geology II (771114P) or equivalent knowledge.

**Recommended or required reading:**

Material given during the lectures and Lehtinen, M., Nurmi, P., Rämö, T. (1998) Suomen kallioperä – 3000 vuosimiljoonaa. Suomen Geologinen Seura, Gummerus Jyväskylä, ISBN 952-90-9260-1, p. 94-324 (available on webpages of Suomen Geologisen Seura). Parts of Craig, J.R., Vaughan, D.J. & Skinner, B.J. (1996) Resources of the Earth - Origin, Use, and Environmental Impact. Prentice Hall, 472 p.

**Assessment methods and criteria:**

Written examination.

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

**762104P: Introduction to solid earth geophysics, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Elena Kozlovskaya

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

1st year autumn, every year.

**Learning outcomes:**

Upon the completion of the course, a student

- can describe the position and role of geophysics in the field of the Earth system sciences
- can list major unsolved global research problems in the Earth system sciences
- can describe the structure of the Earth and its neighbouring environment in space (spheres), their internal geophysical properties and the interactions between different spheres
- can describe large scale transfer (movement) of rock material inside the Earth and on its surface (convection, plate tectonics)
- can name major geophysical research methods.

**Contents:**

An overview of geophysics: physics of geosphere, hydrosphere, atmosphere and magnetosphere. Solid Earth geophysics and Earth Sciences. Properties, structure and dynamics of the Earth. Geophysical methods used to explore the interior of the Earth. Earth as a planet: shape, size, rotation, revolution. Gravity: Earth's gravity field, geoid, gravimetry, isostasy, tides. Deformation and rheology. Seismology: seismic waves and the internal structure of the Earth. Seismics: refraction and reflection profiling. Earth as a magnet: geomagnetic field, spatial and temporal variations, Earth-Sun interaction, space weather, palaeomagnetism. Thermal, electrical and radioactive properties of the Earth. Dynamic Earth: plate tectonics, internal dynamics.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures, 10 h exercises, 93 h independent study.

**Target group:**

Course is compulsory for geoscience students (geophysics, geology). Also for the other students of the University of Oulu.

**Prerequisites and co-requisites:**

No specific prerequisites. The course substitutes previous courses 762103P Introduction to Geophysics (2 cr) and 762192P Solid Earth Geophysics (3 cr).

**Recommended optional programme components:**

Parallel courses Introduction to geology I (771113P), Introduction to geology II (771114P).

**Recommended or required reading:**

Material given during the lectures and U., Borén, E., Hjelt, S.-E., Karjalainen, T. and Sirviö, J. (2004) Geofysiikka, Tunne maapallo. WSOY, 191 p. Additional recommended reading: Musset, A.E. and Aftab Khan, M. (2000) Looking into the Earth: An Introduction to Geological Geophysics. Cambridge University Press, 470 p. and Lowrie, W. (1997) Fundamentals of Geophysics. Cambridge University Press, 354 p.

**Assessment methods and criteria:**

Examination.

B.Sc. students in physics can complete the course 762103P Johdatus geofysiikkaan/Introduction to Geophysics (2 cr) in their curriculum by this course without exercises.

**Grading:**

5-1/fail

**Person responsible:**

Toivo Korja

**Working life cooperation:**

No

**Other information:**

<https://wiki.oulu.fi/display/762104P/>

*Compulsory*

**762104P-01: Introduction to solid earth geophysics (part 1): Introduction to geophysics, 0 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

762103P Introduction to geophysics 2.0 op

Ei opintojaksokuvauksia.

**762104P-02: Introduction to solid earth geophysics (part 2): Solid Earth geophysics, 0 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

**774301A: A Basic Course in Geochemistry, 6 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

1st spring

**Learning outcomes:**

Upon completion of this course, students will have a broad overview of the different fields of geochemistry and be able to relate the behavior of elements to different physico-chemical processes in nature. They will be able to convert geochemical data from one form to another (wt%, molar and cation proportions, milliequivalents), plot these data on different diagrams, and carry out simple mineral dissolution/precipitation and mass balance calculations.

**Contents:**

Geochemistry as a field of science; history of geochemistry; tasks and fields of geochemistry; origin and electron configuration of chemical elements; origins and structure of the Earth; meteorites; the geochemical classification of the elements; composition of earth's different spheres; geochemical differentiation; composition of magmas; dissolution and precipitation of minerals; pH-Eh-diagrams; introduction to isotope geochemistry.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

32 h lectures, 12 h exercises

**Target group:**

All students conducting basic courses in geosciences.

**Prerequisites and co-requisites:**

A basic course in chemistry.

**Recommended optional programme components:**

It is recommended that a basic course in chemistry (e.g. 780117P) has been taken during the previous fall semester.

**Recommended or required reading:**

Gill, Robin, Chemical Fundamentals of Geology, Chapman & Hall, London, 1996, 298 p. And Mason, B. & Moore, C. B.: Principles of Geochemistry, 4th Student Edition, J. Wiley, New York, 1982, p. 187-209.

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

**Assessment methods and criteria:**

Examination in both theory and calculations.

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

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

**771303A: Bachelor of Science thesis, 9 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

9 credits

**Language of instruction:**

Finnish/English

**Timing:**

3rd year

**Learning outcomes:**

Depending on the assignment, students will be able to conduct research work including hypothesis formulation, sampling and interpretation of data, and writing a report, or alternatively, they will be able to make a literature search of a given research topic and write a synthesis of previously published relevant studies.

**Contents:**

Individual research of literature, field work or laboratory work. Before starting the thesis, students must agree upon the details of the thesis with their professor or lecturer.

**Mode of delivery:**

Independent work and personal supervision.

**Learning activities and teaching methods:**

Literature study or small research project.

**Target group:**

All Bachelor level students.

**Prerequisites and co-requisites:**

Around two years of geosciences studies.

**Recommended or required reading:**

Selected separately for each student.

**Assessment methods and criteria:**

A 20-30 page thesis.

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

**Grading:**

Pass/fail

**Person responsible:**

Professors, lecturers

**Working life cooperation:**

Usually no.

**Other information:**

Before starting the thesis, students must agree upon the details of the thesis with their professor.

**773344A: Basics of glacial geology, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon completion of the course, students should have acquired basic knowledge of glaciogenic sediment types and of morphological landforms and can present theories of how glaciers are formed.

**Contents:**

A review to history of glacial research and its methods; theories of how glaciers are generated and factors that affect them; present-day glaciers and their research; how snow turns into ice; movement of ice; structures of glaciers; glacier types; facts and theories about the geological activities in glaciers and how glacial sediments, landforms and erosional features are formed; glaciofluvial, glaciolacustrine and glaciomarine sedimentation, glacial deposits in pre-pleistocene formations, causes of ice ages.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

26 h lectures

**Target group:**

2nd and 3rd year geoscience students.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P) or equivalent knowledge, Introduction to Quaternary deposits of Finland and their resources (771116P).

**Recommended or required reading:**

Bennet, M.R. & Glasser, N.F. (1996) Glacial Geology, Ice sheet and Landforms. Wiley. 364 p.

**Assessment methods and criteria:**

Written examination

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773346A: Environmental geology, 5 op****Voimassaolo:** 01.08.2015 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Juha Pekka Lunkka**Opintokohteen kielet:** Finnish**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon completion of the course, students should have acquired basic knowledge of concepts of environmental geology.

**Contents:**

Basic concepts of environmental geology, geological processes, landforms and risks related to geological processes, geological resources, and environmental geological aspects in planning the land use, environmental geochemistry.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

24 h lectures

**Target group:**

2nd and 3rd year geoscience students.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P) or equivalent knowledge.

**Recommended or required reading:**

Heikki Niini, Raimo Uusinoka, Risto Niinimäki (2007) *Geologia ympäristötoiminnassa*. Rakennusgeologinen yhdistys – Byggnadsgeologiska föreningen r.y., 354 p., Murck, B.W., Skinner, B.J. & Porter, S.C. (1996) *Environmental Geology*, John Wiley & Sons, 535 p.

**Assessment methods and criteria:**

Written examination

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**762305A: Geophysical research methods of rock and soil, 6 op****Voimassaolo:** 01.08.2015 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

2nd spring



**Learning outcomes:**

After passing the course the student can explain on which the use of geophysical methods in studying rock and soil is based. The student can describe theoretical basics and the measuring techniques of the methods and is able to apply the methods in various important economical and civil tasks.

**Contents:**

The aim of the course is to learn the principles of applying different geophysical methods for various economical and civil tasks. Geophysical subjects in sediments and bedrock and basics for their exploration. Basics of petrophysical properties. Gravity methods, magnetic methods, resistivity methods, IP method, electromagnetic methods, radiometric methods and seismic methods: the physical principles, devices and the most important ways of using them in practice. Aero-geophysical methods. Borehole measurements. Geothermal research.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 40 h, practical exercises 20 h, field exercises 20 h plus independent study.

**Target group:**

Students of Oulu Mining School, and the Faculties of Science and Technology. Obligatory to geosciences students in B.Sc. degree.

**Prerequisites and co-requisites:**

No particular pre-requisites.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Material given during lectures and Peltoniemi, M. (1988) Maa- ja kallioperän geofysikaaliset tutkimusmenetelmät and applicable parts of the following textbooks: Milsom, J. (1989) Field Geophysics; Telford, W.M., Geldart, T.M. & Sheriff, R.E. (1990) Applied Geophysics; Kearey, P., Brooks, M. & Hill, I. (2002) An Introduction to Geophysical Exploration (3<sup>rd</sup> edition); Parasnis, D.S. (1997) Principles of Applied Geophysics (5<sup>th</sup> edition); Reynolds, J.M. (2011) An Introduction to Applied and Environmental Geophysics (2nd edition); Sharma, P.V., (1997) Environmental and Engineering Geophysics.

**Assessment methods and criteria:**

Examination

**Grading:**

5-1/fail

**Person responsible:**

Kari Moisio, Toivo Korja, Elena Kozlovskaya

**Working life cooperation:**

No work practise.

**Other information:**

<https://noppa oulu.fi/noppa/kurssi/762305A/etusivu>

**770390A: Maturity test, 0 op**

**Voimassaolo:** 01.08.2008 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

0 credits

**Language of instruction:**

Finnish or Swedish

**Timing:**

3rd spring

**Learning outcomes:**

The student can independently produce scientific text using his/her mother tongue. The maturity test shows familiarity with the subjects of the Bachelor's thesis.

**Contents:**

Written test on the subject of the B.Sc. thesis.

**Mode of delivery:**

Independent preparation for the test.

**Learning activities and teaching methods:**

Independent work

**Target group:**

Compulsory in the B.Sc. degree to all geoscience students.

**Prerequisites and co-requisites:**

Written after the completion of the Master's thesis.

**Recommended optional programme components:**

No alternative course units.

**Recommended or required reading:**

No reading

**Assessment methods and criteria:**

The test event. The length of the text is recommended to be one exam paper (four pages).

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

**Grading:**

Pass/fail

**Person responsible:**

Supervisor of the Master's thesis.

**Working life cooperation:**

No work practise.

**772339A: Optical mineralogy, 6 op**

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Pekka Tuisku

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

1st spring

**Learning outcomes:**

After the course students are able to identify most common minerals from thin sections under the microscope.

**Contents:**

The basics of crystal optics. Research of the properties of minerals, identifying minerals from thin sections, usage of stereographic projector and basics of the universal stage method.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures, 40 h exercises.

**Target group:**

1st year geoscience students.

**Prerequisites and co-requisites:**

Basic course in mineralogy (771102P).

**Recommended optional programme components:**

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**Recommended or required reading:**

Wm. Revell Phillips (1971) Mineral Optics, p. 1-170; Risto Piispanen (1981) Kideoptiikka, osa I, Isotrooppisten aineiden kideoptiikka; Risto Piispanen and Pekka Tuisku (1996) Kideoptiikka, part II, anisotrooppisten aineiden kideoptiikka; Handbooks: Alexander and Horace Winchell (1967) Elements of Optical Mineralogy. Part II: Description of Minerals. 6th edition; W. E. Tröger (1971) Optische Bestimmung der gesteinsbildenden Minerale. Teil 1, Bestimmungstabellen. 4<sup>th</sup> revised edition; W. E. Tröger (1967) Optische Bestimmung der gesteinsbildenden Minerale. Teil 2, Textband.

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

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Pekka Tuisku

**Working life cooperation:**

No

## 772385A: Ore geology, 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** English

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

2nd or 3rd year, autumn semester

**Learning outcomes:**

Upon completion of the course, students should have a basic knowledge of the classification of ore deposits and an understanding of igneous, hydrothermal and sedimentary ore-forming processes. Students can identify the main types of ores in the field, perform basic mineralogical characterization of ores, and can formulate a petrogenetic model of ore formation.

**Contents:**

The ore-forming processes of orthomagmatic, hydrothermal and sedimentary mineral deposits, examples of different ore types, and interpretation of ore forming processes in a plate tectonic context.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures and hand specimen examination, 30 h lectures.

**Target group:**

All Bachelor-level geoscience students.

**Prerequisites and co-requisites:**

Basic studies in Geosciences.

**Recommended or required reading:**

Robb L. (2005) Introduction to Ore-Forming Processes, Blackwell, 373 p.

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

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

## 773317A: Physical Sedimentology, 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Pertti Sarala

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon completion the student should be able to recognize the main geological agents that control erosion and deposition in different sedimentary environments.

**Contents:**

The aim of the lecture course is to give geological and physical background of the exogenic processes that operate in terrestrial and marine sedimentary environments. The lecture course also introduces the basic methods and concepts used in physical sedimentology. The topics discussed are related to modern and ancient sedimentary environments and processes including themes such as weathering, soils and palaeosoils, mass movement mechanisms, water and ice flow dynamics, erosion and sedimentation processes and products.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

24 h lectures

**Target group:**

Geosciences and geography students (suits well as a minor subject course).

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P) or equivalent knowledge, Introduction to Quaternary deposits of Finland and their resources (771116P).

**Recommended optional programme components:**

The course is a pre-requisite for other courses in the Quaternary Geology.

**Recommended or required reading:**

Press, F. & Siever, R. (1998) Understanding Earth. W.H. Freeman and Company, p. 134-161, p. 264-455 and material given during lectures.

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

**Assessment methods and criteria:**

Attending lectures and written examination.

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

## 771304A: Practical training, 4 - 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4-5 credits

**Language of instruction:**

Finnish/English

**Timing:**

Commonly done as summer work during Bachelor's studies.

**Learning outcomes:**

Students will get familiar with geologists' duties in real-world situations and can assess the development of their own expertise during the training.

**Contents:**

Practical training accomplished under the guidance of a qualified geologist in Finland or abroad. Before the training, students must in advance agree upon the details of the field work with their professor, such as the work place, time, instructor and the supervisor.

**Mode of delivery:**

Participation in work life.

**Learning activities and teaching methods:**

A period of 1.5 to 3 month of practical work in a company or research institute, written report. For work exceeding 1.5 months 4 ECTS credits are granted and for the extending 2 months, 5 ECTS credits are granted.

**Target group:**

Obligatory to all geosciences students pursuing a Bachelor's degree.

**Assessment methods and criteria:**

A written report on the training work.

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

**Grading:**

Pass/fail

**Person responsible:**

Eero Hanski, Juha Pekka Lunkka

**Working life cooperation:**

Yes

**Other information:**

One practical work course belongs to the Bachelor's degree.

## 773343A: Quaternary Geology Seminar I, 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd year

**Learning outcomes:**

Upon completion of the course, the student will be able to construct an essay on given scientific topic and give a scientific presentation on a subject of their field.

**Contents:**

The student prepares an essay and gives an oral presentation (about 30 minutes) on a subject that has required independent work. The student also acts once as an opponent. Active class participation required.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Seminar work (oral presentation and acting as an opponent) and independent preparation of an essay.

**Target group:**

Bachelor-level students.

**Prerequisites and co-requisites:**

The required pre-requisite is the completion of the following courses prior to enrolling for the course unit: Basic courses in Geology, Physical Sedimentologia (773317A) and the Basics of Glacial Geology (773344A).

**Recommended optional programme components:**

Corresponding seminar is organised for those who give a seminar presentation in Quaternary Geology (772337A). Either 772337A or 773343A is required.

**Recommended or required reading:**

Reading chosen separately for each student.

**Assessment methods and criteria:**

Seminar presentation and acting as an opponent and a short essay.  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**Other information:**

Topic of the seminar presentation may be related to that of the Bachelor's thesis.

**772337A: Seminar in geology and mineralogy I, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd year

**Learning outcomes:**

After the course, students' ability to construct and give a scientific presentation on a subject of their field has increased and their skills to write scientific text have improved.

**Contents:**

Students prepare and give an oral presentation (about 30 minutes) on a subject that has required independent work and judgement. Each participant acts once as an opponent.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Preparing a seminar presentation and an essay.

**Target group:**

All geology students (geology and mineralogy).

**Prerequisites and co-requisites:**

Basic studies in geosciences.

**Recommended optional programme components:**

Corresponding seminar is organised for those who give a seminar presentation in Quaternary Geology (773343A). Either 772337A or 773343A is required.

**Recommended or required reading:**

Reading material depends on the chosen subjects and is informed upon starting the course/ or students are given the task to search for proper sources from the literature.

**Assessment methods and criteria:**

Seminar presentation and acting as an opponent and a short essay.

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

**Grading:**

Pass/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

**Other information:**

Topic of the seminar presentation may be related to that of the Bachelor's thesis.

**A326104: Surficial Geology Minor, 25 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

*E1*

### **773324A: Field mapping of Quaternary deposits, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon the completion of the course, the student will be able to produce a Quaternary geology map based on own field data.

**Contents:**

A field course introduces the techniques used in mapping of Quaternary deposits. In the field students are reconstructing a 1: 20 000 scale Quaternary map from a pre-selected mapping area.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures and exercises in the field.

**Target group:**

Bachelor-level geoscience students.

**Prerequisites and co-requisites:**

The required pre-requisite is the completion of the following courses prior to enrolling for the course unit: Basic courses in Geosciences, Physical Sedimentology (773317A), Basics of Glacial Geology (773344A) and Technical Properties of Sediments (773316A).

**Recommended optional programme components:**

No

**Recommended or required reading:**

No

**Assessment methods and criteria:**

Participation and quality of the map produced during the mapping course. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass/fail

**Person responsible:**

Juha Pekka Lunkka, Tiina Eskola

**Working life cooperation:**

No

**773306A: Quaternary Geology of Finland, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon completion of the course, students should have acquired knowledge of the Finnish glacial landforms and deglaciation in Finland.

**Contents:**

The pre-Quaternary landform of Finland; thermomers and cryomers during Pleistocene period; Finnish glacial landforms and their regional division; occurrence of landforms and their combinations as seen in aerial photos; deglaciation; the highest shoreline and its meaning; water-laid deposits; eolian deposits; land uplift; evolutionary phases of lakes; evolution of organic environment.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures

**Target group:**

2nd or 3rd year geoscience students.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P) or equivalent knowledge, Introduction to Quaternary deposits of Finland and their resources (771116P).

**Recommended or required reading:**

Koivisto M. (2004): Jääkaudet, WSOY, Helsinki, 233 p.

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

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No



**773316A: Technical Properties of Sediments, 8 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Tiina Eskola**Opintokohteen kielet:** Finnish**ECTS Credits:**

8 credits

**Language of instruction:**

Finnish

**Timing:**

3rd study year

**Learning outcomes:**

Upon completion of the course, student should have acquired knowledge of specify the physical and geotechnical qualities of sediments.

**Contents:**

Introduction to different boring methods; taking samples of fine-grained sediments. Laboratory work: determining consistency and structure of different sediments; determining different mechanical properties of sediments.

**Mode of delivery:**

The tuition will be implemented as face-to-face teaching.

**Learning activities and teaching methods:**

Lectures 30 h/ exercises 60 h/ independent study 90 h.

**Target group:**

The course unit is aimed primarily for students majoring in Quaternary geology.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P) or equivalent knowledge, Introduction to Quaternary deposits of Finland and their resources (771116P), Quaternary geology of Finland (773306A).

**Recommended or required reading:**

A handout. Rantamäki, Jääskeläinen & Tamminne (1984): Geotekniikka. pp. 31-161, 249-274, Otakustantamo, Velde.

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

**Assessment methods and criteria:**

Students participate actively in teaching, written reports.

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

**Grading:**

5-1/fail

**Person responsible:**

Tiina Eskola

**Working life cooperation:**

No

**773322A: Surficial geology in ore exploration, 5 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon completion of the course, students should have a basic knowledge of the dispersal of ore boulders and how boulders and till geochemistry are utilised in ore exploration.

**Contents:**

This course provides practical skills for performing surficial geological ore prospecting in glaciated areas. Boulder prospecting; glacial and geochemical dispersion in different landforms; different modes of occurrence of element. Methods: digging, boring, grain analyses, separations and applications.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures

**Target group:**

2nd or 3rd study year students.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P), Quaternary Geology of Finland (773306A), Basics of glacial geology (773344A).

**Recommended or required reading:**

Kujansuu, R. ja Saarnisto, M. (eds.) (1990): Glacial Indicator Tracing, A.A. Balkema, 252 p.  
The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773300A: Quaternary Stratigraphy, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon the completion of the course, the student will be able to explain the stratigraphical methods used in Quaternary Geology, to discuss stratigraphical issues using basic concepts of stratigraphy. The student will also be able to explain how environments and climate have changed during the Quaternary.

**Contents:**

The last period of the history of Earth is called the Quaternary. The course focuses on Quaternary history and stratigraphy of the Earth. The course consists of the following topics: basic concepts of stratigraphy including litho-, bio-, and chronostratigraphy, geochronology and other types of stratigraphical practices; stratigraphical methods; absolute and relative dating methods; marine and terrestrial sediments as stratigraphical archives; classical and modern stratigraphical models; climate change.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

26 h lectures

**Target group:**

Geoscience students, geography students (pursuing minor in geology).

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P) or equivalent knowledge, Introduction to Quaternary deposits of Finland and their resources (771116P).

**Recommended or required reading:**

Ehlers, J. (1996) Quaternary and Glacial Geology, applicable parts; Wiley & Sons, New York. Lowe, J.J. & Walker, M.J.C. (1997) Reconstructing Quaternary Environments, applicable parts; Longman, Hong Kong, 2nd edition. Donner, J. (1995): The Quaternary History of Scandinavia. World and Regional Geology 7. Cambridge University Press, 200 p.

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

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**762306A: Hydrology in geosciences, 6 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish (It is possible to do the course in English, although all the lectures and exercises will be given in Finnish).

**Timing:**

2nd or 3rd spring term; given every year.

**Learning outcomes:**

Upon the completion of the course, a student

- can define the concept of a water cycle, can name the elements of the cycle, can identify their physical basis and can estimate the magnitude of different components using the water balance equation
- can name and distinguish the principles of the methods used to observe evaporation, precipitation and runoff, and summarize their spatial and temporal variation in Finland
- can describe the behaviour of underground water in vadoze zone and aquifers and can define how the groundwater is formed and how it flows
- can identify different types of aquifers and can describe their relationship with structures of soil and bedrock
- owns basics of hydrogeology (groundwater geology)
- can name major geological and geophysical methods used in groundwater research and exploration

**Contents:**

Introduction to hydrology and hydrological processes in geosciences. Properties and behaviour of water in hydrosphere including hydrological cycle, its different components (evaporation, precipitation and runoff) and their relationship, observations and spatial and temporal variation of each hydrological component in Finland. The second part of the course introduces properties and behaviour of water underground including geohydrological and hydrogeophysical aspects of water and hydrogeology. This part of the course concentrates on the behaviour and properties of water in soil, superficial deposits and bedrock, particularly in Finland. Themes such as groundwater flow, aquifers, groundwater quality, geological and geophysical research methods in hydrogeology will also be introduced.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

40 h lectures, 20 h exercises, 100 h independent study.

**Target group:**

Course is compulsory for geoscience students (geophysics, geology). Also offers to the other students of the University of Oulu.

**Prerequisites and co-requisites:**

The following courses are required: Introduction to Solid Earth Geophysics (762104P); Physical Sedimentology (773317A); Introduction to Glacial Geology (773303A).

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Handouts and lecture notes. Selected parts from: Hooli, J. & Sallanko, J., (1996) Hydrologian luentomoniste; Grundvatten, Teori & Tillämpning. Knutsson, G. & Morfeldt, C-O. (1993) Svensk Byggtjänst, 304 p. Maanalaiset vedet - pohjavesigeologian perusteet; Korkka-Niemi, K. & Salonen, V-P. (1996) Täydennyskoulutuskeskus. Turun yliopisto, 181 p. Mälkki, E. (1999) Pohjavesi ja pohjaveden ympäristö. Tammi, 304 p.

**Assessment methods and criteria:**

Examination

**Grading:**

5-1/fail

**Person responsible:**

Toivo Korja and Juha Pekka Lunkka

**Working life cooperation:**

No work practice

**Other information:**

<https://wiki oulu.fi/display/762306A/>

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4-5 credits

**Language of instruction:**

Finnish/English

**Timing:**

Normally 3rd or later study year.

**Learning outcomes:**

Students will get familiar with geologists' duties in real-world situations and can assess the development of their own expertise during the training.

**Contents:**

Practical training accomplished under the guidance of a qualified geologist in Finland or abroad. Before the training, students must in advance agree upon the details of the field work with their professor such as the work place, time, instructor and the supervisor.

**Mode of delivery:**

Participation in work life.

**Learning activities and teaching methods:**

A period of 1.5 to 3 month of practical work in a company or research institute, written report. For work exceeding 1.5 months 4 ECTS credits are granted and for the extending 2 months, 5 ECTS credits are granted.

**Target group:**

Bachelor- or Master-level geoscience students.

**Assessment methods and criteria:**

A written report on the training work.

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

**Grading:**

Pass/fail

**Person responsible:**

Eero Hanski, Juha Pekka Lunkka

**Working life cooperation:**

Yes

**Other information:**

Only one practical training (773343A) is compulsory to and valid for the Bachelor degree. The second one (773345A) can be included in the Master's degree.

## **A325604: Geology and Mineralogy Minor, 25 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

**772334A: Bedrock mapping, 3 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish, in field exercises potentially also English.

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon completion the student should be able to:

- compile a bedrock map
- utilize different source materials in this work.

**Contents:**

Map materials and coordinate systems, methods of bedrock mapping and geological field work, supervised exercise to product a bedrock map.

**Mode of delivery:**

Face to face in the class and field.

**Learning activities and teaching methods:**

8 h lectures, field exercises and independent assignments 32 h.

**Target group:**

Bachelor-level geoscience students.

**Prerequisites and co-requisites:**

Basic studies in Geosciences.

**Recommended optional programme components:**

-

**Assessment methods and criteria:**Participation in teaching in the field, construction of a geological map and its explanation. Read more about [assessment criteria](#) at the University of Oulu webpage.**Grading:**

Pass/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No

**772344A: Sedimentary Petrology, 5 op****Voimassaolo:** 01.08.2011 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Pekka Tuisku

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

During the course students will get familiar with the basic concepts of sedimentary rocks and develop a general understanding on their classification and processes of formation. They will know about the major sedimentary structures, major depositional environments and their facies and stratigraphic characteristics and be able to interpret potential sources and transportation mechanisms of sediments based on their macroscopic and microscopic characteristics.

**Contents:**

Characteristics and classification of sedimentary rocks, their mode of occurrence and processes of formation. Identification of sedimentary rocks and their minerals using microscope.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

20 h lectures, 20 h microscope exercises.

**Target group:**

2nd or 3rd year geoscience students.

**Prerequisites and co-requisites:**

Optical mineralogy (772339A), Introduction to Geology II (771114P).

**Recommended optional programme components:**

-

**Recommended or required reading:**

Blatt and Tracy (2006) Petrology: Igneous, sedimentary and metamorphic, Freeman, 3rd edition. The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Learning diary and written report or alternatively written examination. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

Pekka Tuisku

**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 credits

**Language of instruction:**

English

**Timing:**

2nd or 3rd year

**Learning outcomes:**

Students will obtain basic knowledge on ore minerals and their mode of occurrence, learn to recognize 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. Identify ore mineral and assemblages.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

14 h lectures, 21 h exercises

**Target group:**

Students specializing in geology and mineralogy.

**Prerequisites and co-requisites:**

Introduction to ore geology (771108P), Basic mineralogy (771102P) and Optical mineralogy (772339A).

**Recommended or required reading:**

Craig, J.P. & Vaughan, D.J. (1994) Ore Microscopy and Ore Petrography. Wiley & Sons, 2<sup>nd</sup> ed. 434 p.  
 Ramdohr, P.: 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, 3<sup>rd</sup> 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 literature can be checked from [this link](#).

**Assessment methods and criteria:**

Examination, laboratory exercises.

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

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

**772310A: General mineralogy, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Pekka Tuisku

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**



Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

The student will deepen their basic knowledge of mineralogy.

**Contents:**

Research history and research methods of mineralogy. Classification of minerals, crystal chemical structures, chemical compositions, the most important properties and occurrence of minerals in rocks.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

26 h lectures

**Target group:**

2<sup>nd</sup> and 3<sup>rd</sup> year geosciences students.

**Prerequisites and co-requisites:**

Basic course in Mineralogy 771106P.

**Recommended or required reading:**

Wenk & Bulakh, Minerals: their Constitution and Origin, Cambridge University Press.

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

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Pekka Tuisku, Jukka Pekka Ranta, Tiina Eskola

**Working life cooperation:**

No

**772316A: Structural geology, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish or English

**Timing:**

2nd or 3rd year, autumn semester

**Learning outcomes:**

The student is able to analyze and describe deformation structures of the bedrock, and based on the result, he/she can evaluate the mechanisms of deformation and characteristics of the deformation processes.

**Contents:**

Development of structural geology and principles of the stress and strain theory, microscopic structural elements, fractures and fault structures, folding and fold structures, multiphase deformation and interference structures.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

24 h lectures, 85 h independent study.

**Target group:**

2nd and 3rd year geoscience students.

**Prerequisites and co-requisites:**

Basic studies in Geosciences.

**Recommended optional programme components:**

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**Recommended or required reading:**

Material given during lectures and Haakon Fossen (2010) Structural Geology, Cambridge University Press, 480 p.

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

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No

**772341A: Igneous Petrology, 7 op**

**Voimassaolo:** 01.01.2009 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Pekka Tuisku

**Opintokohteen kielet:** English

**ECTS Credits:**

7 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd year

**Learning outcomes:**

Students will be able to describe and classify the main types of igneous rocks in the field, and identify the main rock forming minerals and the textures of the rocks under the microscope. Students also are able to classify basic petrogenetic processes, including partial melting, crystallization, and contamination, and will be able to place igneous rocks into a broad geotectonic framework.

**Contents:**

The course provides an introduction to the main concepts of Igneous Petrology, including nomenclature, classification, processes of melting and crystallization, and identification of rocks and minerals under the microscope, as well as the distribution of igneous rocks in a global tectonic framework (mid-ocean ridges,

subduction zones, continental rifts, oceanic island volcanism, continental anorogenic magmatism). The petrogenesis of the main types of igneous rocks (komatiites, basalts, andesites, dacites- rhyolites, granite family, gabbro-norites, alkaline rocks) will be discussed.

**Mode of delivery:**

Face to face, independent microscope exercises.

**Learning activities and teaching methods:**

26 h lectures, 30 h microscope exercises.

**Target group:**

Bachelor-level geoscience students.

**Prerequisites and co-requisites:**

Optical mineralogy (772339A), Introduction to Geology I (771113P).

**Recommended optional programme components:**

Petrology of metamorphic rocks (772345A) and Petrology of sedimentary rocks (772344A).

**Recommended or required reading:**

Winter J.D. (2001) An Introduction to Igneous and Metamorphic Petrology, Prentice Hall, 697 p. or Blatt and Tracy (2006) Petrology: Igneous, Sedimentary and Metamorphic, Freeman, 3<sup>rd</sup> edition.

**Assessment methods and criteria:**

Learning diary and written report or alternatively written examination.

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

**Grading:**

5-1/fall

**Person responsible:**

Pekka Tuisku

**Working life cooperation:**

No

**772345A: Metamorphic Petrology, 6 op**

**Voimassaolo:** 01.08.2011 - 31.07.2015

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Pekka Tuisku

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

During the course students will get familiar with the basic concepts of metamorphic rocks and develop a general understanding on their classification and processes of formation. They will know about the major structures of metamorphic rocks and be able to identify their minerals and textures based on macroscopic and microscopic characteristics. In addition they will be able to relate their mineralogical and textural observations to the processes that generate different kinds of metamorphic rocks.

**Contents:**

Metamorphism and factors that control it; metamorphic facies and their textures and occurrences. Identification of metamorphic rocks and their minerals using microscope.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

26 h lectures, 30 h microscope exercises.

**Target group:**

2nd or 3rd year geoscience students.

**Prerequisites and co-requisites:**

Optical mineralogy (772339A), Introduction to geology I (771113P).

**Recommended optional programme components:**

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**Recommended or required reading:**

Blatt and Tracy, Petrology (2006): Igneous, sedimentary and metamorphic, Freeman, 3rd edition.  
The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Learning diary and written report or alternatively written examination.  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

Pekka Tuisku

**Working life cooperation:**

No

**A326108: Studies in Surficial Geology, 15 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Peuraniemi, Vesa Juhani

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

*E3*

**773324A: Field mapping of Quaternary deposits, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon the completion of the course, the student will be able to produce a Quaternary geology map based on own field data.

**Contents:**

A field course introduces the techniques used in mapping of Quaternary deposits. In the field students are reconstructing a 1: 20 000 scale Quaternary map from a pre-selected mapping area.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures and exercises in the field.

**Target group:**

Bachelor-level geoscience students.

**Prerequisites and co-requisites:**

The required pre-requisite is the completion of the following courses prior to enrolling for the course unit: Basic courses in Geosciences, Physical Sedimentology (773317A), Basics of Glacial Geology (773344A) and Technical Properties of Sediments (773316A).

**Recommended optional programme components:**

No

**Recommended or required reading:**

No

**Assessment methods and criteria:**

Participation and quality of the map produced during the mapping course. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass/fail

**Person responsible:**

Juha Pekka Lunkka, Tiina Eskola

**Working life cooperation:**

No

**773306A: Quaternary Geology of Finland, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon completion of the course, students should have acquired knowledge of the Finnish glacial landforms and deglaciation in Finland.

**Contents:**

The pre-Quaternary landform of Finland; thermomeres and cryomeres during Pleistocene period; Finnish glacial landforms and their regional division; occurrence of landforms and their combinations as seen in aerial photos; deglaciation; the highest shoreline and its meaning; water-laid deposits; eolian deposits; land uplift; evolutionary phases of lakes; evolution of organic environment.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures

**Target group:**

2nd or 3rd year geoscience students.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P) or equivalent knowledge, Introduction to Quaternary deposits of Finland and their resources (771116P).

**Recommended or required reading:**

Koivisto M. (2004): Jääkaudet, WSOY, Helsinki, 233 p.

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

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773316A: Technical Properties of Sediments, 8 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Tiina Eskola

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

8 credits

**Language of instruction:**

Finnish

**Timing:**

3rd study year

**Learning outcomes:**

Upon completion of the course, student should have acquired knowledge of specify the physical and geotechnical qualities of sediments.

**Contents:**

Introduction to different boring methods; taking samples of fine-grained sediments. Laboratory work: determining consistency and structure of different sediments; determining different mechanical properties of sediments.

**Mode of delivery:**

The tuition will be implemented as face-to-face teaching.

**Learning activities and teaching methods:**

Lectures 30 h/ exercises 60 h/ independent study 90 h.

**Target group:**

The course unit is aimed primarily for students majoring in Quaternary geology.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P) or equivalent knowledge, Introduction to Quaternary deposits of Finland and their resources (771116P), Quaternary geology of Finland (773306A).

**Recommended or required reading:**

A handout. Rantamäki, Jääskeläinen & Tamminne (1984): Geotekniikka. pp. 31-161, 249-274, Otakustantamo, Velde.

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

**Assessment methods and criteria:**

Students participate actively in teaching, written reports.

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

**Grading:**

5-1/fail

**Person responsible:**

Tiina Eskola

**Working life cooperation:**

No

**773322A: Surficial geology in ore exploration, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon completion of the course, students should have a basic knowledge of the dispersal of ore boulders and how boulders and till geochemistry are utilised in ore exploration.

**Contents:**

This course provides practical skills for performing surficial geological ore prospecting in glaciated areas. Boulder prospecting; glacial and geochemical dispersion in different landforms; different modes of occurrence of element. Methods: digging, boring, grain analyses, separations and applications.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures

**Target group:**

2nd or 3rd study year students.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P), Quaternary Geology of Finland (773306A), Basics of glacial geology (773344A).

**Recommended or required reading:**

Kujansuu, R. ja Saarnisto, M. (eds.) (1990): Glacial Indicator Tracing, A.A. Balkema, 252 p.  
The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773300A: Quaternary Stratigraphy, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon the completion of the course, the student will be able to explain the stratigraphical methods used in Quaternary Geology, to discuss stratigraphical issues using basic concepts of stratigraphy. The student will also be able to explain how environments and climate have changed during the Quaternary.

**Contents:**

The last period of the history of Earth is called the Quaternary. The course focuses on Quaternary history and stratigraphy of the Earth. The course consists of the following topics: basic concepts of stratigraphy including litho-, bio-, and chronostratigraphy, geochronology and other types of stratigraphical practices; stratigraphical methods; absolute and relative dating methods; marine and terrestrial sediments as stratigraphical archives; classical and modern stratigraphical models; climate change.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

26 h lectures

**Target group:**

Geoscience students, geography students (pursuing minor in geology).

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P) or equivalent knowledge, Introduction to Quaternary deposits of Finland and their resources (771116P).

**Recommended or required reading:**

Ehlers, J. (1996) Quaternary and Glacial Geology, applicable parts; Wiley & Sons, New York. Lowe, J.J. & Walker, M.J.C. (1997) Reconstructing Quaternary Environments, applicable parts; Longman, Hong Kong, 2nd edition. Donner, J. (1995): The Quaternary History of Scandinavia. World and Regional Geology 7. Cambridge University Press, 200 p.

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



**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka

**Working life cooperation:**

No

**773650S: Biostratigraphy: Pollen and spores, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Tiina Eskola

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course, students should be able to prepare pollen samples in the laboratory and identify the most common pollen types and spores in Finland.

**Contents:**

Theory of the pollen analysis and laboratory methods, the most common pollen and spore types, manufacturing preparations, sediment analysis.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 20 h/ exercises 38 h/ independent work 40 h.

**Target group:**

The course unit is aimed primarily at major subject students.

**Prerequisites and co-requisites:**

Introduction to Geology II (771114P).

**Recommended or required reading:**

Handouts and Bennett, K.D. & Willis, K.J. (2001) Pollen. In: Smol, J.P., Birks, H.J.B., Last, W.M. (Eds.). Tracking Environmental Change Using Lake Sediments. Volume 3: Terrestrial, Algal, and Siliceous Indicators. Kluwer, Dordrecht, The Netherlands, pp. 5 - 32. Berglund, B. (Ed.) (1988) Handbook of Holocene Palaeoecology and Palaeohydrology. Wiley & Sons, p. 455-484.

**Assessment methods and criteria:**

Students participate actively in teaching, written report and an examination.

**Grading:**

Pass/fail

**Person responsible:**

Tiina Eskola

**Working life cooperation:**

No

**773654S: Biostratigraphy: Diatoms, 5 op****Voimassaolo:** 01.08.2015 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Tiina Eskola**Opintokohteen kielet:** Finnish**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th study year

**Learning outcomes:**

Upon completion of the course, students should be able to prepare diatom samples in the laboratory and identify some of the most general diatoms in Finland.

**Contents:**

Theory of the diatom analysis and laboratory methods, the most general diatom genera and species, manufacturing preparations, sediment analysis.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 22 h/ exercises 42 h/ independent work 30 h.

**Target group:**

The course unit is aimed primarily at major subject students.

**Prerequisites and co-requisites:**

Basic studies in geosciences.

**Recommended or required reading:**

Handouts and Battarbee, R.W., Jones, V.J., Flower, R.J., Cameron, N.g., Bennion, H., Varvalho, L., Juggins, S. (2001) Diatoms. In: Smol, J.P., Birks, H.J.B., Last, W.M. (Eds.). Tracking Environmental Change Using Lake Sediments. Volume 3: Terrestrial, Algal, and Siliceous Indicators. Kluwer, Dordrecht, The Netherlands, pp. 155 - 202. Berglund, B. (Ed.) (1988) Handbook of Holocene Palaeoecology and Palaeohydrology. Wiley & Sons., p. 527-570. Forsström, L. (1999) Piikuoriset levät. Opintomoniste, Oulun yliopisto Geotieteiden laitos, 104 p.

**Assessment methods and criteria:**

Students participate actively in teaching, written report.

**Grading:**

Pass/fail

**Person responsible:**

Tiina Eskola

**Working life cooperation:**

No

**773345A: Work practice 2, 4 - 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4-5 credits

**Language of instruction:**

Finnish/English

**Timing:**

Normally 3rd or later study year.

**Learning outcomes:**

Students will get familiar with geologists' duties in real-world situations and can assess the development of their own expertise during the training.

**Contents:**

Practical training accomplished under the guidance of a qualified geologist in Finland or abroad. Before the training, students must in advance agree upon the details of the field work with their professor such as the work place, time, instructor and the supervisor.

**Mode of delivery:**

Participation in work life.

**Learning activities and teaching methods:**

A period of 1.5 to 3 month of practical work in a company or research institute, written report. For work exceeding 1.5 months 4 ECTS credits are granted and for the extending 2 months, 5 ECTS credits are granted.

**Target group:**

Bachelor- or Master-level geoscience students.

**Assessment methods and criteria:**

A written report on the training work.

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

**Grading:**

Pass/fail

**Person responsible:**

Eero Hanski, Juha Pekka Lunkka

**Working life cooperation:**

Yes

**Other information:**

Only one practical training (773343A) is compulsory to and valid for the Bachelor degree. The second one (773345A) can be included in the Master's degree.

**A325608: Studies in Geology and Mineralogy, 15 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

**772334A: Bedrock mapping, 3 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish, in field exercises potentially also English.

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

Upon completion the student should be able to:

- compile a bedrock map
- utilize different source materials in this work.

**Contents:**

Map materials and coordinate systems, methods of bedrock mapping and geological field work, supervised exercise to product a bedrock map.

**Mode of delivery:**

Face to face in the class and field.

**Learning activities and teaching methods:**

8 h lectures, field exercises and independent assignments 32 h.

**Target group:**

Bachelor-level geoscience students.

**Prerequisites and co-requisites:**

Basic studies in Geosciences.

**Recommended optional programme components:**

-

**Assessment methods and criteria:**

Participation in teaching in the field, construction of a geological map and its explanation.

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

Pass/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No

**772341A: Igneous Petrology, 7 op****Voimassaolo:** 01.01.2009 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Pekka Tuisku

**Opintokohteen kielet:** English

**ECTS Credits:**

7 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd year

**Learning outcomes:**

Students will be able to describe and classify the main types of igneous rocks in the field, and identify the main rock forming minerals and the textures of the rocks under the microscope. Students also are able to classify basic petrogenetic processes, including partial melting, crystallization, and contamination, and will be able to place igneous rocks into a broad geotectonic framework.

**Contents:**

The course provides an introduction to the main concepts of Igneous Petrology, including nomenclature, classification, processes of melting and crystallization, and identification of rocks and minerals under the microscope, as well as the distribution of igneous rocks in a global tectonic framework (mid-ocean ridges, subduction zones, continental rifts, oceanic island volcanism, continental anorogenic magmatism). The petrogenesis of the main types of igneous rocks (komatiites, basalts, andesites, dacites- rhyolites, granite family, gabbro-norites, alkaline rocks) will be discussed.

**Mode of delivery:**

Face to face, independent microscope exercises.

**Learning activities and teaching methods:**

26 h lectures, 30 h microscope exercises.

**Target group:**

Bachelor-level geoscience students.

**Prerequisites and co-requisites:**

Optical mineralogy (772339A), Introduction to Geology I (771113P).

**Recommended optional programme components:**

Petrology of metamorphic rocks (772345A) and Petrology of sedimentary rocks (772344A).

**Recommended or required reading:**

Winter J.D. (2001) An Introduction to Igneous and Metamorphic Petrology, Prentice Hall, 697 p. or Blatt and Tracy (2006) Petrology: Igneous, Sedimentary and Metamorphic, Freeman, 3<sup>rd</sup> edition.

**Assessment methods and criteria:**

Learning diary and written report or alternatively written examination.  
Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fall

**Person responsible:**

Pekka Tuisku

**Working life cooperation:**

No

**772344A: Sedimentary Petrology, 5 op**

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Pekka Tuisku

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

During the course students will get familiar with the basic concepts of sedimentary rocks and develop a general understanding on their classification and processes of formation. They will know about the major sedimentary structures, major depositional environments and their facies and stratigraphic characteristics and be able to interpret potential sources and transportation mechanisms of sediments based on their macroscopic and microscopic characteristics.

**Contents:**

Characteristics and classification of sedimentary rocks, their mode of occurrence and processes of formation. Identification of sedimentary rocks and their minerals using microscope.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

20 h lectures, 20 h microscope exercises.

**Target group:**

2nd or 3rd year geoscience students.

**Prerequisites and co-requisites:**

Optical mineralogy (772339A), Introduction to Geology II (771114P).

**Recommended optional programme components:**

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**Recommended or required reading:**

Blatt and Tracy (2006) Petrology: Igneous, sedimentary and metamorphic, Freeman, 3rd edition. The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Learning diary and written report or alternatively written examination. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

Pekka Tuisku

**Working life cooperation:**

No

**772345A: Metamorphic Petrology, 6 op**

**Voimassaolo:** 01.08.2011 - 31.07.2015

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Pekka Tuisku

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

During the course students will get familiar with the basic concepts of metamorphic rocks and develop a general understanding on their classification and processes of formation. They will know about the major structures of metamorphic rocks and be able identify their minerals and textures based on macroscopic and microscopic characteristics. In addition they will be able to relate their mineralogical and textural observations to the processes that generate different kinds of metamorphic rocks.

**Contents:**

Metamorphism and factors that control it; metamorphic facies and their textures and occurrences. Identification of metamorphic rocks and their minerals using microscope.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

26 h lectures, 30 h microscope exercises.

**Target group:**

2nd or 3rd year geoscience students.

**Prerequisites and co-requisites:**

Optical mineralogy (772339A), Introduction to geology I (771113P).

**Recommended optional programme components:**

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**Recommended or required reading:**

Blatt and Tracy, Petrology (2006): Igneous, sedimentary and metamorphic, Freeman, 3rd edition. The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Learning diary and written report or alternatively written examination. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

5-1/fail

**Person responsible:**

Pekka Tuisku

**Working life cooperation:**

No

**772385A: Ore geology, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** English

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

2nd or 3rd year, autumn semester

**Learning outcomes:**

Upon completion of the course, students should have a basic knowledge of the classification of ore deposits and an understanding of igneous, hydrothermal and sedimentary ore-forming processes. Students can identify the main types of ores in the field, perform basic mineralogical characterization of ores, and can formulate a petrogenetic model of ore formation.

**Contents:**

The ore-forming processes of orthomagmatic, hydrothermal and sedimentary mineral deposits, examples of different ore types, and interpretation of ore forming processes in a plate tectonic context.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures and hand specimen examination, 30 h lectures.

**Target group:**

All Bachelor-level geoscience students.

**Prerequisites and co-requisites:**

Basic studies in Geosciences.

**Recommended or required reading:**

Robb L. (2005) Introduction to Ore-Forming Processes, Blackwell, 373 p.  
The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**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 credits

**Language of instruction:**

English

**Timing:**

2nd or 3rd year

**Learning outcomes:**

Students will obtain basic knowledge on ore minerals and their mode of occurrence, learn to recognize 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. Identify ore mineral and assemblages.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

14 h lectures, 21 h exercises

**Target group:**

Students specializing in geology and mineralogy.

**Prerequisites and co-requisites:**

Introduction to ore geology (771108P), Basic mineralogy (771102P) and Optical mineralogy (772339A).

**Recommended or required reading:**

Craig, J.P. & Vaughan, D.J. (1994) Ore Microscopy and Ore Petrography. Wiley & Sons, 2<sup>nd</sup> ed. 434 p.  
 Ramdohr, P.: 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, 3<sup>rd</sup> 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 literature can be checked from [this link](#).

**Assessment methods and criteria:**

Examination, laboratory exercises.

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

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

**772310A: General mineralogy, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Pekka Tuisku

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

The student will deepen their basic knowledge of mineralogy.

**Contents:**

Research history and research methods of mineralogy. Classification of minerals, crystal chemical structures, chemical compositions, the most important properties and occurrence of minerals in rocks.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

26 h lectures

**Target group:**

2<sup>nd</sup> and 3<sup>rd</sup> year geosciences students.

**Prerequisites and co-requisites:**

Basic course in Mineralogy 771106P.

**Recommended or required reading:**

Wenk & Bulakh, Minerals: their Constitution and Origin, Cambridge University Press.  
The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Written examination

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

**Grading:**

5-1/fail

**Person responsible:**

Pekka Tuisku, Jukka Pekka Ranta, Tiina Eskola

**Working life cooperation:**

No

**772338A: Work practice II, 4 - 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4-5 credits

**Language of instruction:**

Finnish or English

**Timing:**

Any year after completion of the 1st work practise.

**Learning outcomes:**

Students will get familiar with geologists' duties in real-world situations and can assess the development of their own expertise during the training.

**Contents:**

Practical training accomplished under the guidance of a qualified geologist in Finland or abroad. Before the training, students must in advance agree upon the details of the field work with their professor, such as the work place, time, instructor and the supervisor.

**Mode of delivery:**

Attending work life.

**Learning activities and teaching methods:**

A period of 1.5 to 3 month of practical work in a company or research institute, written report. For work exceeding 1.5 months 4 ECTS credits are granted and for the extending 2 months, 5 ECTS credits are granted.

**Target group:**

Bachelor- or Master-level geoscience students.

**Assessment methods and criteria:**

A written report on the training work.

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

**Grading:**

Pass/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

Yes.

**Other information:**

Only one practical training (773343A or 772337A) is compulsory to and valid for the Bachelor degree. The second one (772338A) can be included in the Master's degree.

## **A323702: Studies in Geochemistry, 15 - 100 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Basic Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

*E5*

### **774329A: Introduction to Environmental Geochemistry, 5 op**

**Voimassaolo:** 01.01.2005 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

The student will acquire knowledge of the physico-chemical processes and factors controlling the dispersion of elements in the surface environments. The student will be able to carry out calculations related to hydrogeochemical processes such as dissolution/precipitation, solubility of gases, absorption, and metal complex formation.

**Contents:**

Concepts of the environment and environmental geochemistry; solution, hydrolysis and redox reactions of minerals, sorption and related geochemical processes, topical environmental problems (acid rain, decrease of ozone, greenhouse phenomenon, heavy metal fallout) from the viewpoint of geochemistry; buffer systems of nature; heavy metals in environment; acid mine drainage.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures, 12 h computer exercises.

**Target group:**

2nd and 3rd year geoscience students.

**Prerequisites and co-requisites:**

Basic course in geochemistry (774301A)

**Recommended optional programme components:**

Advisable to have taken the course before the course Geochemistry of mining environment (774636S).

**Recommended or required reading:**

Sawyer, Clair N., McCarty, Perry L., Parkin, Gene F. (2003) Chemistry for Environmental Engineering and Science, Boston, McGraw-Hill, p. 1-397 and Alloway, B. J. (Ed.) (1995) Heavy Metals in Soils, London, Blackie Academic & Professional, p. 1-57.

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

**Assessment methods and criteria:**

Examination on theory and calculations as homework.

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

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

**774304A: Analytical methods in geochemistry, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd study year

**Learning outcomes:**

After the course students should know which kind of sample pretreatment and analysis methods are used for geological samples.

**Contents:**

Detection limits and errors in analysis, presentation of analytical results, sampling, sample pretreatment, sample digestion (melts, solutions), silicate analysis theories and practice of different instrumental methods (AAS, XRF, ICP-AES, ICP-MS, TIMS), a visit to a geochemical laboratory.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

24 h lectures, 6 h calculation exercises, visit to a laboratory.

**Target group:**

Bachelor- or Master-level geoscience students.

**Prerequisites and co-requisites:**

Basic course in geochemistry (774301A).

**Recommended or required reading:**

Gill, Robin (Ed.) (1997) Modern analytical geochemistry: an introduction to quantitative chemical analysis for earth, environmental and materials scientists, Harlow, Longman, 329 p. and Sawyer, Clair N., McCarty, Perry L., Parkin, Gene F. (2003) Chemistry for Environmental Engineering and Science, Boston, McGraw-Hill, p. 410-451.

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

**Assessment methods and criteria:**

Written examination or essay.

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

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

## **A439101: Basic Studies, Mining Technology and Mineral Processing, 70 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*Basic Studies*

## **477011P: Introduction to Process and Environmental Engineering I, 5 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Aki Sorsa, Sanna Taskila

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

470219A Introduction to Process Engineering 3.5 op

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

Finnish

**Timing:**

Implementation during periods 1-2 on the autumn term

**Learning outcomes:**

The objective of this course is to give insight to the whole perspective of process and environmental engineering and to familiarise the students with the terminology involved. In addition, the objective is also to outline the connections between process and environmental engineering and other fields closely related to them.

After the course, the student can analyse the process and environmental engineering aspects of an industrial process. He/She can, for example, divide the process into unit processes, analyse the process or a chain of processes based on the material balances, identify and evaluate the significance of essential mechanical, chemical and transport phenomena, analyse the control and process design aspects of a process etc. He/She can also evaluate the significance of different aspects of process and environmental engineering to the overall production system when these aspects are further examined in forthcoming courses.

**Contents:**

The course is divided into the next eight separate themes: 1. Unit processes and material balances. 2. Environmental impacts and their classification. 3. Mechanical phenomena. 4. Momentum, heat and mass transfer phenomena. 5. Chemical reactions and reactors. 6. The possibilities of biological process engineering. 7. Process dynamics and control. 8. Process measurements and measurability.

**Mode of delivery:**

Group work and contact lectures supporting those

**Learning activities and teaching methods:**

Assignments (8 altogether) carried out in small groups and contact lectures supporting them (16 hours)

**Target group:**

Bachelor's degree students in the study fields of process and environmental engineering

**Prerequisites and co-requisites:**

None

**Recommended optional programme components:**

The course serves as an introduction to the studies in process and environmental engineering

**Recommended or required reading:**

The material is provided during the contact lectures and through the course webpages. It is also expected that the students seek material for completing the assignments independently.

**Assessment methods and criteria:**

The assignments (altogether 8) covering the course themes carried out in small groups. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilises a numerical grading scale 1-5 and fail.

**Person responsible:**

Dr Aki Sorsa

**Working life cooperation:**

No

**Other information:**

The assessment method utilized requires the active attendance to the group work and contact lectures from the beginning of the course

**488010P: Introduction to Process and Environmental Engineering II, 5 op**

**Voimassaolo:** 01.08.2013 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Fabritius, Timo Matti Juhani

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

488011P Introduction to Environmental Engineering 5.0 op

477012P Introduction to Automation Engineering 5.0 op

**ECTS Credits:**

5 cr / 135 hours of work

**Language of instruction:**

Available only in Finnish

**Timing:**

The course is given in the spring semester, during periods III and IV. It is recommended to complete the course at the 1st spring semester.

**Learning outcomes:**

Students can examine industrial processes using the methods and perspectives of process and environmental engineering (e.g. material management, phenomenon-based considerations and automation) and they recognize the role of different areas of the process and environmental engineering, when these areas are considered in the forthcoming courses.

**Contents:**

1. Environmental thinking and industrial ecology. 2. Materials in production processes. 3. Water resources and land use. 4. Municipal and industrial water supply. 5. PI diagrams. 6. Process design. 7. Control and operation of processes.

**Mode of delivery:**

Classroom education

**Learning activities and teaching methods:**

Group exercises and contact-education (14 h) that supports these exercises. Available only in Finnish.

**Target group:**

Students of process and environmental engineering

**Prerequisites and co-requisites:**

None

**Recommended optional programme components:**

This course is an introduction to the other courses of process and environmental engineering

**Recommended or required reading:**

Material will be distributed during lectures and via course www-site

**Assessment methods and criteria:**

Group exercises. Please note that the course is not available in English, but only in Finnish. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

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

**Person responsible:**

Professor Timo Fabritius

**Working life cooperation:**

No

**Other information:**

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

### **031010P: Calculus I, 5 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Course

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

**Opettajat:** Ilkka Lusikka

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay031010P Calculus I (OPEN UNI) 5.0 op

**ECTS Credits:**

5

**Language of instruction:**

Finnish

**Timing:**

Autumn semester, periods 1-3.

**Learning outcomes:**

After completing the course the student identifies concepts of vector algebra and can use vector algebra for solving problems of analytic geometry. The student can also explain basic characteristics of elementary functions and is able to analyse the limit and the continuity of real valued functions of one variable. Furthermore, the student can solve problems associated with differential and integral calculus of real valued functions of one variable.

**Contents:**

Vector algebra and analytic geometry. Limit, continuity, differential and integral calculus and applications of real valued functions of one variable. Complex numbers.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

Lectures 55 h / Group work 22 h.

**Target group:**

-

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Grossmann, S.I.: Calculus of One Variable; Grossmann, S.I.: Multivariable Calculus, Linear Algebra and Differential Equations (partly); Adams, R.A.: A Complete Course Calculus (partly).

**Assessment methods and criteria:**

Intermediate exams or a final exam.

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

**Grading:**

Numerical grading scale 1-5.

**Person responsible:**

Ilkka Lusikka

**Working life cooperation:**

-

**Other information:**

-

**031075P: Calculus II, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies



**Laji:** Course

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

**Opettajat:** Ilkka Lusikka

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay031075P Calculus II (OPEN UNI) 5.0 op

031011P Calculus II 6.0 op

**ECTS Credits:**

5

**Language of instruction:**

Finnish

**Timing:**

Spring, period 3

**Learning outcomes:**

The course gives the basics of theory of series and differential and integral calculus of real and vector valued functions of several variables. After completing the course the student is able to examine the convergence of series and power series of real terms. Furthermore, the student can explain the use of power series e.g. in calculating limits and is able to solve problems related to differential and integral calculus of real and vector valued functions of several variables.

**Contents:**

Sequences, series, power series and Fourier series of real terms. Differential and integral calculus of real and vector valued functions of several variables.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures 28 h / Group work 28 h.

**Target group:**

-

**Prerequisites and co-requisites:**

The recommended prerequisite is the completion of the course Calculus I.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Kreyszig, E.: Advanced Engineering Mathematics; Grossmann, S.I.: Multivariable Calculus, Linear Algebra and Differential Equations.

**Assessment methods and criteria:**

Intermediate exams or a final exam.

**Grading:**

Numerical grading scale 1-5.

**Person responsible:**

Ilkka Lusikka

**Working life cooperation:**

-

**Other information:**

-

**031076P: Differential Equations, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay031076P	Differential Equations (OPEN UNI)	5.0 op
800320A	Differential equations	5.0 op
031017P	Differential Equations	4.0 op

Ei opintojaksokuvauksia.

### **031078P: Matrix Algebra, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

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

**Opettajat:** Matti Peltola

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay031078P	Matrix Algebra (OPEN UNI)	5.0 op
031019P	Matrix Algebra	3.5 op

Ei opintojaksokuvauksia.

### **031021P: Probability and Mathematical Statistics, 5 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Course

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

**Opettajat:** Jukka Kemppainen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay031021P	Probability and Mathematical Statistics (OPEN UNI)	5.0 op
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**ECTS Credits:**

5

**Language of instruction:**

Finnish

**Timing:**

Spring semester, periods 4-6

**Learning outcomes:**

After completing the course the student knows the key concepts of probability and the most important random variables and is able to use them in calculating probabilities and parameters of probability distributions. In addition, the student is able to analyze statistical data by calculating interval and point estimates for the parameters. The student is also able to formulate statistical hypotheses and test them.

**Contents:**

The key concepts of probability, random variable, parameters of probability distributions, estimation of parameters, hypothesis testing.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures 44 h/Exercises 22 h/Self-study 68 h.

**Target group:**

-

**Prerequisites and co-requisites:**

The recommended prerequisites are the course 031010P Calculus I and some parts of the course 031011P Calculus II.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Milton, J.S., Arnold, J.C. (1992): Introduction to Probability and Statistics.

**Assessment methods and criteria:**

Intermediate exams or a final exam.

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

**Grading:**

Numerical grading scale 1-5.

**Person responsible:**

Jukka Kemppainen

**Working life cooperation:**

-

**Other information:**

-

**031022P: Numerical Analysis, 5 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Course

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

**Opettajat:** Marko Huhtanen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5

**Language of instruction:**

Finnish

**Timing:**

Spring semester, periods 4-5

**Learning outcomes:**

The student recognizes what numerical solution methods can be used to solve some specific mathematical problems, can perform the required steps in the numerical algorithm and is able to perform the error analysis.

**Contents:**

Numerical linear algebra. Numerical methods for systems of equations, Basics of the approximation theory. Numerical quadratures. Numerical methods for ordinary and partial differential equations.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures 44 h / Group work 22 h.

**Target group:**

-

**Prerequisites and co-requisites:**

The recommended prerequisite is the completion of the courses Calculus I and II, Differential Equations and Matrix algebra.

**Recommended optional programme components:**

-

**Recommended or required reading:**

J. Douglas Faires and Richar L. Burden, Numerical methods; Alfio Quarteroni, Riccardo Sacco, Fausto Saleri, Numerical mathematics

**Assessment methods and criteria:**

Intermediate exams or a final exam.

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

**Grading:**

Numerical grading scale 1-5.

**Person responsible:**

Marko Huhtanen

**Working life cooperation:**

-

**Other information:**

-

**761113P: Electricity and magnetism, 5 op**

**Voimassaolo:** 01.01.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Physics

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

761119P	Electromagnetism 1	5.0 op
761119P-01	Electromagnetism 1, lectures and exam	0.0 op
761119P-02	Electromagnetism 1, lab. exercises	0.0 op
766319A	Electromagnetism	7.0 op
761103P	Electricity and Magnetism	4.0 op

**ECTS Credits:**

5 credits

**Language of instruction:**

The lectures will be in Finnish. The textbook is in English and exercises are selected from the textbook. For further information, contact the responsible person of the course.

**Timing:**

Spring

**Learning outcomes:**

The student is able to describe the basic concepts of electricity and magnetism and to apply those when solving the problems related to electromagnetism.

**Contents:**

Electromagnetic interaction is one of the four fundamental interactions in physics and many phenomena like light, radio waves, electric current, magnetism and formation of solid matter are based on electromagnetism. The current technological development is largely based on applications of electromagnetism in energy production and transfer, telecommunications and information technology.

*Contents in brief:* Coulomb's law. Electric field and potential. Gauss's law. Capacitors and dielectrics. Electric current, resistors, electromotive force and DC circuits. Magnetic field, motion of a charged particle in electric and magnetic fields, and applications. Ampère's law and Biot-Savart law. Electromagnetic induction and Faraday's law. Inductance and inductors. R-L-C circuits, alternating current and AC circuits.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures 32 h, 6 exercises (12 h), 2 laboratory exercises (8 h), self-study 81 h

**Target group:**

For the students of the University of Oulu.

**Prerequisites and co-requisites:**

Knowledge of vector calculus and basics of differential and integral calculus are needed.

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously

**Recommended or required reading:**

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 13th edition, 2012, chapters 21-31. Also older editions can be used.

Lecture material: Finnish lecture material will be available on the web page of the course.

Course material availability can be checked [here](#).

**Assessment methods and criteria:**

Three mini examinations and end examination or final examination

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

**Grading:**

Numerical grading scale 0 – 5, where 0 = fail

**Person responsible:**

Anita Aikio

**Working life cooperation:**

No work placement period

**Other information:**

<https://wiki oulu.fi/display/761113P/>

*Compulsory*

**761113P-01: Electricity and magnetism, lectures and exam, 0 op**

**Voimassaolo:** 01.01.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Field of Physics

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

761119P	Electromagnetism 1	5.0 op
761119P-01	Electromagnetism 1, lectures and exam	0.0 op
761119P-02	Electromagnetism 1, lab. exercises	0.0 op
766319A	Electromagnetism	7.0 op
761103P	Electricity and Magnetism	4.0 op
761121P	Laboratory Exercises in Physics 1	3.0 op

Ei opintojaksokuvauksia.

**761113P-02: Electricity and magnetism, lab. exercises, 0 op****Voimassaolo:** 01.01.2015 -**Opiskelumuoto:** Basic Studies**Laji:** Partial credit**Vastuuyksikkö:** Field of Physics**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

761119P	Electromagnetism 1	5.0 op
761119P-01	Electromagnetism 1, lectures and exam	0.0 op
761119P-02	Electromagnetism 1, lab. exercises	0.0 op
766319A	Electromagnetism	7.0 op
761103P	Electricity and Magnetism	4.0 op

Ei opintojaksokuvauksia.

**461102A: Statics, 5 op****Voimassaolo:** 01.08.2015 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Field of Mechanical Engineering**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Lahtinen, Hannu Tapio**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

ay461102A	Statics (OPEN UNI)	5.0 op
461016A-01	Statics, examination	0.0 op
461016A-02	Statics, exercises	0.0 op
461016A	Statics	5.0 op

Ei opintojaksokuvauksia.

**780117P: General and Inorganic Chemistry A, 5 op****Voimassaolo:** 01.08.2015 -**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Field of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op
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**ECTS Credits:**

5 credits /134 hours of work

**Language of instruction:**

Finnish

**Timing:**

1st autumn

**Learning outcomes:**

After this course the student should understand basic concepts of chemistry as described in international general chemistry curriculum.

**Contents:**

Basic concepts of chemistry, chemical formula, chemical reaction, chemical equation, oxidation-reduction reactions, stoichiometry, gases, chemical equilibrium, acids and bases, additional aspects of acid-base equilibria, solubility and complex-ion equilibria.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

32 hours of lectures and applications, 20 hours of exercises and 82 hours of self-study

**Target group:**

Biochemistry, Chemistry, Biology, Geology, Mechanical Engineering, Process Engineering, Environmental Engineering compulsory. In the entity of 25 credits (minor studies), compulsory. Physical sciences, Mathematical sciences, optional.

**Prerequisites and co-requisites:**

Upper secondary school chemistry

**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:**

Petrucci, R.H., Herring, F.G., Madura, J.D. ja Bissonnette, C.: General Chemistry: Principles and Modern Applications, 10. edition (also 7., 8. and 9. edition), Pearson Canada Inc., Toronto, 2011. Chapters 1 – 6, 15 – 18.

**Assessment methods and criteria:**

Two intermediate examinations or one final examination Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Lecturer Leena Kaila

**Working life cooperation:**

No

**Other information:**

No

**780123P: Introductory Laboratory Works in Chemistry, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Chemistry

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits /134 hours of work

**Language of instruction:**

Finnish

**Timing:**

1st autumn or 1st spring

**Learning outcomes:**

After this course, the student can apply laboratory safety instructions and act accordingly. He/she can communicate by using basic laboratory terminology and work in a group under the guidance. The student identifies basic laboratory equipment and can use them properly. He/she recognizes the importance of the planning of the laboratory work. The student is able to utilize the basic chemistry techniques and determination methods in the given task. Furthermore, the student can also make laboratory notes and write a report on the performed task.

**Contents:**

Laboratory safety, basic laboratory equipment, basic chemistry techniques and determination methods as well as some of their theoretical background, carrying out chemical synthesis and checking the purity of the product, problems related to the studied determination methods, keeping a laboratory notebook, writing a report.

**Mode of delivery:**

Supervised laboratory work, independently done preparatory problems.

**Learning activities and teaching methods:**

Safety in laboratory 2 hours, 65 hours of laboratory work + demonstrations + problems, 67 hours of self-study.

**Target group:**

Biochemistry, Process Engineering, Environmental engineering, compulsory. In the entity of 25 credits, compulsory. Physical Sciences, Geology, Mathematical Sciences, optional.

**Prerequisites and co-requisites:**

General and Inorganic Chemistry A (780117P, 5 cr) and Introduction to Organic Chemistry (780116P, 5 cr). Student is allowed to participate to the course simultaneously when participating the prerequisites. Attendance at the lecture of Safety in laboratory is compulsory.

**Recommended optional programme components:**

Participation in the courses General and Inorganic Chemistry A (780117P, 5 cr) and Introduction to Organic Chemistry (780116P, 5 cr).

**Recommended or required reading:**

Instruction Book (in Finnish): Kemian perustyöt

**Assessment methods and criteria:**

Accomplishment of the course requires accepted preparatory problems, laboratory exercises, problems related to them and final examination. Laboratory exercises and final examination has to be completed within next two terms.

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

**Grading:**

The course utilizes verbal grading scale pass/fail.

**Person responsible:**

Ph.D. Teija Kangas

**Working life cooperation:**

No

**Other information:**

Attendance at the lecture of Safety at work is compulsory. The exercises must be done before each laboratory assignment. Deadline of the written report is binding. Failure will lead to the renewal of the work.

**491100P: Orientation to OMS studies, 1 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.



**030005P: Information Skills, 1 op****Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Faculty of Technology**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Ursula Heinikoski, Sassali, Jani Henrik**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

030004P Introduction to Information Retrieval 0.0 op

**ECTS Credits:**

1 ECTS credit

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd year

**Learning outcomes:**

Students know the different phases of information retrieval process and basic techniques of scientific information retrieval. They will find the most important reference databases of their discipline and know how to evaluate information sources and retrieval results.

**Contents:**

Retrieval of scientific information, the retrieval process, key databases of the discipline, and evaluation of information retrieval and information sources.

**Mode of delivery:**

Blended teaching: classroom training, web-based learning material and exercises in Optima environment, a final assignment on a topic of the student's own choice

**Learning activities and teaching methods:**

Training sessions 8h, group working 7h, self-study 12h

**Target group:**

Compulsory for all students of the Faculty of Technology, the Faculty of Information Technology and Electrical Engineering and the Faculty of Architecture. In the Faculty of Science compulsory for students of biology, physics, geosciences, chemistry and geography. Optional for students of biochemistry and mathematics.

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Web learning material <https://wiki oulu.fi/display/030005P>.

**Assessment methods and criteria:**

Passing the course requires participation in the training sessions and successful completion of the course assignments.

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

**Grading:**

pass/fail

**Person responsible:**

Science and Technology Library Tellus, tellustieto (at) oulu.fi

**Working life cooperation:**

-

**Other information:**

**902011P: Technical English 3, 6 op****Voimassaolo:** 01.08.1995 -**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Negotiated Education**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** English**Proficiency level:**[CEFR B2 - C1](#)**Status:**

This course is compulsory for the students who have chosen English as their foreign language. (See the foreign language requirements for your own degree programme.)

**Required proficiency level:**

English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise. If you need to take English, but lack this background, please get in touch with the [Languages and Communication contact teacher](#) for your department to discuss individual solutions.

**ECTS Credits:**

6 ECTS credits (The workload is 160 hours.)

STUDENTS OF ENGINEERING: The course consists of 3 x 2-ECTS modules.

STUDENTS OF ARCHITECTURE: The course consists of 2 x 3-ECTS modules.

Students with the matriculation exam grade *Laudatur* or *Eximia cum laude approbatur* will be exempted from part of the course (2 ECTS credits).

**Language of instruction:**

English

**Timing:**

STUDENTS OF ENGINEERING:

PYO, KO, TuTa: *1st & 2nd* years of studies, beginning 1st year autumn.

SO & CSE: 2nd & 3rd years of studies, beginning 2nd year autumn.

STUDENTS OF ARCHITECTURE:

*1st & 2nd* years of studies, beginning 1st year spring and continuing 2nd year autumn.

**Learning outcomes:**

By the end of the course, you will be able to

- demonstrate efficient strategies and methods for developing and maintaining your English proficiency
- communicate using the core vocabulary required for professional language use in your field
- apply language skills, intercultural awareness and presentation techniques necessary for working in a multicultural environment
- use language, culture and communication skills at a B2-C1 CEFR level in accordance with your own professional needs.

**Contents:**

In this course, you will focus on developing oral and written English language skills which enable you to follow developments in your own professional field and manage successfully in an international, intercultural working environment.

STUDENTS OF ENGINEERING:

The course consists of three modules:

1. first, [Professional English for Technology](#) (PET, 2 ECTS credits),
2. then **two modules** (2 ECTS credits each) from a [free-choice module menu, in which each module has its own content](#). These modules allow you to develop further skills in specific core areas. Read the module descriptions with care so that you choose modules which match your own needs, interests and level.

TuTa students, however, take ONE module from the free-choice menu and then, in second year

autumn, the [Business Plan](#) module, which is integrated with a course in their own department ( [555222A Tuotantotalouden harjoitustyöt](#) ) .

**STUDENTS OF ARCHITECTURE:**

The course consists of two modules:

See the course description of each module ( [902011P-38](#) module A and [902011P-39](#) module B for a detailed explanation of the course content.

**Mode of delivery:**

STUDENTS OF ENGINEERING: The mode of delivery varies according to the modules you take. See the course descriptions for the individual modules.

STUDENTS OF ARCHITECTURE: face-to-face teaching in the premises of your own department and independent study

**Learning activities and teaching methods:**

STUDENTS OF ENGINEERING: The teaching methods and learning activities depend on which free-choice modules you choose. See the course descriptions for the individual modules.

**STUDENTS OF ARCHITECTURE:**

The classroom teaching comprises about 50% of the total student workload for the course and includes mini-lectures, group and teamwork, student presentations. The independent work component comprises online work and independent study in preparation for classroom activities.

**Target group:**

Students of the Faculty of Technology

- all Engineering Departments
- the Department of Architecture

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Materials will be provided by the teacher.

**Assessment methods and criteria:**

Assessment methods vary according to the individual modules taken. The assessment criteria are based on the learning outcomes of the module.

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

**Grading:**

pass / fail.

**Person responsible:**

Each department in the Technical Faculty has its own [Languages and Communication contact teacher](#) for questions about English studies.

**Working life cooperation:**

-

**Other information:**

[See the Languages and Communication Study Guide, English, TTK.](#)

**901008P: Second Official Language (Swedish), 2 op**

**Voimassaolo:** 01.08.1995 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Negotiated Education

**Opintokohteen kielet:** Swedish

**Leikkaavuudet:**

ay901008P Second Official Language (Swedish) (OPEN UNI) 2.0 op

**Proficiency level:**

B1/B2/C1 (Common European Framework of Reference)

**Status:**

This course is compulsory to all students except those who have at least 60 ECTS credits of Swedish studies in their degrees. The language proficiency provided by the course unit is equivalent to the language proficiency required of a state official with an academic degree working in a bilingual municipality area (Act 424/03 and Decree 481/03).

According to the requirements of the law, the student must be able to use Swedish both orally and in writing in various professional situations. Achieving this kind of proficiency during a course unit that lasts for only one semester requires that the student has already achieved the necessary starting proficiency level prior to taking the course.

**Required proficiency level:**

The required starting proficiency level for students of all faculties is a grade of 7 or higher from the Swedish studies at secondary school (B-syllabus) or equivalent knowledge AND a passing grade from the proficiency test held at the beginning of the course unit. Based on this proficiency test the students are directed to brush up on their language skills if it is deemed necessary; mastering basic vocabulary and grammar is a prerequisite to achieving the necessary language proficiency for the various communication situations one faces in professional life.

If a student has not completed Swedish studies (B-language) at secondary school with a grade of 7 or higher, or his/her language skills are otherwise lacking, he/she must achieve the required proficiency level BEFORE taking this compulsory Swedish course.

**ECTS Credits:**

2 ECTS credits

**Language of instruction:**

Swedish

**Timing:**

Students of the School of Architecture: autumn term of 1st year of studies

Students of Industrial Engineering and Management : autumn semester of the 2nd year of studies

Students of Process Engineering and Environmental Engineering: autumn or spring semester of the second year of studies

Mechanical Engineering: autumn or spring semester of the third year of studies

The Faculty of Information Technology and Electrical Engineering: Students of Electrical Engineering and Computer Science Engineering: Autumn or spring term of 1st year of studies.

**Learning outcomes:**

Upon completion of the course unit the student should be able to read and understand texts from his/her academic field and make conclusions based on them. The student should be able to write typical professional emails and short reports. He/she should be able to carry himself/herself according to Swedish etiquette when acting as host or guest. The student should also be able to discuss current events and special field-specific matters, use the vocabulary of education and plan and give short oral presentations relating to his/her own field.

**Contents:**

Communicative oral and written exercises, which aim to develop the student's Swedish proficiency in areas relevant to his/her academic field and future professional tasks. The student practises oral presentation and pronunciation. Situational exercises done individually and in pairs and groups. Discussions in small groups. Current texts about the student's special field. Written exercises relating to the student's professional field. Practising presentation skills.

**Mode of delivery:**

Contact teaching

**Learning activities and teaching methods:**

1 x 90 minutes of contact teaching per week and self-directed study, 53 hours per course.

**Target group:**

See Timing

**Prerequisites and co-requisites:**

See Required Proficiency Level

**Recommended optional programme components:**

-

**Recommended or required reading:**

Study material will be provided by the teacher.

**Assessment methods and criteria:**

The course unit focuses on improving both oral and written language skills and requires active attendance and participation in exercises, which also require preparation time. 100% attendance is required. The course unit tests both oral and written language skills.

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

**Grading:**

Oral and written language proficiencies are tested separately and assessed using the so called KORU-criteria (publication of HAMK University of Applied Sciences, 2006). Separate grades will be awarded for the successful completions of both oral and written portions of the course unit: the possible passing grades are **satisfactory skills and good skills** (see language decree 481/03). The grades are based on continuous assessment and testing.

**Person responsible:**

See contact teachers on the Language and Communication home page [http://www oulu.fi /languagesandcommunication/student\\_counselling](http://www oulu.fi /languagesandcommunication/student_counselling)

**Working life cooperation:**

-

**Other information:**

Students sign up for teaching in WebOodi. A student can only sign up for one teaching group. When signing up, it is imperative that the student fills in his/her university email address (paju oulu.fi), major subject and Swedish grades attained during secondary education in the Further Information field. Information in sign-up periods and course unit timetables can be found in WebOodi.

**A439102: Intermediate Studies, Mining Technology and Mineral Processing, 60 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*Intermediate Studies*

**477121A: Particle Technology, 5 op**

**Voimassaolo:** 01.08.2015 - 31.07.2022

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

477120A	Fluid and Particle Engineering	5.0 op
477101A	Fluid and Particle Engineering I	3.0 op

**ECTS Credits:**

5 ECTS / 133 h of work

**Language of instruction:**

Finnish

**Timing:**

Implementation in spring term, period 4

**Learning outcomes:**

Upon completion of the course, a student should be able to identify the mainline mechanical processes in process industry enhancing the degree of upgrading, as well as recovery operations related to those mechanical main processes. The student is able to identify the equipments related to the mechanical processes and can explain their purpose of use and their operational principles.

**Contents:**

Granular material and sampling, particle size and particle size distribution, specific surface area, basics in grinding, crushing, sieving and mineral concentration, froth flotation, mineral concentration methods based on density difference, magnetic concentration and other concentration methods, granulation, separation from suspensions

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

The implementation methods of the course are varying. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works.

**Target group:**

: Bachelor students in process and environmental engineering

**Prerequisites and co-requisites:**

Introduction to process and environmental engineering I (477011P)

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lecture materials and other materials that will be announced at the lectures

**Assessment methods and criteria:**

This course utilizes continuous assessment including lecture diaries and three intermediate exams. Alternatively, the course can also be completed by taking the end exam.

**Grading:**

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

**Person responsible:**

Ari Ämmälä

**Working life cooperation:**

No

**Other information:**

-

**477122A: Bulk Solids Handling, 5 op****Voimassaolo:** 01.08.2015 - 31.07.2023**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Field of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

477120A Fluid and Particle Engineering 5.0 op

477102A Bulk Solids Handling 4.0 op

**ECTS Credits:**

5 ECTS / 133 h of work

**Language of instruction:**

Finnish

**Timing:**

Implementation in period 2 (autumn term)

**Learning outcomes:**

Upon completion of the course, a student should be able to identify auxiliary mechanical unit processes as well as equipments and phenomena related to them. In addition, the student can explain application of unit processes and can describe their operational principles.

**Contents:**

Liquid and suspensions: fluid mechanics, pumping and hydraulic transport, mixing. Gases and aerodispersions: gas dynamics, compression, pneumatic transport. Granular bulk material: properties, storage, mechanical transportation, fluidization.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

The implementation methods of the course vary. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works.

**Target group:**

Bachelor students in process or environmental engineering

**Prerequisites and co-requisites:**

477101A Particle Technology

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lecture materials and other materials that will be announced at the lectures

**Assessment methods and criteria:**

This course utilizes continuous assessment including lecture diaries and three intermediate exams. Alternatively, the course can also be completed by taking the end exam.

**Grading:**

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

**Person responsible:**

Ari Ämmälä

**Working life cooperation:**

No

**Other information:**

-

**461103A: Strength of materials I, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Mechanical Engineering

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

**Opettajat:** Lahtinen, Hannu Tapio

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

461010A-01 Strength of Materials I, examination 0.0 op

461010A-02 Strength of Materials I, exercises 0.0 op

461010A Strength of Materials I 7.0 op

Ei opintojaksokuvauksia.

#### 461106A: Dynamics, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Mechanical Engineering

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

**Opettajat:** Koivurova Hannu

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

461018A-01 Dynamics, examination 0.0 op

461018A-02 Dynamics, exercises 0.0 op

461018A Dynamics 4.0 op

Ei opintojaksokuvauksia.

#### 477401A: Thermodynamic Equilibria, 5 op

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Eetu-Pekka Heikkinen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

470611A Metallurgy Processes 7.0 op

**ECTS Credits:**

5 cr / 135 hours of work

**Language of instruction:**

Available only in Finnish

**Timing:**

The course is given in the autumn semester, during period II. It is recommended to complete the course at the 2nd year of Bachelor's studies.

**Learning outcomes:**

Student is capable of defining chemical equilibria of the systems that are related to industrial processes and understands the relevance of equilibria (and their computational determination) as a part of process analysis, planning and control. Additionally, (s)he can define a meaningful system to be considered in computation thermodynamics; i.e. (s)he can create a computationally solvable problem based on technical problem that in itself is not solvable computationally.

**Contents:**

Concepts of enthalpy (H), entropy (S) and Gibbs free energy (G). The effect of temperature and pressure on H, S and G. Chemical and phase equilibria. Activity and activity coefficient. Calculation of thermodynamic equilibria using equilibrium constant as well as Gibbs free energy minimisation.

**Mode of delivery:**

Classroom education



**Learning activities and teaching methods:**

Lectures, software exercise as well as other exercises. Available only in Finnish.

**Target group:**

Students of process and environmental engineering

**Prerequisites and co-requisites:**

'Basic Principles in Chemistry' and 'Material and Energy Balances' as prerequisites

**Recommended optional programme components:**

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a education that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

**Recommended or required reading:**

Material will be distributed during lectures and exercises.

**Assessment methods and criteria:**

Students are required to make a portfolio consisting of a learning diary and exercises. Please note that the course is organised only in Finnish.

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

**Grading:**

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

**Person responsible:**

University Lecturer Eetu-Pekka Heikkinen

**Working life cooperation:**

No

**Other information:**

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun. Course webpage (in Finnish): <http://www.oulu.fi/pyomet/477401a>.

**477201A: Material and Energy Balances, 5 op**

**Voimassaolo:** 01.08.2005 - 31.12.2019

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Tiina Leiviskä

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

477221A Material and Energy Balances 5.0 op

470220A Fundamentals of Chemical Process Engineering 5.0 op

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

Finnish. The course can be completed in English as a book examination.

**Timing:**

Autumn period 1

**Learning outcomes:**

The student is able to formulate material and energy balances for a process by taking into account the restrictions set by reaction stoichiometry. The student knows how the created mathematical formulation can be exploited in process consideration.

**Contents:**

Formulation of material and energy balances by taking into account the effects of chemical reactions.

**Mode of delivery:**

Lectures and group exercise

**Learning activities and teaching methods:**

Lectures 40h, group work 10h and self-study 80h

**Target group:**

Bachelor students in of Process or Environmental Engineering

**Prerequisites and co-requisites:**

Basics from the course Introduction to Process Engineering

**Recommended optional programme components:**

-

**Recommended or required reading:**

Reklaitis, G.V.: Introduction to Material and Energy Balances. John Wiley & Sons, 1983. ISBN 0-471-04131-9.

**Assessment methods and criteria:**

During the course, there are two intermediate exams and both of them must be passed. Alternatively student can participate in final exam after the course. In addition to this, the students will be making a group exercise, which will be evaluated.

Read more about the course assessment and grading systems of the University of Oulu at [www.oulu.fi/english/studying/assessment](http://www.oulu.fi/english/studying/assessment)

**Grading:**

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

**Person responsible:**

Dr Tiina Leiviskä

**Working life cooperation:**

No

**Other information:**

-

**477222A: Reactor Analysis, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

477202A Reactor Analysis 4.0 op

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

Finnish

**Timing:**

Period 2 (autumn term)

**Learning outcomes:**

By completing the course the student is able to explain the determination methods of the reaction rate from experimental data and he/she can illustrate the basics of deterministic modelling. On that basis, the student has skills to analyse the behaviour of ideal reactors and to perform initial reactor selection and sizing.

**Contents:**

Elementary reactions, kinetics of homogenous reactions. Reaction rate on the basis of experimental data. Modelling of ideal reactors. Yield, selectivity and reactor size. Heuristics for selecting reactor type and operating conditions.

**Mode of delivery:**

Lectures and small group exercises

**Learning activities and teaching methods:**

Lectures 40h and self-study 90h

**Target group:**

Bachelor students in process and environmental engineering, minor subject students

**Prerequisites and co-requisites:**

Objectives of 477201A Material and Energy Balances and 477401A Thermodynamic Equilibrium

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lecture handouts. Levenspiel, O., Chemical Reaction Engineering. John Wiley & Sons, New York, 1972 (Chapters 1-8). Atkins, P.W.: Physical Chemistry, Oxford University Press, 2002. 7th Ed. (Parts) ISBN 0-19-879285-9.

**Assessment methods and criteria:**

Combination of examination and group exercises

**Grading:**

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

**Person responsible:**

University Lecturer Juha Ahola

**Working life cooperation:**

No

**Other information:**

-

**477052A: Fluid Mechanics, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

477301A Momentum Transfer 3.0 op

**ECTS Credits:**

5 ECTS / 133 hours of work.

**Language of instruction:**

Finnish, can be completed in English as a book examination.

**Timing:**

Implementation in spring semester during 3<sup>rd</sup> period. It is recommended to complete the course at the second (Bachelor's) spring semester. The course will be lectured first time in spring 2016.

**Learning outcomes:**

After the course the student is able to determine the viscosity of pure substances and mixtures and to estimate the effect of temperature and pressure on viscosity. The student is able to recognise the

interactions between a solid body and flowing fluid and to distinguish the forces, their directions and to calculate their magnitudes. The student is able to formulate momentum balance equations and to solve these in order to calculate velocity distribution, flow rate and pressure drop. The student is able to distinguish laminar and turbulent flow regimes from others and is able to use the correct equations according to flow regime. After the course the student is able to design pipelines and other simple flow mechanical process equipment.

**Contents:**

Viscosity. Mechanism of momentum transfer. Creating and solving differential momentum balances. Friction factor. Macroscopic balances. Flow in pipes and open-channels.

**Mode of delivery:**

Face-to-face teaching in Finnish. Book examination in English.

**Learning activities and teaching methods:**

Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

**Target group:**

Bachelor's degree students of process and environmental engineering.

**Prerequisites and co-requisites:**

Knowledge of solving differential equations.

**Recommended optional programme components:**

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

**Recommended or required reading:**

Munson, B.R., Young, D.F. & Okiishi, T.H. Fundamentals of Fluid Mechanics.

**Assessment methods and criteria:**

This course utilizes continuous assessment. During the course there are 5 intermediate exams. The course can also be completed by final examination. Read more about the course assessment and grading systems of the University of Oulu at [www.oulu.fi/english/studying/assessment](http://www.oulu.fi/english/studying/assessment).

**Grading:**

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

**Person responsible:**

University teacher Eero Tuomaala

**Working life cooperation:**

No

**Other information:**

-

**477501A: Process dynamics, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Leiviskä, Kauko Johannes

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay477501A Process Control Engineering I 5.0 op

470431A Process Control Engineering I 5.0 op

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

Finnish/English. The main lecturing language is Finnish, but the course can also be taken in English with some special arrangements. Contact the responsible person.

**Timing:**

Negotiable (for the English version)

**Learning outcomes:**

After the course, the student understands the basic principles of dynamical behaviour of different processes, can write dynamic mass and energy balances for unit processes, and can solve these with the help of the transfer function approach. He knows also the connection between process control and process dynamics.

**Contents:**

Basics of process models and dynamics. Dynamic models. Lumped and distributed parameter models. Practical examples of different unit processes such as chemical reactors, distillation columns and heat exchangers. Modelling of large-scale processes.

**Mode of delivery:**

Negotiable (the course can be taken in English with some special arrangements - contact the responsible person)

**Learning activities and teaching methods:**

Solving exercise problems; textbook

**Target group:**

Exchange and other international students (for the English version)

**Prerequisites and co-requisites:**

Courses Material and Energy Balances, Heat Transfer, Mass Transfer and Control System Analysis recommended beforehand

**Recommended optional programme components:**

The course forms a basis to the advanced courses in the field of control engineering

**Recommended or required reading:**

Parts of the textbook used: Luyben, W.L.: Process Modeling, Simulation and Control for Chemical Engineers. McGraw Kogakusha Ltd., Tokyo 1973, 558 pp.

**Assessment methods and criteria:**

Homework and written/oral test

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Person responsible:**

Professor Kauko Leiviskä

**Working life cooperation:**

No

**Other information:**

-

**477502A: Experiment design and analysis, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Aki Sorsa

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

470432A Process Control Engineering II 5.0 op

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

Finnish

**Timing:**

Implementation in the 4th period on the spring term

**Learning outcomes:**

After the course, the student knows different experimental design methods and their applicability for different problems. He can also design experiments for multi-variable processes and analyze the results. He can also use some basic means to visualize the results got from experimental data and choose proper tools for experiment design problems.

**Contents:**

Systematic design of process experiments with matrix techniques (Hadamard, Central Composite Design, Taguchi). Graphical and statistical analysis of experimental data. Correlation, regression and variance analysis. Dynamic data based modelling.

**Mode of delivery:**

Lectures and extensive exercise work

**Learning activities and teaching methods:**

Lectures during one period

**Target group:**

Bachelor's students in process and environmental engineering

**Prerequisites and co-requisites:**

Course Process Dynamics is recommended beforehand

**Recommended optional programme components:**

The course forms a basis to the advanced courses in the field of control engineering

**Recommended or required reading:**

Reading materials. *Additional literature*: Diamond W.J.: Practical Experiment Designs. Lifetime Learning Publications. Belmont, California, 1981. 348 pp.

**Assessment methods and criteria:**

Examination. It is recommended to take the course also according to the principle of continuous evaluation.

**Grading:**

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Person responsible:**

Professor Kauko Leiviskä

**Working life cooperation:**

No

**Other information:**

For exchange/international students also the course 477041S Experimental Design is recommended

#### **493300A: Principles of mineral processing, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Saija Luukkanen

**Opintokohteen kielet:** English, Finnish

**Leikkaavuudet:**

ay493300A Principles of mineral processing (OPEN UNI) 5.0 op

Ei opintojaksokuvauksia.

#### **477716A: Surface Chemistry Principles and Applications in Mineral and Mining Technology, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

477703A Surface Chemistry Principles of Minerals 3.0 op

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

Finnish/English

**Timing:**

In spring period 3. It is recommended to take this course on the 1st year of the Master's degree phase, i.e. the 4th year of all.

**Learning outcomes:**

After completing the course, student can describe mineral engineering processes and unit operations on the basis of physical chemistry. The course introduces students to surface phenomena of physical chemistry.

**Contents:**

Thermodynamic basic equations; chemical interactions, especially those of boundary surfaces; zeta potential, total surface charges; bubbles; surface reagents, etc.

**Mode of delivery:**

Implemented as face-to-face teaching (or by distant learning)

**Learning activities and teaching methods:**

Lectures, exercises

**Target group:**

The students of the Mineral Processing study option in the study programmes Process Engineering or Environmental Engineering

**Prerequisites and co-requisites:**

The Bachelor level studies of 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:**

Materials delivered at the lectures or electronically

**Assessment methods and criteria:**

Scored exercises. Final examination.

**Grading:**

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

**Person responsible:**

Jaakko Rämö (Thule Institute, University of Oulu)

**Working life cooperation:**

No

**Other information:**

Resources allowing, the course is given for the LTU students by an electronic connection (as distant learning)

**A439125: Supplementary Studies, Mining Technology and Mineral Processing, 25 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

*Geology***771113P: Introduction to Geology I, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay771113P Introduction to Geology I (OPEN UNI) 5.0 op

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

1st year autumn

**Learning outcomes:**

Students have an understanding of the basic concepts of the Earth, from its composition and internal *structure* to the geological *processes* that has led to its evolution the present Earth as part of the solar system. They can tell how endogenic processes in the mantle and crust produce magmas and how magmas produce different igneous rock type upon emplacement below and on the Earth's surface. Students are able to recognise and classify common igneous rocks based on their mineral composition and are familiar with common metamorphic rocks and know the metamorphic facies concepts. They can relate deformation and metamorphism of the rocks to plate tectonic processes.

**Contents:**

Evolution of the Earth as part of the solar system, structure and composition of the Earth. Classification of igneous rocks, magmatism, origin and crystallisation of magmas, volcanism, metamorphism and formation of metamorphic rocks, plate tectonics and deformation structures.

**Mode of delivery:**



Face to face

**Learning activities and teaching methods:**

36 h lectures, 6 h exercises

**Target group:**

1st year geoscience students. The course is a good minor subject course for others.

**Prerequisites and co-requisites:**

Basic course in mineralogy (771102P) is parallel to this course.

**Recommended optional programme components:**

This course is intended as an introduction to the scope and methods of igneous and metamorphic petrology.

**Recommended or required reading:**

Martti Lehtinen, Pekka Nurminen and Tapani Rämö (1998) Suomen kallioperä – 3000 vuosimiljoonaa. Suomen Geologinen Seura, Gummerus Jyväskylä, ISBN 952-90-9260-1, Chapters 2-3. John Grotzinger & Thomas H. Jordan (2010 or 2014) Understanding Earth, 6<sup>th</sup> or 7<sup>th</sup> edition, Chapters 1-4, 6-7, 9-10, 12.

**Assessment methods and criteria:**

Written examination and identification test of rock types.

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

*Compulsory*

**771113P-02: Introduction to Geology I, Rock identification, 0 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

**771113P-01: Introduction to Geology I, lectures, 0 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

Ei opintojaksokuvauksia.

**771114P: Introduction to Geology II, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

1st year autumn

**Learning outcomes:**

Upon completion of the course, students should have acquired basic knowledge on the concepts and processes of surficial geology. Students should also be able to identify basic sediment types and soils.

**Contents:**

Basic concepts of surficial physical geology, weathering, erosion, sedimentation, and sediment types, soils and geological processes forming sedimentary deposits.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

16 h lectures, 8 h exercises

**Target group:**

1st year Geoscience students. The course is a good minor subject course for others.

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Handouts and John Grotzinger & Thomas H. Jordan (2010 or 2014) Understanding Earth, 6<sup>th</sup> or 7<sup>th</sup> edition, Chapters 5, 8, 15-21.

**Assessment methods and criteria:**

Obligatory exercises and written examination.

**Grading:**

5-1/fail

**Person responsible:**

Juha Pekka Lunkka and Tiina Eskola

**Working life cooperation:**

No

### **774301A: A Basic Course in Geochemistry, 6 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

1st spring

**Learning outcomes:**

Upon completion of this course, students will have a broad overview of the different fields of geochemistry and be able to relate the behavior of elements to different physico-chemical processes in nature. They will be able to convert geochemical data from one form to another (wt%, molar and cation proportions, milliequivalents), plot these data on different diagrams, and carry out simple mineral dissolution /precipitation and mass balance calculations.

**Contents:**

Geochemistry as a field of science; history of geochemistry; tasks and fields of geochemistry; origin and electron configuration of chemical elements; origins and structure of the Earth; meteorites; the geochemical classification of the elements; composition of earth's different spheres; geochemical differentiation; composition of magmas; dissolution and precipitation of minerals; pH-Eh-diagrams; introduction to isotope geochemistry.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

32 h lectures, 12 h exercises

**Target group:**

All students conducting basic courses in geosciences.

**Prerequisites and co-requisites:**

A basic course in chemistry.

**Recommended optional programme components:**

It is recommended that a basic course in chemistry (e.g. 780117P) has been taken during the previous fall semester.

**Recommended or required reading:**

Gill, Robin, Chemical Fundamentals of Geology, Chapman & Hall, London, 1996, 298 p. And Mason, B. & Moore, C.B.: Principles of Geochemistry, 4th Student Edition, J. Wiley, New York, 1982, p. 187-209. The availability of the literature can be checked from [this link](#).

**Assessment methods and criteria:**

Examination in both theory and calculations.

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

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

**771102P: Basic course in mineralogy, 6 op****Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Pekka Tuisku**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

1st year autumn

**Learning outcomes:**

Students obtain a basic knowledge on mineralogy.

**Contents:**

Crystal, crystal systems, mineral, rocks. Formation of minerals in geological processes, chemical and physical properties of minerals, occurrence and utilization.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

20 h lectures, 16 h exercises. Exercises are compulsory.

**Target group:**

1st year geosciences students.

**Prerequisites and co-requisites:**

No

**Recommended optional programme components:**

-

**Recommended or required reading:**Risto Piispanen ja Pekka Tuisku (2005) Mineralogian perusteet. <http://cc oulu.fi/~petuisku/Mineralogia/MinPer.htm>**Assessment methods and criteria:**

Examination, compulsory exercises

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

1-5/fail

**Person responsible:**

Pekka Tuisku, Jukka Pekka Ranta

**Working life cooperation:**

No

**Other information:**

-

**492300A: Rock mechanics, 5 op****Voimassaolo:** 01.08.2016 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

**A439124: Working Life Studies, Mining Technology and Mineral Processing, 25 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Study module

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

### *Working Life Studies*

#### **555225P: Basics of industrial engineering and management, 5 op**

**Voimassaolo:** 01.01.2014 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Industrial Engineering and Management

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

**Opettajat:** Jukka Majava

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay555225P Basics of industrial engineering and management (OPEN UNI) 5.0 op

555221P Introduction to Production 2.0 op

555220P Basic Course in Industrial Engineering and Management 3.0 op

#### **Language of instruction:**

Finnish. English material is also used.

#### **Timing:**

Periods 1-2.

#### **Learning outcomes:**

Upon completion of the course the student should be able to describe what operations management means. The student can explain the core concepts of business operations and utilize these concepts in describing and analyzing organizational operations. In addition, he/she can explain in general terms the factors that affect economic performance of organizations. The student is able to utilize the terminology used in operations management, describe the financial processes of companies and based on this describe the use of cost accounting in organizational decision-making. The student can also calculate unit costs in various simplified settings, calculate various alternatives, as well as perform planning and goal oriented calculations based on given data, and draw conclusions based on the calculation results.

#### **Contents:**

Operations and productivity, operations strategy, forecasting, cost accounting, investments, sustainability, capacity management, location decisions, layout strategies, human resources management, supply chain management, subcontracting, inventory management, production planning, MRP & ERP, production scheduling, Just-in-Time & Lean operations, maintenance.

#### **Mode of delivery:**

The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

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

Web-based lectures 20 h / exercises 18 h / self-study 96 h.

#### **Target group:**

: Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

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

No prerequisites exist.

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

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555285A Project management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

**Recommended or required reading:**

Lecture and exercise materials. Heizer, J. & Render, B. (2014) Operations management: sustainability and supply chain management, 11th ed. Pearson.

**Assessment methods and criteria:**

This course utilizes continuous assessment. During the course, there are nine mandatory weekly assignments. At least half of the assignments must be passed.

**Grading:**

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

**Person responsible:**

D.Sc. Jukka Majava.

**Working life cooperation:**

No.

**Other information:**

Substitutes courses 555220P Basic Course in Industrial Engineering and Management 3 ECTS cr and 555221P Introduction to Production 2 ECTS cr.

**555265P: Occupational Safety and Health Management, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Industrial Engineering and Management

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

**Opettajat:** Henri Jounila

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

555263A Technology, Society and Work 2.0 op

555260P Basic Course in Occupational Safety and Wellbeing at Work 3.0 op

**Required proficiency level:**

**ECTS Credits:**

5,0 ECTS credits.

**Language of instruction:**

Finnish. English material is also used.

**Timing:**

Periods 3-4.

**Learning outcomes:**

After the course the student is capable of explaining basic terms of occupational safety and health. He/she is able to assess the importance of occupational safety, health and well-being at work. In addition, he/she is able to assess the significance of occupational safety in the improving of productivity and quality. He/she can apply different safety analysis. Upon completion of the course the student is familiar with the core issues of occupational safety and health management.

**Contents:**

Occupational safety and health, safety management, safety culture, laws and standards, hazards and risks, occupational diseases and work accidents, safety analysis, occupational safety at shared industrial work sites, occupational safety card, HSEQ-assessment procedure, other current issues.

**Mode of delivery:**

The tuition will be implemented as face-to-face teaching.

**Learning activities and teaching methods:**

Lectures and assignments 26 h / group work 40 h / self-study 68 h.

**Target group:**

Industrial Engineering and Management, Mechanical Engineering, Process Engineering and Environmental Engineering students.

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lecture materials. Other materials will be defined during the course.

**Assessment methods and criteria:**

The grading is based on the exam (50 % of the grade) and exercises (50 % of the grade).

**Grading:**

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

**Person responsible:**

Henri Jounila

**Working life cooperation:**

No.

**Other information:**

Substitutes courses 555260P Basic Course in Occupational Safety and Wellbeing at Work + 555263A Technology, Society and Work.

**491300A: Practical Training, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 ECTS, 2 months working full-time

**Language of instruction:**

Finnish or English

**Timing:**

Student usually works in summer time.

**Learning outcomes:**

During the practical training the student is exposed to his/her working environment from the point of view of his/her studies and becomes acquainted with one of a possible future job. The student can identify the

problems associated with the working environment and can propose improvements to them. The student will experience points of contact between working life and studies.

**Contents:**

-

**Mode of delivery:**

Working as employee

**Learning activities and teaching methods:**

Suitable areas for practical training are, for example, the mining and metallurgical industry and mining projects

**Target group:**

Bachelor's students in Mining Technology and Mineral Processing

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

-

**Assessment methods and criteria:**

Student has to show original references and leave the application and report to student advisor. In reference must be training time period and duties.

**Grading:**

Verbal scale Passed/Failed

**Person responsible:**

Student advisor Saara Luhtaanmäki

**Working life cooperation:**

Yes

**Other information:**

The objective is to give an overview of the industrial area where the student may possibly work after graduation. Practical training nurtures theoretical study. In addition the training should give the student a general idea about the company and its technical and organizational operations, financial management and supervision. Student training positions often place students in employee-type positions so that the student becomes familiar with practical work, work safety, as well as with the social nature of the working environment. Students will land the jobs themselves.

**900060A: Technical Communication, 2 op**

**Voimassaolo:** 01.08.2005 - 31.07.2021

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Negotiated Education

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay900060A Technical Communication (OPEN UNI) 2.0 op

470218P Written and Oral Communication 3.0 op

**Proficiency level:**

-

**Status:**

This course unit is compulsory for students of Electrical Engineering, Computer Science, Communications Technologies and Engineering Mechanical Engineering, Process and Environmental Engineering.



**Required proficiency level:**

-

**ECTS Credits:**

2 credits

**Language of instruction:**

Finnish

**Timing:**

Electrical Engineering, Computer Science and Engineering and Communications Technologies: 2nd year spring term or 3rd year autumn term or 3rd year spring term.

Mechanical Engineering: 3rd year.

Process and Environmental Engineering: 1 st year spring or autumn term.

**Learning outcomes:**

Upon completion of the course the student should be familiar with the central principles of work and study-related communication, both oral and written, and be able to apply this knowledge in his/her own communication. The student should be able to prepare and give an illustrative and understandable oral presentation on a topic related to his/her own field in a way that suits the audience and the situation. The student should also be able to seek information and report on his/her findings in writing. The student should be able to analyse and assess his/her own writing and the writing of his/her peers. He/she should be able to act in group communication situations in a target-oriented manner. The student should also be able to give and receive constructive criticism.

**Contents:**

Professional communication skills: team writing, the process of writing and its different stages, distinctive features of formal scientific and professional texts, oral communication, preparing an illustrative presentation, methods of convincing one's audience, giving and receiving constructive criticism, the features of a functioning team, the group process and the roles of team members, negotiations and meeting practices.

**Mode of delivery:**

Multimodal teaching

**Learning activities and teaching methods:**

Contact hours ca. 20 h and independent group work or self-study ca. 40 h.

**Target group:**

Bachelors students of Electrical Engineering, Computer Science, Communications Technologies and Engineering Mechanical Engineering, Process and Environmental Engineering.

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Kauppinen, Anneli & Nummi, Jyrki & Savola, Tea: Tekniikan viestintä: kirjoittamisen ja puhumisen käsikirja (EDITA); Nykänen, Olli: Toimivaa tekstiä: Opas tekniikasta kirjoittaville (TEK) and material in Optima study environment.

**Assessment methods and criteria:**

Active participation in contact teaching, independent study and completion of given assignments. Read more about [assessment criteria](#) at the University of Oulu webpage.

**Grading:**

Pass / fail

**Person responsible:**

Kaija Oikarainen

Toropainen, Outi

**Working life cooperation:**

-

**Other information:**

All students are required to attend the first meeting of the course unit so the work groups can be formed and work started in a timely and efficient manner. When signing up for the course unit, you should keep in mind that completing it requires a responsible attitude and a strong commitment to the work because the teamwork-based exercises rely heavily on the participation and activity of the students.

If the student is involved in the University's student associations or functions in a position of trust in university government, student union administration or Oulun Teekkariyhdistys ry (or in its subordinate guilds), he/she may be relieved of some of the group communication exercises. These compensatory actions must always be agreed upon separately with the course unit's teacher. The student must present an official statement from a person in charge of the governing body or association, which details the student's tasks and involvement with that body or association. Participation that took place over five years ago does not entitle the student to any compensation.

#### **491302A: Bachelor's thesis, 8 op**

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish, English

Ei opintojaksokuvauksia.

#### **491303A: Maturity test, 0 op**

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

## **Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset**

### **762361A: An intermediate level course from another Finnish university, 0 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

Variable credits

**Contents:**

Courses taken at other Finnish universities.

**Person responsible:**

Elena Kozlovskaya

**762363A: An intermediate level course from another university abroad, 0 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**Voidaan suorittaa useasti:** Kyllä**ECTS Credits:**

Variable credits

**Contents:**

Courses taken, e.g., during international exchange programs (Erasmus, Nordplus, etc.).

**Person responsible:**

Elena Kozlovskaya

**772682S: Applied Field Techniques in Economic Geology, 5 op****Voimassaolo:** 01.08.2012 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Pertti Sarala**Opintokohteen kielet:** English**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

Students will be able to describe and classify the different dispersion processes of the chemical elements in different environments. They are able to choose the most appropriate sampling and analysis methods to carry out an exploration program.

**Contents:**

The course includes the basic principles of exploration geochemistry and the use of surficial deposits in ore exploration. The dispersion mechanisms of elements in different environments are described. The use of the fine fraction and heavy minerals of surficial deposits will be included in the course contents. It also provides an introduction to the sampling in the field using different drilling techniques and discusses the main analysis techniques.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures, 30 h exercises

**Target group:**

Masters students and PhD students in geology.

**Prerequisites and co-requisites:**

Bachelor's degree and Ore geology (772385A).

**Recommended optional programme components:**

Other courses in the International Master programme.

**Recommended or required reading:**

Rose, Hawkes & Webb: Geochemistry in Mineral Exploration. Academic Press. G.J.S. Govett (Ed.): Handbook of Exploration Geochemistry, volumes 1-6. 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

**772631S: Archean Geology, 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:**

Students will have gathered a thorough understanding of the geology and mineral deposits of Archean terranes in Fennoscandia and are able to draw comparisons to Archean terranes elsewhere in the world. Students understand the origins of life on the planet, and implications on geological processes.

**Contents:**

Evolution of the Earth's early crust, associated mineralisation processes, and emergence of life. Particular focus is placed on Fennoscandia, Kaapvaal, Yilgarn, Pilbara, Superior, and Greenland.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures, given by staff of Oulu University and selected invited speakers.

**Target group:**

Masters and PhD students in Geosciences.

**Prerequisites and co-requisites:**

Bachelor of Science degree

**Recommended or required reading:**

Lehtinen, M., Nurmi, P. and Rämö, T. (2005) Precambrian Geology of Finland, Elsevier (Developments in Precambrian Geology). Windley B.F. (1995) The Evolving Continents, John Wiley and Sons.

"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

**772613S: Bedrock geology of Finland, 6 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

After the course students should 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. Emphasis on Paleoproterozoic rocks (there is a separate course on Archean bedrock).

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 40 h

**Target group:**

Master's and PhD students in geology.

**Prerequisites and co-requisites:**

Studies equivalent to Bachelor's degree.

**Recommended or required reading:**

Lehtinen, M., Nurmi, P. ja Rämö, T. (2005) Precambrian Geology of Finland. 736 p. Elsevier.

Additional material delivered during the course.

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

**Assessment methods and criteria:**

Examination/Essay

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

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

## 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

**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 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

After completing the course, students can describe and assess environmental problems associated with metal mining. They are familiar with the chemical and mineralogical phenomena related to acid mine drainage and know how to test the acid-producing or -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

**Learning activities and teaching methods:**

28 h lectures

**Target group:**

Master's students in geology and mineralogy and other students interested in environmental issues.

**Prerequisites and co-requisites:**

Basic course in geochemistry (774301A), also recommended Introduction to Environmental Geochemistry (774329A).

**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 literature can be checked from [this link](#).

**Assessment methods and criteria:**

Written examination/essay

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

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

**772621S: Geology of alkaline rocks, carbonatites and kimberlites, 5 op****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:**

Upon completion of the course, students are familiar with the occurrence, composition and genesis of alkaline rocks, carbonatites and kimberlites and can assess their economic potential.

**Contents:**

Occurrence of alkaline rocks, carbonatites and kimberlites and their mineralogy, petrography, geochemistry, petrogenesis and economic geology.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

24 h lectures

**Target group:**

Master's and PhD students in geology.

**Prerequisites and co-requisites:**

Igneous petrology (772341A), Ore geology (772385A).

**Recommended optional programme components:**

Other courses in the International Master programme.

**Recommended or required reading:**

Lehtinen, M., Nurmi, P. & T. Rämö (Eds.) (2005) Precambrian Geology of Finland - Key to the evolution of the Fennoscandian Shield. Elsevier, Amsterdam. Mitchell, R.H. (1986) Kimberlites; Mineralogy, Geochemistry and Petrology, 442 p.

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:**

Hugh O'Brien

**Working life cooperation:**

No

**762322A: Geomagnetism, 5 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish (optionally English)

**Timing:**

4. - 5. year

**Learning outcomes:**

Upon the completion of the course, a student

- can describe how and where the Earth's magnetic field is generated
- can describe the reasons for the temporal and spatial variations of the geomagnetic field
- can describe how the geomagnetic field is described mathematically and physically
- can identify the instruments used in geomagnetic research on ground and in space
- can describe the magnetic field of other planets and the Sun and how the Sun interacts with the Earth's magnetic field
- can describe methods used to investigate Earth's electrical conductivity and magnetic susceptibility
- can define and discuss on the role of palaeomagnetism in the Earth sciences
- can list major phases and inventions in the history of geomagnetic research

**Contents:**

Introduction. History of geomagnetism. Origin of the Earth's magnetic field and its present state. Magnetometers. Temporal and spatial variations of the geomagnetic field. Mathematical representation of Earth's magnetic field. Magnetic field of the Sun and other planets in our solar system. Magnetic properties of Earth materials. Geomagnetic methods. Palaeomagnetism.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures 24 h, homework exercises 12 h, self-study 97 h

**Target group:**

Primarily for the students of the degree programme in physics. Also for the other students of the University of Oulu.

**Prerequisites and co-requisites:**

No specific prerequisites

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously

**Recommended or required reading:**

Handouts. Jacobs, J.A., (ed.), 1987: Geomagnetism. Vols 1-4; Merrill, R.T., McElhinny, M.W. & McFadden, P.L., 1996: The Magnetic field of the Earth: Paleomagnetism, the core and the deep mantle.

Course material availability can be checked [here](#).**Assessment methods and criteria:**

Examination (form to be selected during the course)

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

Numerical grading scale 0 – 5, where 0 = fail

**Person responsible:**

Toivo Korja

**Working life cooperation:**

No work placement period

**Other information:**<https://wiki oulu.fi/display/762322A/>**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:**

-

## 772687S: Gold deposits, 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:**

The students know the distribution of the major gold deposits in Finland and elsewhere, they comprehend the main models of ore formation, and can formulate criteria relevant in exploration for the various types of gold deposits.

**Contents:**

Distribution and petrogenesis of gold deposits globally.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 30h, microscopy exercises

**Target group:**

Masters students and PhD students in geology.

**Prerequisites and co-requisites:**

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

**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.

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

**Assessment methods and criteria:**

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

**Grading:**

5-1/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No

## 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 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

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 petrogenesis 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 Geology 100<sup>th</sup> 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/fai

**Person responsible:**

N.N.

**Working life cooperation:**

No

## 762103P: Introduction to geophysics, 2 op

**Voimassaolo:** 01.08.2009 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

762104P-01 Introduction to solid earth geophysics (part 1): Introduction to geophysics 0.0 op

**ECTS Credits:**

2 credits

**Language of instruction:**

Finnish (It is possible to accomplish the course in English, although all the lectures will be given in Finnish).

**Timing:**

1. year, autumn fall

**Learning outcomes:**

Upon the completion of the course, a student

- can describe the structure of the Earth and its neighbouring environment in space (spheres), their internal geophysical properties and the interactions between different spheres
- can describe large scale transport (movement) of rock material inside the Earth and on its surface (convection, plate tectonics) and give physical and geological reasons for transport
- can describe the position and role of geophysics in the field of the Earth system sciences
- can list major unsolved global research problems in the Earth system sciences
- can name major geophysical research methods

**Contents:**

See [762104P](#)

**Person responsible:**

Toivo Korja

## 762107P: Introduction to global environmental geophysics, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2nd or 3rd spring

**Learning outcomes:**

After the course the student can define and explain the physical principles of global environmental issues and the use of geophysical methods in local environmental studies.

**Contents:**

An overview of the physical principles of global environmental issues and the use of geophysical methods in environmental case studies. The structure of the Earth and its geophysical processes: solid earth, oceans, atmosphere, glaciers, groundwater, nuclear waste disposal and natural disasters. Follow-up measurements of environment. Principles of modeling the environment: the Earth as a system. Climate change and its consequences.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures and practicals totalling 40 h plus independent study 93 h.

**Target group:**

The course is suitable for students of the Oulu Mining School, Faculty of Science and the Faculty of Technology  
Obligatory for students of geophysics in the B.Sc. degree.

**Prerequisites and co-requisites:**

No particular pre-requisites

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously.

**Recommended or required reading:**

Lecture notes and Kakkuri, J. & Hjelt, S.-E., 2000: Ympäristö ja geofysiikka and applicable parts of the following:  
Houghton, J., 2004: Global warming: The complete briefing (3rd ed.).

**Assessment methods and criteria:**

Examination and approved practicals

**Grading:**

Numerical grading scale 0 – 5, where 0 = fail

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No work placement period

**Other information:**

<https://noppa oulu.fi/noppa/kurssi/762107p/etusivu>

**762193P: Introduction to hydrology and hydrogeophysics, 4 op****Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Oulu Mining School**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish (It is possible to accomplish the course in English, although all the lectures and exercises will be given in Finnish).

**Timing:**

The course is not lectured any more.

**Learning outcomes:**

Upon the completion of the course, a student

- can define the concept of a water cycle, can name the elements of the cycle, can identify their physical basis and can estimate the magnitude of different components using the water balance equation
- can name and distinguish the principles of the methods used to observe evaporation, precipitation and runoff, and summarize their spatial and temporal variation in Finland

- can describe the behaviour of underground water in vadoze zone and aquifers and can define how the groundwater is formed and how it flows
- can name major geophysical methods used in groundwater research and exploration

**Contents:**

See [762306A](#)

**Person responsible:**

Toivo Korja

**774637S: Isotope geochemistry for economic geologists, 6 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** English

**ECTS Credits:**

6 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

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

**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

**Learning activities and teaching methods:**

32 h lectures, 16 h computer exercises

**Target group:**

Master's students in geology and mineralogy.

**Prerequisites and co-requisites:**

Ore geology (772385A).

**Recommended or required reading:**

Faure, G. (1986) Principles of Isotope Geology. 2nd edition, J. Wiley & Sons, New York, p. 1-423. Dickin, A.P. (2005) Radiogenic Isotope Geology, 2nd edition, Cambridge University Press, 492 p. Journal articles given during the course.

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

**Assessment methods and criteria:**

Examination on theory+essay and calculations as homework.

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

**Grading:**

5-1/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

**772628S: Layered intrusions and their ore deposits, 5 op**

**Voimassaolo:** 01.08.2009 -

**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:**

By the end of this course, students should have an understanding of the origin of igneous layering, the processes that control the generation and emplacement of the magmas, and the formation of the ore deposits associated with layered intrusions. Students will be able to compare layered igneous bodies to the world's main layered intrusions (notably Bushveld Complex, Great Dyke, Stillwater Complex, Skaergaard Monchegorsk and Panzhihua) in terms of stratigraphy, petrogenesis and mineralization potential. In particular, students will be able to assess the economic potential of Finnish layered intrusions.

**Contents:**

Layered intrusions in space and time, mineralogy, petrology, stratigraphy and ore-forming processes in layered intrusions. Examination of rock textures and mineralogy under the microscope and exploration modeling.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

30 h lectures, 12 h exercises

**Target group:**

Masters students and PhD students in geology.

**Prerequisites and co-requisites:**

Igneous petrology (772341A), Ore geology (772385A)

**Recommended or required reading:**

Cawthorn, R.G. (1996) Layered Intrusions. Elsevier, 531 p., Parsons, I. (Ed.) (1987) Origins of Igneous Layering. NATO ASI series, Series C, Mathematical and physical sciences; vol. 196. D. Reitel Publishing Company, Dordrecht, Holland.

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:**

Sheng-Hong Yang

**Working life cooperation:**

No

## 774629S: Literature essay, 4 - 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th year

**Learning outcomes:**

Students will be able to search for geochemical data from the literature, related a particular geological or geochemical problem, and write a logical synthesis on the subject.

**Contents:**

Independent literature search and writing of an essay on a given topic.

**Mode of delivery:**

Personal tuition

**Learning activities and teaching methods:**

Independent work

**Target group:**

Master geosciences students. Suitable also for chemistry students

**Prerequisites and co-requisites:**

Geoscience students need to have passed the Basic course in geochemistry (774301A) at least one intermediate- or advanced-level geochemistry course.

**Recommended or required reading:**

Will be informed separately

**Assessment methods and criteria:**

Essay

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

**Grading:**

Pass/fail

**Person responsible:**

E. Hanski

**Working life cooperation:**

No

## 772615S: Literature study, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

Students acquire deep knowledge on a particular geology and mineralogy topic.

**Contents:**

Independent literature search and writing of an essay on a given theme.

**Mode of delivery:**

Independent work and personal tuition.

**Target group:**

Master's students

**Prerequisites and co-requisites:**

Bachelor's degree

**Recommended optional programme components:**

Will be informed separately.

**Recommended or required reading:**

Will be informed separately.

**Assessment methods and criteria:**

Report

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



**Grading:**

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

**772666S: Master's thesis, 30 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

35 credits

**Language of instruction:**

Finnish, English

**Timing:**

5th year

**Learning outcomes:**

Upon completing a Master's thesis, students will gain advanced understanding on a subject belonging economic geology or geology and mineralogy in generally. They will be able to use and apply pertinent research methods and theoretical knowledge of their research field, make independent inferences from their observations and measurements, and utilise effectively scientific literature.

**Mode of delivery:**

Students carry out a personal research project, which is normally based field and/or laboratory work, and they write a Master's thesis (pro gradu) on the results. The topic of the thesis is agreed with the supervisor from the department and with other potential internal or external supervisors. Personal guidance is given by the supervisor (s) during the research and writing stage. The official reviewers of the thesis are decided by the chair of the educational programme board of the department after the proposal of the professor of the discipline and the thesis is accepted and rated by the educational programme board.

**Target group:**

All Master's level geoscience students.

**Prerequisites and co-requisites:**

Sufficient amount of intermediate- and advanced-level courses to enable the student to start independent research work.

**Recommended or required reading:**

Reading is decided separately in each case.

**Assessment methods and criteria:**

Thesis

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

**Grading:**

5-1/fail

**Person responsible:**

Professors, lecturers

**Working life cooperation:**

Yes (commonly)

## 772608S: Mining geology, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay772608S Mining geology (OPEN UNI) 3.0 op

**ECTS Credits:**

3 credits

**Language of instruction:**

English

**Timing:**

4th or 5th year

**Learning outcomes:**

Students learn practical aspects of the work of mining geologists. Students will be equipped to perform the basic tasks of mining geology.

**Contents:**

Lectures on various aspects of mining, underground and surface visits to mining operations and processing plant, exercises including logging and GIS applications. The course will be arranged with an industry partner. Previous partners include Pyhäsalmi Cu-Zn Mine and Suurikuusikko gold mine.

**Mode of delivery:**

Face to face on a mine site.

**Learning activities and teaching methods:**

40 h lectures, mine visits and exercises.

**Target group:**

Master students in geology.

**Prerequisites and co-requisites:**

Hydrothermal Ore Deposits (772672S), Magmatic Ore Deposits (772671S).

**Recommended optional programme components:**

Other courses in International Master programme.

**Recommended or required reading:**

Will be given on site.

**Assessment methods and criteria:**

Report.

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

**Grading:**

Pass/fail

**Person responsible:**

Eero Hanski

**Working life cooperation:**

No

## 772689S: Nickel deposits of the Fennoscandian Shield, 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 of the course, students should know the geology, petrogenesis, and geophysical signatures of the major Ni deposits in Finland and Fennoscandia. Major deposits covered include the Finnish Ni belt, Kevitsa, Pechenga, Mochegorsk, Outokumpu and Talvivaara. Students will be able to compare the Fennoscandian deposits to Ni deposits elsewhere in the world, and to compile key targeting criteria for exploration.

**Contents:**

Geology and petrogenesis of Ni deposits of the Fennoscandian Shield.

**Mode of delivery:**

Face to face

**Learning activities and teaching methods:**

Lectures 30 h, microscopy exercises 12 h.

**Target group:**

Master's and PhD students in geology.

**Prerequisites and co-requisites:**

Igneous petrology (772341A), Ore geology (772385A).

**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.

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:**

Examination

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

**Grading:**

5-1/fail

**Person responsible:**

N.N.

**Working life cooperation:**

No

## 762352A: Practical training, 5 op

**Voimassaolo:** 01.08.2009 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

English or Finnish

**Timing:**

M.Sc. studies

**Learning outcomes:**

In practical training, a student is introduced to working life in geophysics. After training, the student can recognize the skills and demands of the job and can define need for the selection of the content of studies.

**Contents:**

The student works at least eight weeks in a company or institute acting in the field of geophysics. The employer must be accepted in advance in the discussions with the responsible person of the course.

**Mode of delivery:**

Training (minimum 2 months)

**Learning activities and teaching methods:**

A written report

**Target group:**

Recommended for M.Sc. students in geophysics

**Prerequisites and co-requisites:**

No specific prerequisites

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously

**Recommended or required reading:**

No specific material

**Assessment methods and criteria:**

Report

**Grading:**

Scale pass/fail

**Person responsible:**

Toivo Korja

**Working life cooperation:**

Work placement period

## 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

## 772693S: Sedimentary 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 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.

**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:**

N.N.

**Working life cooperation:**

No

## 762321A: Seismology and the structure of the earth, 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

English

**Timing:**

3rd -5th year

**Learning outcomes:**

After this course student can explain the seismic wave phenomena, the wave propagation, and the difference and significance of different seismic waves related to the investigation of the Earth's structure. Student can define and explain basic theory and terminology behind seismic wave observations, analysis and interpretation. Student can analyze earthquake fault plane solutions and seismograms. Student can describe seismic methods used for investigating the Earth. He can define Earth's seismic structure, analyze results of seismic investigations and distinguish between different plate tectonic areas from seismic viewpoint.

**Contents:**

This course focuses in the fundamentals of the most important methods for investigating the Earth's deep structure, seismological and seismic methods. Course starts with some history of seismology, theory of wave motion, seismic waves, their propagation and properties. Seismic ray, raytracing and travel time inversion. Seismic registrations and the Earth's deep structure. Location and magnitudes of earthquakes and fault plane solution. The structure of crust, mantle and core in the light of seismic research. The relationship between seismology and plate tectonics and seismic soundings in the Finland and the Europe.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures 30 h, exercises 15 h, self-study 88 h

**Target group:**

Optional for students of Geophysics. Recommend for everyone interested in understanding the principles of the most important method in studying the interior of earth.

**Prerequisites and co-requisites:**

No specific prerequisites

**Recommended optional programme components:**

No alternative course units or course units that should be completed simultaneously

**Recommended or required reading:**

Lecture notes. Selected parts: Stein, S. and Wysession, M., 2003: An introduction to seismology, earthquakes, and earth structure. Shearer, P.M., 1999: Introduction to seismology. Bolt, B.A., 1999: Inside the Earth. Evidence from earthquakes; Bullen, K.E. & Bolt, B.A., 1985: An introduction to the theory of seismology.

**Assessment methods and criteria:**

One written examination

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

**Grading:**

Numerical grading scale 0 – 5, where 0 = fail

**Person responsible:**

Elena Kozlovskaya

**Working life cooperation:**

No work placement period

**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

## 762192P: Solid Earth Geophysics, 3 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish (It is possible to accomplish the course in English, although all the lectures and exercises will be given in Finnish).

**Timing:**

1. year, autumn term

**Learning outcomes:**

Upon the completion of the course, a student

- can name major geophysical research methods, describe their physical basis and name the research targets both in global and applied geophysics

- can describe Earth's large scale internal structure and a detailed local structure of the Fennoscandian lithosphere (crust, upper mantle)

**Contents:**

See [762104P](#)

**Person responsible:**

Toivo Korja

## 772658S: Special issues in geology and mineralogy, 1 - 9 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Eero Hanski

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

5 credits.

**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 geology and mineralogy. The students will have gained a deeper understanding of specific aspects of the subject.

**Contents:**

A course on a current topic given by a staff member or outside lecturer. Topics include economic geology, petrology, and mineralogy

**Mode of delivery:**



Face to face teaching

**Learning activities and teaching methods:**

30 h lectures and 10 h practical work consisting of examination of rock samples, maps or working with digital data.

**Target group:**

Masters and PhD students in geology

**Prerequisites and co-requisites:**

Bachelor in geology

**Recommended or required reading:**

Will be informed separately.

**Assessment methods and criteria:**

Examination

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

**Grading:**

1-5/fail

**Person responsible:**

W. Maier

**Working life cooperation:**

No

## 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:**

-

## **772690S: Studies in other universities and colleges, 0 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

Course dependent.

**Contents:**

Courses taken in international exchange programs (Erasmus, Nordplus) or courses taken in other Finnish universities.

**Assessment methods and criteria:**

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

**Person responsible:**

Professors