

# Opasraportti

## Open University - Engineering, manufacturing and construction (2019 - 2020)

### Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

466106S: Advanced topics on design of steel structures, 6 op  
 ay466106S: Advanced topics on design of steel structures (OPEN UNI), 6 op  
 ay462113S: Advanced topics on mechatronics and machine diagnostics (OPEN UNI), 5 op  
 488204S: Air Pollution Control Engineering, 5 op  
 488214S: Air Pollution Control Engineering - Practical Solutions, 5 op  
 771117P: Basic course in mineralogy, 5 op  
 780397A: Chemistry for Teachers, 5 op  
 ay780397A: Chemistry for Teachers (OPEN UNI), 5 op  
 782338A: Chemistry in Industrial Applications, 5 op  
 ay782338A: Chemistry in Industrial Applications (OPEN UNI), 5 op  
 477128S: Circular Bioeconomy, 5 op  
 466105S: Design of Steel Structures, 6 op  
 ay466105S: Design of Steel Structures (OPEN UNI), 6 op  
 488231S: Environmental Chemistry and Ecology, 5 op  
 ay781309A: Environmental Chemistry for Chemistry Teachers, 5 op  
 ay488201A: Environmental Ecology (OPEN UNI), 5 op  
 780117P: General and Inorganic Chemistry A, 5 op  
 ay780117P: General and Inorganic Chemistry A (OPEN UNI), 5 op  
 780118P: General and Inorganic Chemistry B, 5 op  
 ay780118P: General and Inorganic Chemistry B (OPEN UNI), 5 op  
 477416S: High temperature processes, 5 op  
 451535P: History of Architecture I, lecture course, 4 op  
 451534P: History of Architecture I, lecture course, 5 op  
 451537A: History of Architecture II, lecture course, 3 op  
 451504A: History of Architecture III, 3 op  
 450547A: Indesign Basics, 1 op  
 488203S: Industrial Ecology, 5 op  
 ayA440190: Industrial Engineering and Management (IEM) Minor Subject Studies (OPEN UNI), 25 op

#### *Compulsory*

ay555225P: Basics of industrial engineering and management (OPEN UNI), 5 op  
 ay555285A: Project management (OPEN UNI), 5 op  
 ay555286A: Process and quality management (OPEN UNI), 5 op  
 ay555264P: Managing well-being and quality of working life (OPEN UNI), 5 op  
 ay555242A: Product development (OPEN UNI), 5 op  
 488215S: Industry and Environment, 5 op  
 477129S: Inorganics Materials in Circular Economy, 5 op  
 ay802136P: Introduction to Cryptography, 2 op  
 771113P: Introduction to Geology I, 5 op  
 771114P: Introduction to Geology II, 5 op  
 780116P: Introduction to Organic Chemistry, 5 op  
 ay780116P: Introduction to Organic Chemistry (OPEN UNI), 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  
 491101P: Introduction to mining, 5 op  
 491102P: Introduction to solid earth geophysics, 5 op  
 477221A: Material and Energy Balances, 5 op  
 ay477221A: Material and Energy Balances (OPEN UNI), 5 op  
 ay477231A: Material and Energy Balances I (OPEN UNI), 2 op  
 ay477232A: Material and Energy Balances II (OPEN UNI), 3 op  
 450541A: Photoshop, Advanced Photomanipulation, 2 op  
 ay493300A: Principles of mineral processing (OPEN UNI), 5 op  
 492300A: Rock mechanics, 5 op  
 461102A: Statics, 5 op  
 ay461102A: Statics (OPEN UNI), 5 op  
 455511P: Visual Arts I, 5 op  
 455512P: Visual Arts II, 3 op

## Opintojaksojen kuvaukset

### Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

#### **466106S: Advanced topics on design of steel structures, 6 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Mechanical Engineering

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

**Opettajat:** Kangaspuoskari, Matti Johannes

**Opinto-kohteen kielet:** Finnish

**Leikkaavuudet:**

ay466106S	Advanced topics on design of steel structures (OPEN UNI)	6.0 op
460128S-01	Advanced Course in Design of Steel Structures I, examination	0.0 op
460128S-02	Advanced Course in Design of Steel Structures I, exercise work	0.0 op
460128S	Advanced Topics on Design of Steel Structures I	4.0 op

**ECTS Credits:**

6 ECTS

**Language of instruction:**

Finnish

**Timing:**

Periods 3 and 4

**Learning outcomes:**

After completing the course the student is capable of explain the performance and design principles of welded steel structures exposed to fatigue loading. He is able to design the plated structural elements and cold-formed members. He is able to analyze and design a steel frame. He is able to analyze dynamically loaded structures and can explain the effect of vibration on steel structures strength and reliability.

**Contents:**

The following topics are covered during the course: Steel structure under fatigue load. Fracture toughness. Stability and bracing of a steel frame building. Fire design. Plated structural elements with stiffeners. Elements resistance to transverse forces. Cold-formed members. Mechanical vibrations. Seismic design. Chimneys. Crane supporting structures. Accidental design situations and progressive collapse.

**Mode of delivery:**

Face-to-face.

**Learning activities and teaching methods:**

Lectures and exercises 52 h. Self-study 110 h. Total 162 h = 6 ECTS Credits.

**Target group:**

Major students in Structural Engineering, Mashine design, and Engineering Mechancs. 466102A

**Prerequisites and co-requisites:**

460117A Introduction to Structural Design and 466105S Design of Steel Structures. Key notes in courses Statics, Strength of Materials I, Strength of Materials II, Mechanics of materials and Mechanical Vibrations.

**Recommended or required reading:**

Lecture notes (in Finnish). Eurocodes 1990-1999.

**Assessment methods and criteria:**

Three midterm exams or one final exam is required. One design exercise is required.

**Grading:**

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

**Person responsible:**

Matti Kangaspuoskari

### **ay466106S: Advanced topics on design of steel structures (OPEN UNI), 6 op**

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opettajat:** Kangaspuoskari, Matti Johannes

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

466106S Advanced topics on design of steel structures 6.0 op

### **ay462113S: Advanced topics on mechatronics and machine diagnostics (OPEN UNI), 5 op**

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

462115S Tolerance Design 5.0 op

462113S Advanced topics on mechatronics and machine diagnostics 5.0 op

### **488204S: Air Pollution Control Engineering, 5 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Tiina Laitinen, Esa-Matti Turpeinen, Satu Pitkäaho

**Opintokohteen kielet:** English

**Leikkaavuudet:**

ay488204S Air Pollution Control Engineering (OPEN UNI) 5.0 op  
 488213A Sources and control of air pollution 5.0 op  
 480380S Air Protection Techniques 5.0 op

**ECTS Credits:**

5 ECTS credits / 135 hours of work

**Language of instruction:**

English

**Timing:**

Course 488214S Air Pollution Control Engineering - Practical Solutions, 5 cr, replaces this course in academic year 2019-2020.

**Learning outcomes:**

Student is able to explain what kind of air emissions originate from certain industries and power plants, and can explain their effects on environment and health. He/she can describe how air emissions are measured. Student is also aware of common air pollution control systems for different emissions (particulates, VOCs, SO<sub>2</sub>, NO<sub>x</sub>) and is able to design air pollution cleaning devices. In addition, the student is able to describe the main laws related to air emission control.

**Contents:**

Atmosphere and air pollutants. Air pollution effects and regulations. Emission measurements. General ideas in air pollution control. Emission control technologies; primary particulates, VOC emissions, SO<sub>x</sub> emissions, NO<sub>x</sub> emissions. Motor vehicle problem, CO, lead, HAP, Indoor air pollution, and radon.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures 30 h, exercises 12 h, homework 8 h, teamwork presentations 10 h, and self-study 75.

**Target group:**

Master's degree students of the Process and Environmental Engineering study programmes.

**Prerequisites and co-requisites:**

The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II (or 477013P Introduction to Process and Environmental Engineering) and 780109P Basic Principles in Chemistry recommended beforehand.

**Recommended optional programme components:**

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**Recommended or required reading:**

Materials in the Optima environment. de Nevers; N.: Air Pollution Control Engineering. 2nd ed. McCraw-Hill 2000. 586 pp

*Additional literature:* Singh, H. B.: Composition, Chemistry, and Climate of the Atmosphere. New York 1995. 527 pp.; Bretschneider, B. & Kurfurst, J.: Air Pollution Control Technology. Elsevier, Amsterdam 1987. 296 pp.; Hester, R. E. & Harrison, R. M.: Volatile Organic Compound in the Atmosphere. Issues in Environmental Science and Technology. Vol. 4. Bath 1995; Hester, R. E. & Harrison, R. M.: Waste Incineration and the Environment. Issues in Environmental Science and Technology. Vol 4. Bath 1995.

**Assessment methods and criteria:**

Written final exam or intermediate exams.

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:**

Postdoctoral researcher Satu Pitkäaho

**Working life cooperation:**

No

**Other information:**

Korvautuu poikkeuksellisesti lukuvuonna 2019-2020 uudella kurssilla 488214S Air pollution control engineering – practical solutions.

**488214S: Air Pollution Control Engineering - Practical Solutions, 5 op**

Voimassaolo: 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Satu Pitkäaho

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS credits / 135 hours of work

**Language of instruction:**

English

**Timing:**

Implementation in autumn semester during 2 nd period first time in Autumn term 2021.

**Learning outcomes:**

Student is able to explain what kind of air emissions originate from different industrial and energy production sectors. Student deepens knowledge obtained in 488213A course and is able to apply it to different practical emission problems. She/he is able to comprehensively describe, choose, design and optimize emission control technologies. Student understands essential regulations and laws concerning emission control.

**Contents:**

Principles of air pollution control equipment and their use in real applications. Emission control case studies in industry and energy production sector. Air pollution related regulations and laws.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

Lectures 30 h, exercises 12 h, homework 8 h, teamwork presentations 10 h, and self-study 75.

**Target group:**

Master's degree students of the Process and Environmental Engineering study programmes.

**Prerequisites and co-requisites:**

488213A Ilmansuojelutekniikan perusteet

**Recommended optional programme components:**

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**Recommended or required reading:**

Materials in the Optima environment. de Nevers; N.: Air Pollution Control Engineering. 2nd ed. McCraw-Hill 2000. 586 pp

Additional literature: Singh, H. B.: Composition, Chemistry, and Climate of the Atmosphere. New York 1995. 527 pp.; Bretschneider, B. & Kurfurst, J.: Air Pollution Control Technology. Elsevier, Amsterdam 1987. 296 pp.; Hester, R. E. & Harrison, R. M.: Volatile Organic Compound in the Atmosphere. Issues in Environmental Science and Technology. Vol. 4. Bath 1995; Hester, R. E. & Harrison, R. M.: Waste Incineration and the Environment. Issues in Environmental Science and Technology. Vol 4. Bath 1995.

**Assessment methods and criteria:**

Written final exam or intermediate exams.

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:**

Satu Pitkäaho ja Esa Turpeinen

**Working life cooperation:**

No.

**Other information:**

Korvaa lukuvuonna 2019-2020 kurssin 488204S Air Pollution Control Engineering.

## 771117P: Basic course in mineralogy, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Pekka Tuisku

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 ects

**Person responsible:**

Pekka Tuisku

## 780397A: Chemistry for Teachers, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Chemistry

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

**Opettajat:** Teija Kangas

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780397A Chemistry for Teachers (OPEN UNI) 5.0 op

**ECTS Credits:**

5 credits / 135 hours of work

**Language of instruction:**

Finnish

**Timing:**

2nd – 5th year, spring

**Learning outcomes:**

After this course the student should understand the importance of the experiments in the teaching of chemistry. Student should also be able to design demonstrations and laboratory experiments suitable in different levels of learning.

**Contents:**

The course familiarize the students with the experimental works in the schools. Basic concepts in chemistry are revised in the same time.

**Mode of delivery:**

Face-to-face teaching, compulsory.

**Learning activities and teaching methods:**

30 hours of laboratory work (compulsory), 105 hours self-study.

**Target group:**

Students in the teacher specialisation lines, optional

**Prerequisites and co-requisites:**

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**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:**

Material handed out by the the teacher.

**Assessment methods and criteria:**

Practical laboratory work and home work done and reported.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Teija Kangas

**Working life cooperation:**

No

## ay780397A: Chemistry for Teachers (OPEN UNI), 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780397A Chemistry for Teachers 5.0 op

**ECTS Credits:**

5 credits / 135 hours of work

**Language of instruction:**

Finnish

**Timing:**

2nd – 5th year, spring

**Learning outcomes:**

After this course the student should understand the importance of the experiments in the teaching of chemistry. Student should also be able to design demonstrations and laboratory experiments suitable in different levels of learning.

**Contents:**

The course familiarize the students with the experimental works in the schools. Basic concepts in chemistry are revised in the same time.

**Mode of delivery:**

Face-to-face teaching, compulsory.

**Learning activities and teaching methods:**

30 hours of laboratory work (compulsory), 105 hours self-study.

**Target group:**

Students in the teacher specialisation lines, optional

**Prerequisites and co-requisites:**

-

**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:**

Material handed out by the the teacher.

**Assessment methods and criteria:**

Practical laboratory work and home work done and reported.

**Grading:**

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

**Person responsible:**

Teija Kangas

**Working life cooperation:**

No

## 782338A: Chemistry in Industrial Applications, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Chemistry

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay782338A Chemistry in Industrial Applications (OPEN UNI) 5.0 op

782638S Chemistry in Industrial Applications 5.0 op

Ei opintojaksokuvauksia.

## ay782338A: Chemistry in Industrial Applications (OPEN UNI), 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

782338A Chemistry in Industrial Applications 5.0 op

Ei opintojaksokuvauksia.

## **477128S: Circular Bioeconomy, 5 op**

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Elisa Koivuranta

**Opintokohteen kielet:** English

**Leikkaavuudet:**

ay477128S Circular Bioeconomy (OPEN UNI) 5.0 op

477125S Recycling of bioproducts 5.0 op

477106S Recycled Fiber Processes 3.0 op

**ECTS Credits:**

5 cr

**Language of instruction:**

English

**Timing:**

Implementation in the spring period 3.

**Learning outcomes:**

Upon completion of the course, a student should be able to recognize the incentives for the recycling of bioproducts and residues from forest industry. Student is familiarized with circular bioeconomy at the state-of-art level. Student is able to identify the challenges (properties, transportation ect.) of raw materials and their processing, can propose solutions and has ability to review the sustainability of final products.

**Contents:**

Reuse, recycling and utilization of bioproducts and side streams of forest industry in accordance with principles of circular bioeconomy. The properties and processing of raw material. Novel applications in circular bioeconomy.

**Mode of delivery:**

Lectures, group meetings and project work.

**Learning activities and teaching methods:**

Work load in the course is totally 133h. The number of lectures can vary but project working is main activities in the course.

**Target group:**

Students interested in circular bioeconomy.

**Prerequisites and co-requisites:**

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lecture materials and other materials that will be announced at the lectures.

**Assessment methods and criteria:**

The assignment and seminar. More information about assessment methods is given during the course.

**Grading:**



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

**Person responsible:**

Elisa Koivuranta

**Working life cooperation:**

Visiting lecturers from the industry, when feasible.

**Other information:**

This Course replace course 477125S Recycling of bioproducts, 5 cr.

## 466105S: Design of Steel Structures, 6 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Mechanical Engineering

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

**Opettajat:** Kangaspuoskari, Matti Johannes

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

485118S	Design of Steel Structures	5.0 op
ay466105S	Design of Steel Structures (OPEN UNI)	6.0 op
460127S-01	Design of Steel Structures, examination	0.0 op
460127S-02	Design of Steel Structures, exercise work	0.0 op
460125A	Introduction to Design of Steel Structures	4.0 op
460125A-01	Introduction to Design of Steel Structures, examination	0.0 op
460125A-02	Introduction to Design of Steel Structures, exercise work	0.0 op
460127S	Design of Steel Structures	4.0 op

**ECTS Credits:**

6 ECTS

**Language of instruction:**

Finnish

**Timing:**

Periods 1 and 2

Course 485108A replaces this course in academic year 2021-2022.

**Learning outcomes:**

After completing the course the student is capable of explaining the crystalline structure of steel material and he understands elasto-plastic material model. He is able to explain the effect of inclusions, heat treatment and welding process to the mechanical properties of a steel material. The student is familiar with fire design of steel structures. He is able to explain common types of corrosion. The student is able to design the most typical joints in a steel frame and he can analyze simple steel structures. He is also able to analyze stability problems and explain the effects of imperfections and second order effects on frame behavior and member forces.

**Contents:**

The following topics are covered during the course: Ferrous metals and their properties. Principles of Eurocodes. Design of simple steel structure under base loading cases and loading combinations. Corrosion. Design of joints in steel structures. Composite structures with steel member. Section classification. Effective cross-section. Cross-sections with stiffeners. Steel members in bending and axial compression. Buckling, lateral torsional buckling, and torsion.

**Mode of delivery:**

Face-to-face.

**Learning activities and teaching methods:**

Lectures and exercises 52 h. Self-study 110 h. Total 162 h = 6 ECTS Credits.

**Target group:**

Major students in Structural Engineering and Construction Technology, Mashine design, and Engineering Mechancs.

**Prerequisites and co-requisites:**

466102A Introduction to Structural Design. Key notes in courses Statics, Strength of Materials I, Strength of Materials II, Energy principles and Their Use in Beam Structures, and Plates and Shells and Mechanics of materials

**Recommended or required reading:**

Lecture notes (in Finnish). Eurocodes 1990-1999.

**Assessment methods and criteria:**

Three midterm exams or one final exam is required. One design exercise is required.

**Grading:**

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

**Person responsible:**

Matti Kangaspuoskari

**ay466105S: Design of Steel Structures (OPEN UNI), 6 op**

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opettajat:** Kangaspuoskari, Matti Johannes

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

466105S Design of Steel Structures 6.0 op

**488231S: Environmental Chemistry and Ecology, 5 op**

**Voimassaolo:** 01.08.2018 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Väisänen, Virpi Maria

**Opintokohteen kielet:** English

**Leikkaavuudet:**

ay488231S Environmental Chemistry and Ecology (OPEN UNI) 5.0 op

**ECTS Credits:**

5 ECTS credits / 135 hours of work

**Language of instruction:**

English

**Timing:**

A 10 week intensive course is arranged twice per year: in the autumn semester and in the spring semester. For further information concerning the schedule please contact the teachers.

**Learning outcomes:**

Upon completion of the course, the student has an understanding of the multidisciplinary nature and concept of the current environmental problems through the lens of (1) environmental chemistry and (2) environmental ecology. In addition, the student is able to consider how the circular economy tools can be applied to prevent and minimize environmental impacts.

**Contents:**

A project work focusing on four major environmental concerns is done in groups of 4-5 students. In addition to the project work, there are individual course tasks.

**Mode of delivery:**

Online studies.

**Learning activities and teaching methods:**

Project work 100 h / Self-study 35 h

**Target group:**

Students in all disciplines

**Assessment methods and criteria:**

Project work and individual tasks will be assessed. Assessment criteria are based on the learning outcomes of the course. 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 utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**

University lecturer Minna Tiainen and university teacher Virpi Väisänen

**ay781309A: Environmental Chemistry for Chemistry Teachers, 5 op**

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

781309A Environmental Chemistry 5.0 op

**ECTS Credits:**

5 ECTS credits / 135 hours of work

**Timing:**

The course is held in the autumn semester

**Learning outcomes:**

Upon completion the student should have understanding of twelve principles of green chemistry. The student should have acquired an understanding of chemistry of atmosphere, hydrosphere and terrestrial environment. The student is acquainted with the limitations of the use of dangerous chemicals and is able to find updated information of them.

**Contents:**

Fundamentals of environmental chemistry; chemistry of the soil, natural and waste waters and atmosphere, circulation of chemical compounds in the nature, chemical releases, environmentally toxic and other noxious compounds, environmental analytics and basics of physical measurements. Environmental friendly chemistry.

**Mode of delivery:**

Web-based teaching, with face-to-face meetings at the beginning and end of the course

**Learning activities and teaching methods:**

50 hours of the activating learning methods, portfolio work 20h, self-study 64 h. During the course, participants will design and implement a teaching session with materials distributed to all participants.

**Target group:**

The course is aimed at secondary school and high school natural science teachers, the course is also suitable for biology and geography teachers.

**Recommended optional programme components:**

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

**Assessment methods and criteria:**

Portfolio and project work.

50 hours of the activating learning methods, portfolio work 20h, self-study 64 h. During the course, participants will design and implement a teaching session with materials distributed to all participants.

**Grading:**

The course utilizes verbal grading scale "Pass/ Fail"

**Working life cooperation:**

Students can use their outputs in their own teaching work

**ay488201A: Environmental Ecology (OPEN UNI), 5 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** English

**Leikkaavuudet:**

488201A Environmental Ecology 5.0 op

**ECTS Credits:**

5 cr

**Language of instruction:**

English

**Timing:**

4th and 5th period

**Learning outcomes:**

The student is able to define the basic concepts of environmental ecology. He/she has knowledge about the state of the environment and is able to explain the essential environmental problems and the main effects of pollution. In addition, the student knows some solutions to environmental problems and is aware of ethical thinking in environmental engineering. The student also has basic knowledge about toxicology and epidemiology.

**Contents:**

Principles of environmental ecology. Roots of environmental problems. Global air pollution: ozone depletion, acid deposition, global warming and climate change. Water pollution, eutrophication, overexploitation of ground and surface water. Main effects of pollution and other stresses. Non-renewable and renewable energy. Energy conservation and efficiency. Hazardous and solid waste problem. Principles of toxicology, epidemiology, and risk assessment. Environmental ethics.

**Mode of delivery:**

distance teaching

**Learning activities and teaching methods:**

E-learning in the Optima learning environment.

**Target group:**

Master's degree students of the Department of Process and Environmental Engineering

**Prerequisites and co-requisites:**

The courses 477011P Introduction to Process Engineering and 488011P Introduction to Environmental Engineering recommended beforehand

**Recommended or required reading:**

Chiras D.: Environmental Science: Creating a Sustainable Future. New York, Jones and Bartlett Publishers, 2001, Materials in the Optima environment

**Assessment methods and criteria:**

Exercises and exam.

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

**Grading:**

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

**Person responsible:**

Rauli Koskinen

**Working life cooperation:**

No

## 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:**

780120P	Basic Principles in Chemistry	5.0 op
ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op
780115P	General and Inorganic Chemistry II	6.0 op
780114P	General and Inorganic Chemistry I	6.0 op
780113P	Introduction to Chemistry	12.0 op
780102P	Introduction to Inorganic Chemistry	5.0 op
780109P	Basic Principles in Chemistry	4.0 op

**ECTS Credits:**

5 credits / 134 hours of work

**Language of instruction:**

Finnish

**Timing:**

1st autumn

**Learning outcomes:**

After this course, the student:

- can explain organic and inorganic chemistry fundamentals, basic concepts and terminology.
- 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 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:**

-

**Recommended or required reading:**

Petrucci, R.H., Herring, F.G., Madura, J.D. ja Bissonnette, C.: General Chemistry: Principles and Modern Applications, 11. edition (also 7., 8., 9. ja 10. edition), Pearson Canada Inc., Toronto, 2017. Chapters 1-6, 14.2, 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:**

Johanna Havia

**Working life cooperation:**

No

**Other information:**

No

**ay780117P: General and Inorganic Chemistry A (OPEN UNI), 5 op**

**Voimassaolo:** 01.01.2016 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780117P	General and Inorganic Chemistry A	5.0 op
780114P	General and Inorganic Chemistry I	6.0 op
780115P	General and Inorganic Chemistry II	6.0 op
780113P	Introduction to Chemistry	12.0 op
780101P	Introduction to Physical Chemistry	7.0 op
780102P	Introduction to Inorganic Chemistry	5.0 op
780109P	Basic Principles in Chemistry	4.0 op

**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 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:**

N.N.

**Working life cooperation:**

No

**Other information:**

No

**780118P: General and Inorganic Chemistry B, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Chemistry

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780118P	General and Inorganic Chemistry B (OPEN UNI)	5.0 op
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780114P	General and Inorganic Chemistry I	6.0 op
780115P	General and Inorganic Chemistry II	6.0 op
780113P	Introduction to Chemistry	12.0 op
780101P	Introduction to Physical Chemistry	7.0 op
780102P	Introduction to Inorganic Chemistry	5.0 op

**ECTS Credits:**

5 ECTS credits / 134 hours of work

**Language of instruction:**

Finnish

**Timing:**

1st autumn

**Learning outcomes:**

After this course, the student:

- can explain inorganic chemistry fundamentals, basic concepts and terminology
- understand basic concepts of chemistry as described in international general chemistry curriculum.

**Contents:**

Thermodynamics, reaction kinetics, electrochemistry, electrons in atoms, periodic table, chemical bond, intermolecular forces.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

36 hours of lectures and applications, 22 hours of exercises, 76 hours of self-study

**Target group:**

Biochemistry, Chemistry, 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:**

-

**Recommended or required reading:**

Petrucci, R.H., Herring, F.G., Madura, J.D. ja Bissonnette, C.: General Chemistry: Principles and Modern Applications, 11. edition (also 7., 8., 9. ja 10. edition), Pearson Canada Inc., Toronto, 2017. Chapters 7-11.1-11.7, 12.1, 13, 19-20.

**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:**

Matti Niemelä

**Working life cooperation:**

No

**Other information:**

No

**ay780118P: General and Inorganic Chemistry B (OPEN UNI), 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780118P	General and Inorganic Chemistry B	5.0 op
780114P	General and Inorganic Chemistry I	6.0 op

780115P	General and Inorganic Chemistry II	6.0 op
780113P	Introduction to Chemistry	12.0 op
780101P	Introduction to Physical Chemistry	7.0 op
780102P	Introduction to Inorganic Chemistry	5.0 op

**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:**

Thermodynamics, reaction kinetics, electrochemistry, electrons in atoms, periodic table, chemical bond, intermolecular forces.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

36 hours of lectures and applications, 22 hours of exercises, 82 hours of self-study

**Target group:**

Biochemistry, Chemistry, 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:**

-

**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 7 – 12.1, 12.5 – 12.7, 14, 19 – 20.

**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:**

N.N.

**Working life cooperation:**

No

**Other information:**

No

**477416S: High temperature processes, 5 op**

**Voimassaolo:** 28.11.2016 - 31.07.2022

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Eetu-Pekka Heikkinen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

477427A High temperature processes 5.0 op

ay477416S High temperature processes (OPEN UNI) 5.0 op

**ECTS Credits:**



5 cr / 135 hours of work.

**Language of instruction:**

Finnish

**Timing:**

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

**Learning outcomes:**

Students passing the course are familiar with the metal production processes and metallurgical unit operations. Additionally, students know how to evaluate high temperature processes from different perspectives (energy and reductants, refractory materials, slags and ashes, waste and emissions as well as automation, measurements and modelling).

**Contents:**

The most important pyrometallurgical unit operations and other high temperature processes as well as things that need to be taken into account when considering high temperature processes (e.g. energy and reductants, refractory materials, slags and ashes, waste and emissions as well as automation, measurements and modelling).

**Mode of delivery:**

Classroom education

**Learning activities and teaching methods:**

Lectures (approximately 45 hours) supporting the exercises that are made during the course. Only in Finnish.

**Target group:**

Students of process metallurgy.

**Prerequisites and co-requisites:**

Knowledge and skills corresponding the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering are recommended as prerequisites. In order to get credits from this course, bachelor thesis must be completed.

**Recommended optional programme components:**

This course is one of the courses of pyrometallurgy in the module of process metallurgy.

**Recommended or required reading:**

Material will be distributed during lectures and exercises. It is also available via courses www-site. Each student is required to search additional material for the exercises when necessary.

**Assessment methods and criteria:**

Continuous assessment consisting of exercises that are made during the course. Please note that the course is organised only in Finnish.

**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:**

The course includes a seminar day organized together with industry.

**Other information:**

Although it is not required to participate on lectures, it is highly recommended that the students are active and do the required exercises from the very beginning of the course due to continuous assessment used in this course.

## 451535P: History of Architecture I, lecture course, 4 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu School of Architecture

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

**Opettajat:** Petri Vuojala

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay451535P History of Architecture I, lecture course (OPEN UNI) 4.0 op

**ECTS Credits:**

4 ECTS

**Language of instruction:**

Finnish

**Timing:**

Autumn term I and 2

**Learning outcomes:**

After completing the course the student can evaluate the interaction between style periods of European architectural history, technical development and social changes. The student can classify the different eras and recognize their most significant buildings and architects. After the course the student can interpret the classical language of architecture the classical grammar of architecture, as well as recognize the historical layers of built environment.

**Contents:**

Lectures discuss the general history of architecture and discipline of styles from prehistory until the end of 18<sup>th</sup> century and introduce old building methods like brickwork bonds and traditional vault constructions.

**Mode of delivery:**

Lectures, additionally independent studies

**Learning activities and teaching methods:**

Lessons 56 hrs

**Target group:**1<sup>st</sup> year Bachelor level students**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

Course is combined to exercises (451536P)

**Recommended or required reading:**

Handouts, digital slides. A literature list will be delivered during the course.

**Assessment methods and criteria:**

Assessment is based on attendance, learning diary or written examination.

**Grading:**

1-5

**Person responsible:**

Professor Anna-Maija Ylimaula, University lecturer N.N.

**Working life cooperation:**

-

**Other information:**

-

**451534P: History of Architecture I, lecture course, 5 op****Voimassaolo:** 01.08.2019 - 31.07.2020**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Oulu School of Architecture**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Petri Vuojala**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

**451537A: History of Architecture II, lecture course, 3 op****Voimassaolo:** 01.08.2015 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Oulu School of Architecture**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Petri Vuojala**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay451537A History of Architecture II, lecture course (OPEN UNI) 3.0 op

**ECTS Credits:**

3

**Language of instruction:**

Finnish (literature partly in English)

**Timing:**

Spring term I and 2

**Learning outcomes:**

During the course the student learns to recognize the historical roots of the contemporary architecture and recount the development up to today. Having completed the course, the student recognizes the most essential phenomena and styles of 19th and 20th century architecture and can reflect own personal views on contemporary architecture.

**Contents:**

Course discusses the general history of architecture of 19th and 20th centuries.

**Mode of delivery:**

Lectures, additionally independent studies.

**Learning activities and teaching methods:**

Lectures 48 hrs

**Target group:**

1st year Bachelor's level students

**Prerequisites and co-requisites:**

History of architecture I, lecture course (451535P)

**Recommended optional programme components:**

Course is combined to practices (451538A)

**Recommended or required reading:**

Handouts, digital slides. A literature list will be handed out during the course

**Assessment methods and criteria:**

Assessment is based on attendance, learning diary or written examination

**Grading:**

1-5

**Person responsible:**

Dos. Petri Vuojala

**Working life cooperation:**

-

**Other information:**

-

**451504A: History of Architecture III, 3 op**

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu School of Architecture

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

**Opettajat:** Petri Vuojala

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay451504A History of Architecture III (OPEN UNI) 3.0 op

**ECTS Credits:**

3

**Language of instruction:**

Finnish (literature in English and Swedish)

**Timing:**

Autumn term 2 and spring term I

**Learning outcomes:**

The aim is to provide basic knowledge on the history of the Scandinavian and Finnish architecture from the prehistory until the 20th century.

After completing the course the student masters the historical background of the architecture of Finland and Scandinavia starting from pre-historical times. The student recognizes the temporal and stylistic layers of the history of our building tradition and is able to explicate features of Finland's architectural evolution in a relation with the international development and especially in correlation to Sweden and the other Nordic countries.

**Contents:**

Lecture discusses the history of architecture in Scandinavia and especially in Finland from prehistory till 20th C.

**Mode of delivery:**

Lectures, additionally independent studies.

**Learning activities and teaching methods:**

Lectures 36 h

**Target group:**

3rd year Bachelor level students.

**Prerequisites and co-requisites:**

History of architecture I and II, lecture courses ( 451535P and 451537A )

**Recommended optional programme components:**

The course is related to the History of Architecture III, practices course (451505A). Together with the Architecture III, practices course, this course can form the Bachelor's diploma work (8 ECTS) of the Bachelor's degree.

**Recommended or required reading:**

Handouts, digital slides. A literature list will be handed out during the course.

**Assessment methods and criteria:**

Assessment is based learning diary or written examination.

**Grading:**

1-5

**Person responsible:**

Professor Anna-Maija Ylimaula, University lecturer N.N.

**Working life cooperation:**

-

**Other information:**

-

## 450547A: Indesign Basics, 1 op

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu School of Architecture

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

**Opettajat:** Asko Leinonen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay450547A Indesign Basics (OPEN UNI) 1.0 op

**ECTS Credits:**

1

**Language of instruction:**

Finnish

**Timing:**

workshop-type weekend course, the course is organized at most once per academic year.

**Learning outcomes:**

Students master the basic page layout features and understand the possibilities of the software. Students are able to produce pages ready for release combining visual and textual material from various sources.

**Contents:**

Placing formatted text and pictures, page layout and PDF publishing.

**Mode of delivery:**

workshop

**Learning activities and teaching methods:**

Contact teaching 16 h, independent exercises 11 h.

**Target group:**

-  
**Prerequisites and co-requisites:**

-  
**Recommended optional programme components:**

-  
**Recommended or required reading:**

Software help files

**Assessment methods and criteria:**

Based on a project work (the presentation material of a design course at the Oulu School of Architecture or an equivalent work).

**Grading:**

1-5

**Person responsible:**

n.n.

**Working life cooperation:**

Students will learn to use the basic skills of Adobe InDesign publishing software and apply those skills in hands-on work. Students can use style settings in InDesign to make well controlled text and graphic layouts.

**Other information:**

Basic features of page layout in Indesign.

The course is intended for registered students of the Oulu School of Architecture only.

## 488203S: Industrial Ecology, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Väisänen, Virpi Maria

**Opintokohteen kielet:** English

**Leikkaavuudet:**

ay488203S Industrial Ecology and Recycling 5.0 op

480370S Industrial Ecology and Recycling 5.0 op

**ECTS Credits:**

5 ECTS credits / 135 hours of work

**Language of instruction:**

English

**Timing:**

Implementation in autumn semester during 1<sup>st</sup> period.

**Learning outcomes:**

Upon completion of the course, the student will be able to use the tools of industrial ecology and apply them to industrial activity. The student can also analyze the interaction of industrial, natural and socio-economic systems and able to judiciously suggest changes to industrial practice in order to prevent negative impacts. The student can also analyze the examples of industrial symbioses and eco-industrial parks and able to specify the criteria of success for building eco-industrial parks.

**Contents:**

Material and energy flows in economic systems and their environmental impacts. Physical, biological and societal framework of industrial ecology. Industrial metabolism, corporate industrial ecology, eco-efficiency, dematerialization. Tools of industrial ecology, such as life-cycle assessment, design for the environment, green chemistry and engineering. Systems-level industrial ecology, industrial symbioses, eco-industrial parks.

**Mode of delivery:**

Face-to-face teaching in English.

**Learning activities and teaching methods:**

Lectures 30 h / Group work 30 h / Self-study 75 h. The exercises are completed as guided group work.

**Target group:**

Master's degree students of process and environmental engineering.

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Lecture notes; Graedel T.E & Allenby B.R.: Industrial Ecology. New Jersey: Prentice Hall, 2003.

**Assessment methods and criteria:**

All students complete the course in a final exam. Also the exercise will be assessed. The assessment criteria are based on the learning outcomes of the course.

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

**Person responsible:**

University teacher Virpi Väisänen

**Working life cooperation:**

No

**Other information:**

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**ayA440190: Industrial Engineering and Management (IEM) Minor Subject Studies (OPEN UNI), 25 op**

**Voimassaolo:** 01.01.2014 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Study module

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

A440190 Industrial Engineering and Management (IEM) Minor Subject Studies 25.0 op

*Compulsory*

**ay555225P: Basics of industrial engineering and management (OPEN UNI), 5 op**

**Voimassaolo:** 01.01.2014 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opettajat:** Jukka Majava

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

555225P Basics of industrial engineering and management 5.0 op

**ay555285A: Project management (OPEN UNI), 5 op**

**Voimassaolo:** 01.01.2014 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opettajat:** Kirsi Aaltonen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

555288A	Project Management	5.0 op
555285A	Project management	5.0 op

**ay555286A: Process and quality management (OPEN UNI), 5 op****Voimassaolo:** 01.01.2014 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** University of Oulu, Open University**Arvostelu:** 1 - 5, pass, fail**Opetus suunnattu:** University of Oulu, Open University**Opettajat:** Osmo Kauppila**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

555286A	Process and quality management	5.0 op
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**ay555264P: Managing well-being and quality of working life (OPEN UNI), 5 op****Voimassaolo:** 01.01.2014 -**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** University of Oulu, Open University**Arvostelu:** 1 - 5, pass, fail**Opetus suunnattu:** University of Oulu, Open University**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

555264P	Managing well-being and quality of working life	5.0 op
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**ay555242A: Product development (OPEN UNI), 5 op****Voimassaolo:** 01.01.2014 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** University of Oulu, Open University**Arvostelu:** 1 - 5, pass, fail**Opetus suunnattu:** University of Oulu, Open University**Opettajat:** Kai Hänninen**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

555242A	Product development	5.0 op
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**488215S: Industry and Environment, 5 op****Voimassaolo:** 28.06.2019 -**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opintokohteen kielet:** English

**Leikkaavuudet:**

477334S	Industrial activities and environment	5.0 op
ay488215S	Industry and Environment (OPEN UNI)	5.0 op
488221S	Environmental Load of Industry	5.0 op
488205S	Environmental Load of Process Industry	4.0 op

**ECTS Credits:**

5 cr / 135 hours of work

**Language of instruction:**

English

**Timing:**

This course will teach first time in Autumn 2020. This course replaces course 488221S Environmental Load of Industry.

**Learning outcomes:**

The student is able to identify the essential features of the environmental load in different types of (chemical, wood, metallurgical,...) industry. He/she is able to explain the type, quality, quantity and sources of the emissions. The student is familiarized with the main emission control systems and techniques in different industrial sectors. The student can explain the environmental management system of an industrial plant and is able to apply it to an industrial plant.

**Contents:**

Effluents: types, quality, quantity, sources. Unit operations in managing effluents, comprehensive effluent treatment. Environmental management systems, environmental licences, environmental reporting and BAT.

**Mode of delivery:**

Face-to-face teaching.

**Learning activities and teaching methods:**

Lectures 40 h, self-study 93h.

**Target group:**

Master's degree students of the Process and Environmental Engineering study programmes.

**Prerequisites and co-requisites:**

The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II, 488204S Air Pollution Control Engineering and 488110S Water and Wastewater Treatment recommended beforehand.

**Recommended or required reading:**

Material represented in lectures and in the Optima environment.

**Assessment methods and criteria:**

Written final exam or a learning diary.

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:**

Doctoral student Niina Koivikko

**Working life cooperation:**

No.

**Other information:**

The course mainly consists of specific lectures presented by experts who are invited from industry.

This course will teach as online course in Fitech in Spring Term 2020.

## **477129S: Inorganics Materials in Circular Economy, 5 op**

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Elisa Koivuranta



**Opintokohteen kielet:** English

**Leikkaavuudet:**

ay477129S Inorganics Materials in Circular Economy (OPEN UNI) 5.0 op

**ECTS Credits:**

5 cr

**Language of instruction:**

Finnish, English

**Timing:**

Spring 2020

**Learning outcomes:**

Upon completion of the course, a student explains the main incentives, possibilities, challenges and barriers behind the utilization of high-volume industrial residues. Student is familiarized with environmental and legislative aspects related to utilization of industrial residues. The student can identify customer needs and plan new business while taking the limitations set by the environmental and legislative aspects and the industrial residue into account.

**Contents:**

Properties, processing, and utilization potential of industrial residues in various applications. Specific focus in novel large-scale applications. An overview of regulatory aspects related to waste utilization. Environmental and safety aspects of materials. Product development in the context of industrial residues.

**Prerequisites and co-requisites:**

Not limited to certain degree programs.

**Assessment methods and criteria:**

Group work and final seminar.

**Grading:**

Pass/Fail

**Person responsible:**

Elisa Koivuranta

**Working life cooperation:**

Visiting lectures from the industry.

## ay802136P: Introduction to Cryptography, 2 op

**Voimassaolo:** 01.01.2020 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 ECTS

**Language of instruction:**

Finland

**Learning outcomes:**

After completing the course, student

- knows the principles of some traditional symmetric key methods
- is familiar with the possibility to use and apply number theory in cryptography

**Contents:**

The course considers some traditional symmetric key methods.

**Mode of delivery:**

Independent work

**Learning activities and teaching methods:**

Net course; Lecture slides, exercises, solutions of exercises (in Moodle)

**Target group:**

Upper secondary school students

**Prerequisites and co-requisites:**

Number theory and proving (MAA11)

**Recommended optional programme components:**

After completing the course you can expand course to 5 ECTS credits by stack-exercis and final exam.

**Recommended or required reading:**

Lecture slides, exercis, solutions of exercis

**Assessment methods and criteria:**

Stack-exercis

**Grading:**

pass, fail

**Person responsible:**

Marko Leinonen

**Working life cooperation:**

No

**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

**Opettajat:** Kari Strand

**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:**

Kari Strand

**Working life cooperation:**

No

## 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:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 ECTS / 133 hours of work

**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 teaching

**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:**

No

**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.

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

**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

## 780116P: Introduction to Organic Chemistry, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Chemistry

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780116P	Introduction to Organic Chemistry (OPEN UNI)	5.0 op
780103P2	Organic Chemistry I	6.0 op
780108P	Basic Course in Organic Chemistry	6.0 op
780112P	Introduction to Organic Chemistry	4.0 op
780103P	Introduction to Organic Chemistry	6.0 op

**ECTS Credits:**

5 credits / 134 hours of work

**Language of instruction:**

Finnish. Book-examination in English as well.

**Timing:**

1st spring

**Learning outcomes:**

After this course, the student:

- can recognize and name basic organic compounds and explain their properties.
- can explain organic chemistry basic concepts.
- can deduce basic reaction types and solve their mechanisms.

**Contents:**

Classification of organic compounds and their properties. Basic reactions of organic compounds: addition, elimination and substitution along with the reaction mechanisms. Basics of stereochemistry.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

38 hours of lectures plus 12 hours of exercises, 84 hours of independent self-study.

**Target group:**

Biochemistry, Chemistry, Biology, Process Engineering, Environmental Engineering and in the study entity of 25 credits, compulsory.

Physical Sciences, Geology, Geography, 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:**

Hart, H., Hart, D.J. and Craine, L.E.: Organic Chemistry: A Short Course, 10th ed. or the newer edition, Houghton Mifflin Boston, 1999; Hart, H., Hart, D.J. and Craine, L.E.: Study Guide & Solutions Book, Organic Chemistry: A Short Course, 10th ed. or the newer edition, Houghton Mifflin Boston, 1999.

**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:**

Johanna Kärkkäinen

**Working life cooperation:**

No

**Other information:**

No

**ay780116P: Introduction to Organic Chemistry (OPEN UNI), 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780116P Introduction to Organic Chemistry 5.0 op

**ECTS Credits:**

5 credits /134 hours of work

**Language of instruction:**

Finnish. Book-examination in English as well.

**Timing:**

1st autumn and 1st spring

**Learning outcomes:**

After this course, the student can explain organic chemistry fundamentals, basic concepts and terminology, can use them for the description of organic chemistry phenomena. He/she can name organic structures, explain their properties, deduce basic reaction types and solve their mechanisms.

**Contents:**

Basic reactions of organic compounds, basic principles of stereochemistry and reaction mechanisms: Addition, elimination, substitution, including electrophilic aromatic substitution, reactions of carbonyl group. Applications.

**Mode of delivery:**

Face-to-face teaching

**Learning activities and teaching methods:**

42 hours of lectures plus 12 hours of exercises, 80 hours of independent self-study

**Target group:**

Biochemistry, Chemistry, Biology, Process Engineering, Environmental Engineering and in the study entity of 25 credits, compulsory. Physical Sciences, Geology, Geography, 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:**

Hart, H., Hart, D.J. and Craine, L.E.: Organic Chemistry: A Short Course, 10 th ed. or the newer edition, Houghton Mifflin Boston, 1999; Hart, H., Hart, D.J. and Craine, L.E.: Study Guide & Solutions Book, Organic Chemistry: A Short Course, 10th ed. or the newer edition, Houghton Mifflin Boston, 1999.

**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:**

Dr. Johanna Kärkkäinen

**Working life cooperation:**

No

**Other information:**

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

**Opettajat:** Juha Pekka Lunkka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 ECTS / 133 hours of work

**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 teaching

**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. The course is a good minor subject course for others.

**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 s.

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

**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

**Opettajat:** Kari Strand

**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

## 491101P: Introduction to mining, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Saija Luukkanen

**Opintokohteen kielet:** Finnish

**Recommended or required reading:**

loppuentti, harjoitukset, aktiivisuus

## 491102P: Introduction to solid earth geophysics, 5 op

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu Mining School

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

**Opettajat:** Moisio, Kari Juhani

**Opintokohteen kielet:** Finnish

**Timing:**

Spring semester, period 3. Recommended at 1st or 2nd year of the Bachelor studies.

**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 describe the structure of the Earth and its neighbouring environment in space (spheres), their internalgeophysical 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) and can name most common geophysical research methods.

**Contents:**

An overview of geophysics. Solid Earth geo-physics and Earth Sciences. Properties, structure and dynamics of the Earth. Earth as a planet: shape, size, rotation, revolution. Earth's gravitational field. Isostasy. Deformation and rheology. Seismology: seismic waves and the internal structure of the Earth. Earth's geomagnetic field. Geothermics. Electric and electromagnetic methods.

**Learning activities and teaching methods:**

A specific target group is written in this field.

**Prerequisites and co-requisites:**

No specific prerequisites.

**Recommended or required reading:**

Lecture materials. U. Borén, E. Hjelt, S.-E., Karjalainen, T. ja Sirviö, J., 2014. Geofysiikka, Tunne maapallosi. 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 pp. ja Lowrie, W., 1997. Fundamentals of geophysics. Cambridge University press, 354 p.

**Assessment methods and criteria:**

Variable grading and evaluation methods

**Grading:**

1-5/fall

**Person responsible:**

Kari Moisio

**Working life cooperation:**

No working life cooperation

## 477221A: Material and Energy Balances, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Field of Process and Environmental Engineering

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

**Opettajat:** Ahola, Juha Lennart

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay477231A	Material and Energy Balances I (OPEN UNI)	2.0 op
ay477232A	Material and Energy Balances II (OPEN UNI)	3.0 op
ay477221A	Material and Energy Balances (OPEN UNI)	5.0 op
477201A	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:**

Spring periods 3 and 4.

**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:**

High school level chemistry, mathematics and physics.

**Recommended optional programme components:**

The course is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

**Recommended or required reading:**

Reklaitis, G.V.: Introduction to Material and Energy Balances. John Wiley & Sons, 1983. ISBN 0-471-041319.

**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.



**Person responsible:**

Juha Ahola

**Other information:**

This course replaces the course 477201A Material and Energy Balances, 5 ect.

**ay477221A: Material and Energy Balances (OPEN UNI), 5 op****Voimassaolo:** 01.08.2019 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** University of Oulu, Open University**Arvostelu:** 1 - 5, pass, fail**Opetus suunnattu:** University of Oulu, Open University**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

ay477231A	Material and Energy Balances I (OPEN UNI)	2.0 op
ay477232A	Material and Energy Balances II (OPEN UNI)	3.0 op
477221A	Material and Energy Balances	5.0 op

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

2.9.2019-28.5.2020

**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:**

web-based course

**Learning activities and teaching methods:**

web-based course

**Prerequisites and co-requisites:**

High school level chemistry, mathematics and physics.

**Recommended or required reading:**

Introduction to Material and Energy Balances. John Wiley &amp; Sons, 1983. ISBN 0-471-041319. Learning material in a learning environment.

**Assessment methods and criteria:**

During the course, there are scheduled exercise packages that must be passed.

**Grading:**

1 - 5, pass, fail

**ay477231A: Material and Energy Balances I (OPEN UNI), 2 op****Voimassaolo:** 01.01.2020 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** University of Oulu, Open University**Arvostelu:** 1 - 5, pass, fail**Opetus suunnattu:** University of Oulu, Open University**Opettajat:** Ahola, Juha Lennart**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

477231A Material and Energy Balances I 2.0 op  
 ay477221A Material and Energy Balances (OPEN UNI) 5.0 op  
 477221A Material and Energy Balances 5.0 op

### **ay477232A: Material and Energy Balances II (OPEN UNI), 3 op**

**Voimassaolo:** 01.01.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

477232A Material and Energy Balances II 3.0 op  
 477221A Material and Energy Balances 5.0 op  
 ay477221A Material and Energy Balances (OPEN UNI) 5.0 op

Ei opintojaksokuvauksia.

### **450541A: Photoshop, Advanced Photomanipulation, 2 op**

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu School of Architecture

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

**Opettajat:** Asko Leinonen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay450541A Photoshop, Advanced Photomanipulation (OPEN UNI) 2.0 op

**ECTS Credits:**

2

**Language of instruction:**

Finnish

**Timing:**

workshop-type weekend courses, the course is organized once per academic year.

**Learning outcomes:**

Students are able to complete image renderings from 3d modelling software and to supplement them by combining elements from photos for a photorealistic and expressive end-result.

**Contents:**

Color correction, perspective correction.

**Mode of delivery:**

2 weekend workshop including lectures and exercises.

**Learning activities and teaching methods:**

Contact teaching 32 h, independent exercises 22 h.

**Target group:**

-

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

Software help files and handouts.

**Assessment methods and criteria:**

Based on a project work (the presentation material of a design course at the Oulu School of Architecture or an equivalent work).

**Grading:**

1-5

**Person responsible:**

N.N.

**Working life cooperation:**

Students will learn to use the advanced skills of Adobe Photoshop software and apply those skills in hands-on work such as finishing conceptual drawing renderings.

**Other information:**

Adding a finishing touch in Photoshop to images produced with other rendering software. The course is intended for the students of the Oulu School of Architecture only

## ay493300A: Principles of mineral processing (OPEN UNI), 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish, English

**Leikkaavuudet:**

493300A Principles of mineral processing 5.0 op

**ECTS Credits:**

5 ECTS / 133 hours of work

**Language of instruction:**

Finnish; material mainly in English

**Timing:**

2nd period in the autumn. Recommended for the 3<sup>rd</sup> year students.

**Learning outcomes:**

Upon completion the course the student can explain the main unit process used in ore beneficiation and understands the main chemical and mineralogical factors playing the key role in process development. The student is able to calculate the most relevant process related calculations, such as mass balances, concentrate recoveries and grindability. The student is aware of the environmental as well as H&S aspects of mineral processing.

**Contents:**

The main unit processes used in mineral processing. Understanding how the mineralogy and chemistry of the ore influences in the process development.

**Mode of delivery:**

Mainly face-to-face teaching

**Learning activities and teaching methods:**

Lectures, demonstrations, assignments

**Target group:**

Student with mineral processing as major; students of mining engineering, geosciences and process engineering

**Prerequisites and co-requisites:**

-

**Recommended optional programme components:**

-

**Recommended or required reading:**

The material provided during the course. B.A. Wills: Mineral processing technology

**Assessment methods and criteria:**

Final exam, home works and practicals, energy

**Grading:**

1-5/fail

**Person responsible:**

Saija Luukkanen

**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

Opettajat: Zongxian Zhang

Opintokohteen kielet: Finnish

**ECTS Credits:**

5 ECTS /133 hours of work

**Language of instruction:**

English

**Timing:**

3rd year 3rd period

**Learning outcomes:**

Upon completion of the course students should: (1) know the basic properties of rock; (2) be able to make stress or strain analysis to a rock sample and a rock structure; (3) be able to analyse rock failure under compression, shear and tension loads; (4) know which factors influence rock failure or fracture and know how those affect rock fracture; (5) know the basic principles and methods in rock support; (6) be able to do rock support design; (7) be able to apply rock mechanics theory to tunnelling, mining planning, rock drilling, rock excavation, slope engineering, and other rock-related engineering.

**Contents:**

The course will: (1) introduce basic properties and characteristics of rock and rock mass; (2) introduce stress analysis method; (3) present basic theory on rock failure or fracture; (4) introduce basic methods for measuring rock strengths (compressive, shear and tensile) in laboratory; (5) present methods for measuring in-situ stresses; (6) introduce methods for rock support; (7) give knowledge on how to apply rock mechanics to mining engineering and other types of rock engineering.

**Mode of delivery:**

Face to face teaching

**Learning activities and teaching methods:**

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

**Target group:**

Students from mining and mineral processing, geophysics and geology

**Recommended or required reading:**

Brady BHG and Brown ET. Rock Mechanics for underground mining, third edition. New York: Kluwer Academic Publishers, 2004.

Goodman RE. Introduction to rock mechanics, second edition. New York: John Wiley & Sons, 1989.

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

**Assessment methods and criteria:**

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

- For grade 1, the student must be able to know and understand the basic knowledge in this course.
- For grade 2, the student must know how to make stress analysis and rock failure analysis.
- For grade 3 the student must be able to make a plan for rock support.
- For grade 4, the student must be able to make a plan for rock support and evaluate such a plan.
- For grade 5, the student must be able to apply the acquired knowledge to make a very good plan for mining and rock engineering operation by using rock mechanics. He or she must do an outstanding design in at least one aspect, e.g. he/she can find a problem related rock mechanics or rock fracture and know how to solve the problem or how to make improvement.

**Grading:**

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

**Person responsible:**

Zongxian Zhang

**Working life cooperation:**

No

**Other information:**

-

## 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

**ECTS Credits:**

5 ETCS / 149 hours of work

**Language of instruction:**

Lectures in Finnish, foreign students follow the course by reading independently the books in English and taking part to the exercises and exams where all material is given in English.

**Timing:**

The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 1st autumn semester.

**Learning outcomes:**

After the course, the student can calculate forces and moments of loaded structures using equations of vector algebra and trigonometry. He/she can draw a free body diagram of the force system and then solve the unknown forces by using equations of equilibrium. He/she can determine resultants from uniformly distributed loads and apply Coulomb's law of friction in the problem equilibrium. The student can solve problems of internal and external forces of particle systems and rigid body systems in case of static equilibrium. Especially, he/she can draw shear force and bending moment diagrams for beam structures.

**Contents:**

Fundamental laws and concepts in statics. Force systems and their treatment. Equilibrium of particles and rigid bodies. Static forces in isostatic structures such as beams, frames, cables and trusses. Friction.

**Mode of delivery:**

Implemented as Face-to-face -teaching.

**Learning activities and teaching methods:**

Lectures 55 h / exercises 42 h / independent work of solving homework problems 52 h.

**Target group:**

Compulsory for candidate degree students of mechanical engineering programme.

**Prerequisites and co-requisites:**

Now prerequisites required.

**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:**

Salmi, T.: Statiikka, Pressus Oy, Tampere 2005; Beer, F., Johnston, R.: Vector Mechanics for Engineers, Statics, McGraw-Hill Book Company, 1996.

**Assessment methods and criteria:**

In the course acceptable homework and midterm exams / final exam are required. This course utilizes continuous assessment. There are four midterm exams, of which the last one is at the same time a final exam. Homework contain every week three problems that are marked. The student is allowed to participate to a final exam, when the homework is accepted.

**Grading:**

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

**Person responsible:**

University teacher Hannu Lahtinen

**Other information:**

The course gives ability for understanding static equilibrium, ability for determining force balance in structures and readiness for later studies.

**ay461102A: Statics (OPEN UNI), 5 op**

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** University of Oulu, Open University

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

**Opetus suunnattu:** University of Oulu, Open University

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

461102A	Statics	5.0 op
461016A-02	Statics, exercises	0.0 op
461016A-01	Statics, examination	0.0 op
461016A	Statics	5.0 op

**ECTS Credits:**

5 ETCS / 149 hours of work

**Language of instruction:**

Lectures in Finnish, foreign students follow the course by reading independently the books in English and taking part to the exercises and exams where all material is given in English.

**Timing:**

The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 1st autumn semester.

**Learning outcomes:**

After the course, the student can calculate forces and moments of loaded structures using equations of vector algebra and trigonometry. He/she can draw a free body diagram of the force system and then solve the unknown forces by using equations of equilibrium. He/she can determine resultants from uniformly distributed loads and apply Coulomb's law of friction in the problem equilibrium. The student can solve problems of internal and external forces of particle systems and rigid body systems in case of static equilibrium. Especially, he/she can draw shear force and bending moment diagrams for beam structures.

**Contents:**

Fundamental laws and concepts in statics. Force systems and their treatment. Equilibrium of particles and rigid bodies. Static forces in isostatic structures such as beams, frames, cables and trusses. Friction.

**Mode of delivery:**

Implemented as Face-to-face -teaching.

**Learning activities and teaching methods:**

Lectures 55 h / exercises 42 h / independent work of solving homework problems 52 h.

**Target group:**

Compulsory for candidate degree students of mechanical engineering programme.

**Prerequisites and co-requisites:**

Now prerequisites required.

**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:**

Salmi, T.: Statiikka, Pressus Oy, Tampere 2005; Beer, F., Johnston, R.: Vector Mechanics for Engineers, Statics, McGraw-Hill Book Company, 1996.

**Assessment methods and criteria:**

In the course acceptable homework and midterm exams / final exam are required. This course utilizes continuous assessment. There are four midterm exams, of which the last one is at the same time a final exam. Homework contain every week three problems that are marked. The student is allowed to participate to a final exam, when the homework is accepted.

**Grading:**

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

**Person responsible:**

University teacher Hannu Lahtinen

**Other information:**

The course gives ability for understanding static equilibrium, ability for determining force balance in structures and readiness for later studies.

**455511P: Visual Arts I, 5 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu School of Architecture

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay455511P Visual Arts I (OPEN UNI) 5.0 op

**ECTS Credits:**

5

**Language of instruction:**

Finnish

**Timing:**

Autumn term 1-2

**Learning outcomes:**

To deal with different aspects of visual expression, to expand general knowledge relative to the various fields of art and to develop independent creative expression.

After completing the course the student is able to comprehend various sides of visual expression and can implement these skills in exercise work.

**Contents:**

Object and spatial drawing, classical model drawing, designing and modelling.

**Mode of delivery:**

Contact teaching and independent studying.

**Learning activities and teaching methods:**

lectures and/ or contact teaching 6 hours and contact teaching and/ or group guidance 92hours.

**Target group:**

1.nd year students.

**Prerequisites and co-requisites:**

-

**Recommended or required reading:**

Supplemental reading list will be supplied during the course.

**Assessment methods and criteria:**

Based on exercises.

**Grading:**

1-5

**Person responsible:**

Prof. Matti Sanaksenaho.

**Working life cooperation:**

Students are initiated in the artist's work through guidance of a professional artist.

**455512P: Visual Arts II, 3 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Oulu School of Architecture

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay455512P Visual Arts II (OPEN UNI) 3.0 op

**ECTS Credits:**

3

**Language of instruction:**

Finnish

**Timing:**

Spring term 1-2

**Learning outcomes:**

To deal with different aspects of visual expression, to expand general knowledge relative to the various fields of art and to develop independent creative expression.

After completing the course the student is able to comprehend various sides of visual expression and can implement these skills in exercise work.

**Contents:**

Classical model drawing and various applications of composition and colour theory. The relationship between architecture and colour as well as art and space is studied during the course.

**Mode of delivery:**

Contact teaching and independent studying.

**Learning activities and teaching methods:**

lectures and/ or contact teaching hours and contact teaching and/ or group guidance 92 hours

**Target group:**

2.nd year students

**Prerequisites and co-requisites:**

-

**Recommended or required reading:**

Supplemental reading list will be supplied during the course.

**Assessment methods and criteria:**

Based on exercises.

**Grading:**

1-5

**Person responsible:**

Prof. Matti Sanaksenaho.

**Working life cooperation:**

Students are initiated in the artist's work through guidance of a professional artist.