University’s new study guide for academic year 2020-2021 is published at https://opas.peppi.oulu.fi

The study guide includes information on degrees, curriculums, courses and course timetables. Course registrations are still done in Oodi.

If you have questions on information in the study guide, please contact the study field’s Academic Affairs Service Team https://www.oulu.fi/forstudents/faculty-study-affairs

Tutkintorakenteet

Master of Science (Tech), Civil Engineering

Tutkintorakenteen tila: published
Lukuvuosi: 2020-21
Lukuvuoden alkamispäivämäärä: 01.08.2020

Bridge studies (0 - 60 op)

If you have bridge studies in your PSP, please fill them here.
031075P: Calculus II, 5 op
031076P: Differential Equations, 5 op

Module of the Options (55 - 60 op)

Choose one of module of the option.

Geo Engineering

A485221: Module of the Option / Geo Engineering, 60 op
Compulsory
488110S: Water and Wastewater Treatment, 5 op
488134S: Hydrogeology and groundwater engineering, 5 op
485304S: Fundamentals of Civil Engineering, 5 op
488127S: Field measurements, site investigations and geotechnical tests, 5 op
485306S: Geoenvironmental Engineering, 5 op
488141S: Urban hydrology, 5 op
485305S: Modelling in Geoenvironmental Engineering, 5 op
485308S: Foundation Engineering, 5 op
Structural Engineering (for BSc)

A485222: Module of the Option/Structural Engineering and Construction Technology, 60 op

_Compulsory_

- 485103A: Building physics, 5 op
- 485105A: Concrete technology, 5 op
- 485106A: Design of concrete structures, 5 op
- 466105S: Design of Steel Structures, 6 op
- 485104A: Structural renovation of buildings, 5 op
- 485202S: Building information modeling, 5 op
- 485021A: Construction Contracting, 5 op
- 485302A: Foundation Engineering, 5 op
- 485002S: Advanced Practical Training, 5 op

__Choose at least 25 ECTS__

- 466106S: Advanced topics on design of steel structures, 6 op
- 485304S: Fundamentals of Civil Engineering, 5 op
- 485305S: Modelling in Geoenvironmental Engineering, 5 op
- 485306S: Geoenvironmental Engineering, 5 op
- 488127S: Field measurements, site investigations and geotechnical tests, 5 op
- 485401A: Basics of Traffic Engineering, 5 op
- 485402S: Advanced Course in Traffic Engineering, 5 op
- 485403A: Basics of Road Engineering, 5 op
- 485404S: Road Design and Construction, 5 op
- 485115S: Advanced topics on concrete technology, 5 op
- 485116S: Advanced topics on design of concrete structures, 5 op
- 485113S: Advanced topics on building physics, 5 op
- 485025S: Advanced topics on Civil Engineering, 5 op
- 485024S: Construction Consulting, 5 op
- 485204S: Information modelling and automation in building construction and maintenance, 5 op
- 485203A: Information modelling and automation in infrastructure construction and maintenance, 5 op

Structural Engineering (for new students)

A485223: Module of the Option/Structural Engineering, 60 op

__Choose 60 ECTS__

- 485109A: Numerical methods in structural engineering, 5 op
- 485116S: Advanced topics on design of concrete structures, 5 op
- 485115S: Advanced topics on concrete technology, 5 op
- 485113S: Advanced topics on building physics, 5 op
- 466105S: Design of Steel Structures, 6 op
- 466106S: Advanced topics on design of steel structures, 6 op
- 461112S: Mechanical vibrations, 5 op
- 485307S: Cold Climate Engineering, 5 op
- 485202S: Building information modeling, 5 op
- 485112S: Project work in structural engineering, 5 op
- 485111S: Advanced Topics on Structural Timber Design, 5 op
- 485002S: Advanced Practical Training, 5 op

Supplementary Modules (25 - 45 op)

You can choose courses free in this Module or choose at least one of Supplementary Modules. Insert enough studies to Degree (90 ECTS+Master's Thesis).

_Free choice courses_

_Structural Engineering_
Master's Thesis (30 op)

485991S: Master's Thesis Seminar, 0 op
485999S: Master's Thesis in Civil Engineering, 30 op
485990S: Maturity Test, Civil Engineering, 0 op

Bachelor of Science (Tech), Process and Environmental Engineering

Tutkintorakenteen tila: published
Lukuvuosi: 2020-21
Lukuvuoden alkamispäivämäärä: 01.08.2020

Intermediate Studies (60 op)

A485124: Civil Engineering, Intermediate Studies, 60 op

Intermediate Studies
485101A: Introduction to building construction, 5 op
461105A: Technical thermodynamics, 5 op
485103A: Building physics, 5 op
485022A: Fundamentals of built environment, 5 op
485301A: Basics of Geotechnics, 5 op
485302A: Foundation Engineering, 5 op
485201A: Building information modeling and CAD, 5 op
485023A: GIS and geoinformatics, 5 op
485102A: Introduction to structural design, 5 op
485105A: Concrete technology, 5 op
485106A: Design of concrete structures, 5 op
485001A: Practical Training, 5 op

Basic Studies (70 op)

A485120: Civil Engineering, Basic Studies, 70 op

Basic Studies
485000P: Planning of Studies and Career, 1 op
031010P: Calculus I, 5 op
031075P: Calculus II, 5 op
031076P: Differential Equations, 5 op
031021P: Probability and Mathematical Statistics, 5 op
031078P: Matrix Algebra, 5 op
780120P: Basic Principles in Chemistry, 5 op
761119P: Electromagnetism 1, 5 op
461102A: Statics, 5 op
461103A: Strength of materials I, 5 op
555265P: Occupational Safety and Health Management, 5 op
485021A: Construction Contracting, 5 op
555285A: Project management, 5 op
030005P: Information Skills, 1 op

Choose language studies
902150Y: Professional English for Technology, 2 op
902142Y: Business Correspondence, 2 op
902145Y: Working Life Skills, 2 op
902147Y: Academic Vocabulary for Science and Technology, 2 op
902121Y: Other Studies in English (level B2), 2 - 8 op

Choose your mother tongue
901044Y: Second Official Language (Swedish), Written Skills, 1 op
901045Y: Second Official Language (Swedish), Oral Skills, 1 op
900081Y: Second Official Language (Finnish), Written Skills, 1 - 2 op
900082Y: Second Official Language (Finnish), Oral Skills, 1 - 3 op

Bachelor’s Thesis (10 op)
485980A: Bachelor's Thesis, 8 op
900060A: Technical Communication, 2 op
485981A: The Maturity Test for Bachelor's Degree, 0 op

Module preparing for the Option (40 op)
Choose on for your Study Option.

Structural Engineering
A485122: Civil Engineering, Module preparing for the Option / Structural Engineering, 40 op

Structural Engineering
461104A: Strength of materials II, 5 op
461106A: Dynamics, 5 op
461108A: Mechanics of materials, 5 op
461107A: Finite Element Methods I, 5 op
485107A: Timber construction and product technology, 5 op
485110A: Timber product technology and construction, 5 op
485108A: Desing of Steel Structures and Steel Construction, 5 op
485104A: Structural renovation of buildings, 5 op

Geo Engineering
A485121: Civil Engineering, Module preparing for the Option / Geo Engineering, 40 op

Geo Engineering
477052A: Fluid Mechanics, 5 op
488102A: Hydrological Processes, 5 op
488144A: Water distribution and sewage networks, 5 op
492300A: Rock mechanics, 5 op
485401A: Basics of Traffic Engineering, 5 op
485403A: Basics of Road Engineering, 5 op
488505A: Waste management and recycling, 5 op
485303A: Soil Mechanics, 5 op

Mining Engineering
A485123: Civil Engineering, Module preparing for the Option / Mining Engineering, 40 op

Mining Engineering
771113P: Introduction to Geology I, 5 op
771114P: Introduction to Geology II, 5 op
771117P: Basic course in mineralogy, 5 op
461011A: Strength of Materials II, 7 op
461106A: Dynamics, 5 op
461108A: Mechanics of materials, 5 op
491102P: Introduction to solid earth geophysics, 5 op
492300A: Rock mechanics, 5 op
Opintojaksojen kuvaukset

Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

031075P: Calculus II, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Pauliina Uusitalo
Opintokohteen kielet: Finnish
Leikkaavuudet:
   ay031075P  Calculus II (OPEN UNI)  5.0 op
   031011P  Calculus II  6.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish. The course can be completed in English by intermediate exams or by a final exam.

Timing:
Spring semester, period 3

Learning outcomes:
Upon completion of the course, the student is able to examine the convergence of series and power series of real terms, can explain the use of power series e.g. in calculating limits, is able to solve problems related to differential and integral calculus of real and vector valued functions of several variables.

Contents:
Sequences, series, power series and Fourier series of real terms. Differential and integral calculus of real and vector valued functions of several variables.

Mode of delivery:
Online teaching

Learning activities and teaching methods:
Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:
-

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the course 031010P Calculus I.

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
Intermediate exams or a final exam. The exams are remote exams. It is possibility to take exams also at the university.
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:
Pauliina Uusitalo

Working life cooperation:
-

Other information:
-
031076P: Differential Equations, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Basic Studies
**Laji:** Course
**Vastuuysikkö:** Applied Mathematics and Computational Mathematics
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Ruotsalainen Keijo
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- ay031076P  Differential Equations (OPEN UNI)  5.0 op
- 800320A  Differential equations  5.0 op
- 031017P  Differential Equations  4.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the spring, during period 4. It is recommended to complete the course at the 1th spring semester.

**Learning outcomes:**
The students can apply differential equations as a mathematical model. They can identify and solve various differential equations and they have knowledge on basic solvability of differential equations. The student can use the Laplace transform as a solution method.

**Contents:**
Ordinary differential equations of first and higher order. Laplace transform with applications to differential equations.

**Mode of delivery:**
Online teaching, Stack/Moodle digital learning environment

**Learning activities and teaching methods:**
Lectures 28 h / Group work 22 h / Self-study 85 h.

**Target group:**
1. year students of engineering, mathematics and physics.

**Prerequisites and co-requisites:**
The recommended prerequisite is the completion of the course Calculus I.

**Recommended optional programme components:**
-

**Recommended or required reading:**
Recommended literature: Kreyszig, E: Advanced Engineering Mathematics;

**Assessment methods and criteria:**
The course can be completed by intermediate exams (2 exams) or by a final exam.
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:**
Keijo Ruotsalainen

**Working life cooperation:**
No

---

A485221: Module of the Option / Geo Engineering, 60 op

**Voimassaolo:** 01.08.2017 -
**Opiskelumuoto:** Module of the Option
**Laji:** Study module
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

**Compulsory**

**488110S: Water and Wastewater Treatment, 5 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

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

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

**Opettajat:** Elisangela Heiderscheidt

**Opintokohteen kielet:** English

**Leikkaavuudet:**

- 480151S Water and Wastewater Treatment 7.0 op
- 480208S Industrial Water and Wastewater Treatment 3.5 op

**ECTS Credits:**

5 ECTS credits/135 hours of work

**Language of instruction:**

English

**Timing:**

The course unit is held in the autumn semester, during period 1

**Learning outcomes:**

Upon completion of the course, the student will be able to understand the theory and practicalities behind the most used purification processes in water and wastewater treatment. The student will also be capable of performing basic dimensioning calculations and therefore he/she will be able to dimension structures/units of water and wastewater treatment plants and to comprehend the basic requirements of different purification processes.

**Contents:**

Water quality characteristics of source water; basic principles of purification processes (coagulation/flocculation, sedimentation, biological treatment, filtration, disinfection, etc); process units in water and waste water treatment; selection of process units; dimensioning of treatment structures and unit processes.

**Mode of delivery:**

Mix of guided self-study work, face-to-face teaching and field visits.

**Learning activities and teaching methods:**

Lectures (30 h), field visits (5 h), exercises and other assignments (60 h) and self-study (38 h).

**Target group:**

Students in master program of environmental and civil engineering.

**Prerequisites and co-requisites:**

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering (477013P) or I (477011P) and II (488010P).

**Recommended or required reading:**


**Assessment methods and criteria:**

The course can be completed in two different study modes: A) Active mode: midterm exam based on reading material + completion of 2 group exercises + final exam based on lectures and exercises; B)
Passive mode (book exam): 100% self-study mode where the student is provided with 2-3 reference books and attends an exam based on the provided material. (Passive mode can be complete under special circumstances).

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:**
Post-doctoral researcher Dr Elisangela Heiderscheidt

**Working life cooperation:**
Through visits to water and wastewater treatment plants, which include lectures provided by environmental engineers in charge and guided tours, the students familiarize with the main technological and process related principles of the field and have the chance to experience in firsthand how to deal with some of the most common issues related to water and wastewater purification systems.

**Other information:**
The course will be held as distance learning in the fall of 2020.

488134S: Hydrogeology and groundwater engineering, 5 op

- **Voimassaolo:** 28.11.2016 -
- **Opiskelumuoto:** Advanced Studies
- **Laji:** Course
- **Vastuuysikkö:** Field of Process and Environmental Engineering
- **Arvostelu:** 1 - 5, pass, fail
- **Opettajat:** Pekka Rossi
- **Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS credits/133 hours of work

**Language of instruction:**

English

**Timing:**
The course unit is held in the spring semester, during period 3

**Learning outcomes:**
Upon completion of the course, the student will have knowledge on groundwater systems and the basic hydrogeological and engineering concepts involved. This includes analysis of flow in porous media, hydraulics of groundwater systems, groundwater quality and groundwater use. After the course students are able to estimate key factors influencing on groundwater recharge, flow and discharge and to use general methods to calculate groundwater flow.

**Contents:**

2D and 3D groundwater flow, conceptual models, unsaturated layer flow, water storage and retention, heterogeneity and isotropy, aquifer types, pumping tests, geophysical methods, groundwater quality and resources in Finland.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
lectures (18 h), calculus lectures (12 h), homework, exercises and self-study (103 h).

**Target group:**
Master students in the water engineering orientation of the Environmental Engineering program and in master program of civil engineering.

**Prerequisites and co-requisites:**
The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes.
Recommended or required reading:
Lecture handouts

Assessment methods and criteria:
exam and/or lecture exams.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Postdoctoral Researcher Pekka Rossi
Working life cooperation:
Students familiarize themselves to a real groundwater aquifer cases discussed in lectures and in the course exercise.

485304S: Fundamentals of Civil Engineering, 5 op
Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
  488121S  Municiaplity Geotechnics  5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work
Language of instruction:
Finnish
Timing:
The course unit is held in the autumn semester, during period 1
Learning outcomes:
The student understand how geotechnical design is joined to a part of society’s decision-making processes. He or she can prepare an assessment of foundation properties and design reinforcement. He or she understands specialties of railway construction and vibration problems. He or she gets the knowledge of property and surface drainage methods, how to lower groundwater table and what kind of risks are included to earth slopes and how to reinforce those.
Contents:
Norms and instructions, basis of geotechnical design, earth and road structures, soil improvement, property and surface drainage, lowering of groundwater table, pipeline construction, specialties of railway construction and vibration problems, geotechnical monitoring and measurements, earthworks
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures (34 h) and design and calculation exercises (10 h) also self-study (91 h)
Target group:
Master students in the Civil Engineering program
Prerequisites and co-requisites:
Prerequisites: 485301A Basic of Geotechnics (former 488115A Geomechanics), 485201A Building information modeling and CAD (or similar AutoCAD knowledge)

**Recommended optional programme components:**

**Recommended or required reading:**
Lecture handout and other materials delivered in lectures

**Assessment methods and criteria:**
Examination and homeworks

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

**Person responsible:**
University teacher Anne Tuomela

**Working life cooperation:**
The course includes guest lectures from various sectors of civil engineering.

**Other information:**
This course will replace course 488121S Fundamentals of Civil Engineering in Academic year 2020-21.

488127S: Field measurements, site investigations and geotechnical tests, 5 op

**Voimassaajo: 01.08.2015 -**
**Opiskelumuoto: Advanced Studies**

**Laji: Course**

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

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

**Opettajat: Ali Torabi Haghighi**

**Opintokohteen kielet: English**

**Leikkaavuudet:**

488118S Laboratory Exercises and Field Measurements in Environmental Engineering 10.0 op

**ECTS Credits:**
5 ECTS /133 hours of work

**Language of instruction:**
English

**Timing:**
The course unit is given during periods 1 and 2.

**Learning outcomes:**
Upon completion the student should be able to design field measurements and understand the quality of sampling and measurements in the field of environmental engineering. The student also improves skills of working in a team of fellow students to share expertise and execution responsibilities. The student understands the laboratory testing procedures and the associated parameters that help in estimating the soil mechanics and Geotechnical engineering and. The student knows how to use different methods for field measurement and sampling in water and geotechnical issues. The student can take considering the safety during the laboratory works and field measurements. After the course, the student can write detailed engineering reports.

**Contents:**
In the lectures: Units of measurements, error and mistake in laboratory works and field measurements, random and systematic error, precision and accuracy in laboratory work, planning field works, description of measuring site, securing results and material, sample preservation, subsoil exploration, direct & indirect methods of exploration, disturb and undisturbed samples, safety in field work, introduction on surveying, levelling, map and scale, different tests in soil mechanics laboratory. Laboratory works in soil mechanics and geotechnical engineering: sieving test, hydrometer test, Atterberg limits test, proctor test, direct shear box test and oedometer test.
In the field: Working with GPS. Levelling and collecting data for preparing topography map. Soil sampling, surface water and groundwater sampling, Measuring velocity and discharge of river by using current meter and tracer.

**Mode of delivery:**
Face-to-face teaching, laboratory working

**Learning activities and teaching methods:**
Lectures (16 h), Fieldwork (20 h), Lab-work (9 h), Group work (88 h)

**Target group:**
Master students in the Water and Geo Engineering and Water and Environment study options

**Prerequisites and co-requisites:**
The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488115A Geomechanics

**Recommended or required reading:**
Field measurements and Laboratory work instruction, lecture materials

**Assessment methods and criteria:**
Two exams (40%), Report (50%) and assignments (10%), passing the exam is requirement for passing the course

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

**Person responsible:**
University Teacher Ali Torabi Haghighi

**Working life cooperation:**
No

---

485306S: Geoenvironmental Engineering, 5 op

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Tuomela, Anne Marika
**Opintokohteen kielet:** Finnish
**Leikkaavuudet:**
488131S Geoenvironmental Engineering 5.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course unit is held in the autumn semester, during period 1

**Learning outcomes:**
The student knows norms and instruction which are related to contaminated sites. The students can choose the suitable remediation technique for contaminated soil. The student can calculate contaminant transport in soils. The student can also design geotechnical structures of industrial and domestic landfills and evaluate the needs for remediation of contaminated soils. Student knows how to use by-products from industry in different soil construction applications.

**Contents:**
Norms and instructions, a project work where student will discover a contaminated soil and make a proposal for remediation technique, properties of soil materials and industrial by-products, basis of
12

geotechnical design for landfill environment, structures of dams and impoundments, geoenvironmental challenges in mining, remote sensing as a tool for geoenvironmental applications.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (44 h), group work (60 h) and independent work (31 h)

Target group:
Master students in the Civil Engineering program

Prerequisites and co-requisites:
485301A Basics of Geotechnics

Recommended optional programme components:
-

Recommended or required reading:
Lecture handout and other materials delivered in lectures

Assessment methods and criteria:
Written exam and exercises

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

Person responsible:
University teacher Anne Tuomela

Working life cooperation:
The course includes a visit to a site decided later and also guest lectures from professionals in industry and administration.

Other information:
This course will replace course 488131S Geoenvironmental Engineering

488141S: Urban hydrology, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Pekka Rossi
Opintokohteen kielet: English
Leikkaavuudet:
    488146S Urban water management 5.0 op

ECTS Credits:
5 ECTS credits/133 hours of work

Language of instruction:
English

Learning outcomes:
Student has a knowledge on the different aspects of urban hydrology to manage waters in a built environment. Student understands the challenges concerning quantity and quality questions of urban waters and can take them into account in designing.

Contents:
Storm water system design, green infrastructure, urban erosion, drainage, flood control and climate change in urban hydrology, urban water quality and constructed wetlands.

Mode of delivery:
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures (30 h), homeworks (45 h) and a design exercise (58 h).

**Target group:**
Students in master program of environmental engineering and in master program of civil engineering

**Prerequisites and co-requisites:**
AutoCAD ja Matlab prosessi- ja ympäristötekniikan työkaluna or at least equivalent information about CAD use. 477052A Fluid mechanics, 477312A Lämmön- ja aineensiirto and 488102A Hydrological Processes.

**Recommended optional programme components:**
This course is a straight continuation of course 488135A Water distribution and sewage networks (recommended but not prerequisite prior to this course)

**Recommended or required reading:**

**Assessment methods and criteria:**
Examination, seminar and a design exercise.

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

**Person responsible:**
Postdoctoral Researcher Pekka Rossi

**Working life cooperation:**
Course includes guest lectures of storm water designers/consultants and/or municipalities/cities responsible for the storm water management.

**Other information:**
The course has ended and replaced by a new course 488146S Urban water management.

**485305S: Modelling in Geoenvironmental Engineering, 5 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Tuomela, Anne Marika
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
488111S Modelling in Geoenvironmental Engineering 5.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course unit is held in the spring semester, during period 4

**Learning outcomes:**
After the course the student can apply the numerical calculation methods in design and dimensioning of earth and geoenvironmental structures. The student can evaluate the influence of boundary conditions and material parameters in calculation results.

**Contents:**

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures (5 h), design (60 h) and modelling assignments (70 h).

**Target group:**
Master students in the Civil Engineering program

**Prerequisites and co-requisites:**

**Recommended optional programme components:**

**Recommended or required reading:**
Lecture handout and other materials delivered in lectures

**Assessment methods and criteria:**
Passing the course requires solving the given assignments and writing reports about them. The assignments are solved with computer modelling, which requires constant participation to the lectures.

**Grading:**
The course utilizes verbal grading scale pass/fail.

**Person responsible:**
University teacher Anne Tuomela

**Working life cooperation:**
The course includes guest lectures from an international consulting and engineering company.

**Other information:**
This course will replace course 488111S Modelling in Geoenvironmental Engineering

485308S: Foundation Engineering, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

485203A: Information modelling and automation in infrastructure construction and maintenance, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Tanja Kolli
Opintokohteen kielet: Finnish
Leikkaavuudet:

466115S Information modelling and automation in infrastructure construction and maintenance 5.0 op
460180S-01 Automation of Road Construction, examination 0.0 op
460180S-02 Automation of Road Construction, exercises 0.0 op
460180S Automation of Road Construction 5.0 op

Ei opintojaksokuvauksia.

485404S: Road Design and Construction, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Veikko Pekkala
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS / 135 h of work

Language of instruction:
Finnish

Timing:
The course unit is held in the spring semester during period 4

Learning outcomes:
By completing the course student is familiar with road structure and function, structural modernisation, pavements and the basics of earthworks. He/she is also able to design road computer aided.

Contents:
Function of road structure, road damaging, structural modernisation, pavements, Road design and construction

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h, exercises 32 h, self-study 75 h

Target group:
Students in the master's programmes of environmental engineering

Prerequisites and co-requisites:
485403A Basics of Road Engineering

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:
Materials delivered during the lectures

Assessment methods and criteria:
Exam and assignment(s)

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

Person responsible:
Veikko Pekkala
**485307S: Cold Climate Engineering, 5 op**

**Voimassaolo:** 01.08.2020 - 
**Opiskelumuoto:** Advanced Studies 
**Laji:** Course 
**Vastuuysikkö:** Civil Engineering field 
**Arvostelu:** 1 - 5, pass, fail 
**Opettajat:** Anssi Rauhala 
**Opintokohteen kielet:** English 
**Leikkaavuudet:** 

488132S Cold Climate Engineering 5.0 op 

**ECTS Credits:**
5 ECTS credits / 135 hours of work 

**Language of instruction:**
Finnish 

**Timing:**
The course unit is held in the spring semester, during period 3 

**Learning outcomes:**
After the course the student knows how permafrost and seasonally frozen ground affect different aspects of construction. The student can perform frost heave calculations and evaluate the need for ground frost insulation. The student knows how winter conditions are considered in road and street design. Student knows the basics of geothermal energy and energy efficient structures.

**Contents:**
Permafrost and seasonally frozen ground. Frost heave and ground frost insulation. Winter conditions related road, street and water supply design criteria. Geothermal energy. Energy efficient structures.

**Mode of delivery:**
Face-to-face teaching 

**Learning activities and teaching methods:**
Lectures and exercises (28 h), independent study (107 h).

**Target group:**
Master’s students in Civil Engineering 

**Prerequisites and co-requisites:**
485301A Basics of Geotechnics, 485102A Introduction to structural design 

**Recommended optional programme components:**
- 

**Recommended or required reading:**
Lecture handout and other materials delivered in lectures 

**Assessment methods and criteria:**
Examination and assignment(s) 

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

**Person responsible:**
Ansi Rauhala 

**Working life cooperation:**
No 

**Other information:**
-
### 485002S: Advanced Practical Training, 5 op

- **Voimassaolo:** 01.08.2019 -
- **Opiskelumuoto:** Advanced Studies
- **Laji:** Practical training
- **Vastuuysikkö:** Civil Engineering field
- **Arvostelu:** 1 - 5, pass, fail
- **Opintokohteen kiele:** Finnish

#### Leikkaavuudet:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>477005S</td>
<td>Advanced Practical Training</td>
<td>5.0 op</td>
</tr>
<tr>
<td>460004S</td>
<td>Practical Training II</td>
<td>5.0 op</td>
</tr>
</tbody>
</table>

#### ECTS Credits:

- 5 ECTS, 2 months working full-time

#### Language of instruction:

- Finnish or English

#### Timing:

- Student usually works in summer time.

#### Learning outcomes:

During the advanced practical training the student is exposed to his/her working environment from the point of view of his/her studies and becomes acquainted with another possible future job or to a different assignment already in a familiar working environment. The student can identify the problems of the working environment and can solve them. The student can apply theoretical knowledge in practical tasks. The student identifies the tasks appropriate for the Master of Science in Technology at his/her workplace.

#### Mode of delivery:

- Working as employee

#### Target group:

- Master's students in Civil Engineering

#### Assessment methods and criteria:

Student has to show original references and leave the application. In addition she/he has to participate to seminar where she/he reports own summer job. In reference must be training time period and duties.

#### Grading:

- Verbal scale Passed/Failed

#### Person responsible:

- Saara Luhtaanmäki

#### Working life cooperation:

- Yes.

---

### A485222: Module of the Option/Structural Engineering and Construction Technology, 60 op

- **Voimassaolo:** 01.08.2017 -
- **Opiskelumuoto:** Module of the Option
- **Laji:** Study module
- **Vastuuysikkö:** Civil Engineering field
- **Arvostelu:** 1 - 5, pass, fail
- **Opintokohteen kiele:** Finnish

Ei opintojaksojokuvauksia.

*Compulsory*

### 485103A: Building physics, 5 op
Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Filip Fedorik
Opintokohteen kielet: English

Leikkaavuudet:
- 466111S Building physics 5.0 op
- 460160S-01 Building Physics, examination 0.0 op
- 460160S-02 Building Physics, exercises 0.0 op
- 460160S Building Physics 3.5 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
English

Timing:
Autumn, Periods 1-2

Learning outcomes:
After completing the course the student can explain basic phenomenon of building physics. The student can analyse and describe heat, air and moisture transfer in buildings and also explain main causes of typical moisture damages. The student can explain factors affecting energy efficiency and can calculate the energy efficiency number. The student knows the calculation methods in acoustics.

Contents:

Mode of delivery:
Face-to-face and distance learning

Learning activities and teaching methods:
Lectures, exercises, case studies, and self directed learning

Target group:
Students studying structural engineering

Prerequisites and co-requisites:
466101A Introduction to building construction

Recommended or required reading:
The material that is in English will be distributed at the lectures
1) Lecture notes (mainly in Finnish)
2) Suomen rakentamismääräyskokooman osatC1, C2, C3, C4 ja D3.

Assessment methods and criteria:
Exercises and exam

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
university lecturer Raimo Hannila

Other information:
This course will replace course 466111S Building Physics in Academic year 2020-21.

485105A: Concrete technology, 5 op
Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
  466109S  Concrete technology  5.0 op
  460155S-01 Concrete Technology, examination  0.0 op
  460155S-02 Concrete Technology, laboratory exercise  0.0 op
  460155S  Concrete Technology  4.5 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
Finnish

Timing:
Spring semester, periods 3-4

Learning outcomes:
After completing the course the student is able to specify concrete and the materials from which it is made. They can design normal concrete mixes and identify, describe and carry out the main laboratory tests relevant to the use of concrete on site.

Contents:
Cements and cementitious materials, aggregates for concrete, concrete mix design, properties of fresh and hardened concrete, laboratory tests, specification testing and compliance, environmental exposure classes.

Mode of delivery:
Face-to-face and distance learning

Learning activities and teaching methods:
Lectures, exercises, case studies, laboratory sessions and self-directed learning

Target group:
Students studying structural engineering

Prerequisites and co-requisites:
466101A Introduction to building construction

Recommended optional programme components:
466101A Introduction to building construction

Recommended or required reading:
The material that is in English will be distributed at the lectures.
1) Lecture notes (mainly in Finnish),
4) Suomen Standardisoimisliitto ry. SFS-Standardisointi;
5) SFS-EN Standards

Assessment methods and criteria:
Passed laboratory exercises and exam

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
Jorma Hopia

Other information:
This course will replace course 466109S in Academic year 2020-21.
485106A: Design of concrete structures, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

- 466107S Design of concrete structures 6.0 op
- 460147A Introduction to Design of Concrete Technology 4.0 op
- 460147A-01 Introduction to Design of Concrete Technology, examination 0.0 op
- 460147A-02 Introduction to Design of Concrete Technology, exercise work 0.0 op
- 460148S Design of Concrete Structures 4.0 op
- 460148S-01 Design of Concrete Structures I, examination 0.0 op
- 460148S-02 Design of Concrete Structures I, exercises 0.0 op

ECTS Credits:
5 ects

Language of instruction:
Finnish

Timing:
Lectures and exercising on periods 3 and 4.

Learning outcomes:
Upon completion of the course, the student will be able to design typical reinforced concrete structures to EN-standards.

Contents:
Strength and strain properties of concrete and reinforcing bars, time dependent properties. Limit state design of concrete beams and columns to EN standards. Service life design. Fire design. Anchoring and joints of reinforcing bars. Design of flanged cross sections, walls and wall like beams, and foundations carrying walls and columns.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 48 h, project work 24 h and independent work 63 h

Target group:
Bachelor level students in the degree program of civil engineering

Prerequisites and co-requisites:
Basic knowledge of statics, solid mechanics, concrete technology and structural engineering

Recommended or required reading:

Assessment methods and criteria:
The course is passed by partial exams during the course or by a final exam. A project work is also required.
Grading:
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Senior research fellow Antti H. Niemi

Other information:
This course will replace course 466107S Design of concrete structures in Academic year 2020-21.

466105S: Design of Steel Structures, 6 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Kangaspurokari, Matti Johannes
Opintokohteen kielet: Finnish
Leikkaavuudet:
485118S Design of Steel Structures 5.0 op
485108A Design of Steel Structures and Steel Construction 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 able to explain the basic nature of the crystalline structure of steel and its elastomeric material model. He / she is able to evaluate the effect of alloys, heat treatment and welding on the mechanical properties of steel. He / she can explain what happens to steel in the event of a fire and the basics of fire design. The student is able to design the joints of a steel structure frame and can dimension the steel structure under different load combinations. He / she is able to analyze stability problems and can explain inaccuracies and second order effects.

Contents:

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:
Degree students who study steel structure design.

Prerequisites and co-requisites:

Recommended or required reading:

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

485104A: Structural renovation of buildings, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
   466117S  Structural renovation of buildings  5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
Autumn, Period 2

Learning outcomes:
After completing the course students can describe different structural materials and structural systems used in residential buildings in 1900-2000. They are able to identify and explain the typical risk structures and defects in those buildings. They can also explain the old design codes and recommendation used in Finland.

Contents:
Finnish house construction and typical details during 1900-2000. Standards, design recommendations and design methods used in Finland.

Mode of delivery:
Lecture room teaching

Learning activities and teaching methods:
Lectures and exercises

Target group:
Students studying structural engineering

Prerequisites and co-requisites:
Fundamentals of building construction and building physics

Recommended optional programme components:
Recommended or required reading:
Lecture material

Assessment methods and criteria:
Passed practical works and exam

Grading:
The course utilizes a numerical grading scale 1-5. Numerical scale zero stands for a fail.

Person responsible:
Senior research fellow Antti H. Niemi

Working life cooperation:

Other information:
This course will replace the course 466117S in academic year 2020-21.

485202S: Building information modeling, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysiksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
  466114S  Building information modeling  5.0 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
Finnish

Timing:
Autumn semester, periods 1-2

Learning outcomes:
After completing the course the student is able to make 3D models of buildings and detail the connections between building elements and components. He can model different building materials and is familiar with one commercial software.

Contents:

Mode of delivery:
Face-to-face

Learning activities and teaching methods:
Lectures, exercises and self directed learning

Target group:
Students studying structural engineering

Recommended or required reading:
The material that is in English will be distributed at the lectures

Assessment methods and criteria:
Participation to lectures and exercises

Grading:
Pass or fail.
**Person responsible:**
Rauno Heikkilä

**485021A: Construction Contracting, 5 op**

**Voimassaolo:** 01.08.2018 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Liedes, Hannu Tapani
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 488119A Basics of infrastructure planning and development 5.0 op
- 466113S Construction economics 5.0 op
- 460165A-02 Introduction to Construction Economics I, practical work 0.0 op
- 460165A-01 Introduction to Construction Economics I, examination 0.0 op

**ECTS Credits:**
5 ECTS

**Language of instruction:**
Finnish

**Person responsible:**
Hannu Liedes

**Other information:**
This Course replaces courses 466113S and 488119A.

**485302A: Foundation Engineering, 5 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- ay485302A Foundation Engineering (OPEN UNI) 5.0 op
- 488129S Foundation Engineering 5.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course unit is held in the autumn semester during period 2

**Learning outcomes:**
After completing the course, students know the basics of base construction plan, can identify geotechnical dimensioning limit states and use partial factor method. Student can describe different foundation methods, types and principles of typical foundation piles, excavation types, risks and principles of risk management,
Student knows the principles of foundation drainage and frost protection. Student knows the basics of how to design piled foundation. Student knows ultimate bearing capacity formula for shallow foundation (Eurocode).

Contents:

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures and exercises (28 h), self-study (107 h)

Target group:
Students in bachelor's program of civil engineering

Prerequisites and co-requisites:
485301A basics of Geotechnics

Recommended optional programme components:

Recommended or required reading:
Materials delivered in lectures

Assessment methods and criteria:
Exam and assignment(s)

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

Person responsible:
Veikko Pekkala

Working life cooperation:
No

Other information:
This course will replace course 488129S Foundation Engineering.

485002S: Advanced Practical Training, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Practical training
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
   477005S   Advanced Practical Training   5.0 op
   460004S   Practical Training II   5.0 op

ECTS Credits:
5 ECTS, 2 months working full-time

Language of instruction:
Finnish or English

Timing:
Student usually works in summer time.

Learning outcomes:
During the advanced practical training the student is exposed to his/her working environment from the point of view of his/her studies and becomes acquainted with another possible future job or to a different
assignment already in a familiar working environment. The student can identify the problems of the working environment and can solve them. The student can apply theoretical knowledge in practical tasks. The student identifies the tasks appropriate for the Master of Science in Technology at his/her workplace.

**Mode of delivery:**
Working as employee

**Target group:**
Master’s students in Civil Engineering

**Assessment methods and criteria:**
Student has to show original references and leave the application. In addition she/he has to participate to seminar where she/he reports own summer job. In reference must be training time period and duties.

**Grading:**
Verbal scale Passed/Failed

**Person responsible:**
Saara Luhtaanmäki

**Working life cooperation:**
Yes.

*Choose at least 25 ECTS*

**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
- **Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ay466106S</td>
<td>Advanced topics on design of steel structures (OPEN UNI)</td>
<td>6.0 op</td>
</tr>
<tr>
<td>460128S-01</td>
<td>Advanced Course in Design of Steel Structures I, examination</td>
<td>0.0 op</td>
</tr>
<tr>
<td>460128S-02</td>
<td>Advanced Course in Design of Steel Structures I, exercise work</td>
<td>0.0 op</td>
</tr>
<tr>
<td>460128S</td>
<td>Advanced Topics on Design of Steel Structures I</td>
<td>4.0 op</td>
</tr>
</tbody>
</table>

**ECTS Credits:**

6 ECTS

**Language of instruction:**

Finnish

**Timing:**

Periods 3 and 4

**Learning outcomes:**

The student can explain the basics of fatigue design of a welded structure. The student is able to design sheet metal structures and welded plate beam structures. He / she is able to analyze and design steel structures and their joints. They are able to analyze dynamically loaded structures and to evaluate the effect of vibrations on the functionality and usability of structures.

**Contents:**


**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:**
Degree students who study steel structure design.

**Prerequisites and co-requisites:**

**Recommended or required reading:**

**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

---

**485304S: Fundamentals of Civil Engineering, 5 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** Finnish
**Leikkaavuudet:**
- 488121S Municiality Geotechnics 5.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course unit is held in the autumn semester, during period 1

**Learning outcomes:**
The student understand how geotechnical design is joined to a part of society’s decision-making processes. He or she can prepare an assessment of foundation properties and design reinforcement. He or she understands specialties of railway construction and vibration problems. He or she gets the knowledge of property and surface drainage methods, how to lower groundwater table and what kind of risks are included to earth slopes and how to reinforce those.

**Contents:**
Norms and instructions, basis of geotechnical design, earth and road structures, soil improvement, property and surface drainage, lowering of groundwater table, pipeline construction, specialties of railway construction and vibration problems, geotechnical monitoring and measurements, earthworks

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures (34 h) and design and calculation exercises (10 h) also self-study (91 h)

**Target group:**
Master students in the Civil Engineering program
Prerequisites and co-requisites:
Prerequisites: 485301A Basic of Geotechnics (former 488115A Geomechanics), 485201A Building information modeling and CAD (or similar AutoCAD knowledge)

Recommended optional programme components:

Recommended or required reading:
Lecture handout and other materials delivered in lectures

Assessment methods and criteria:
Examination and homeworks

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

Person responsible:
University teacher Anne Tuomela

Working life cooperation:
The course includes guest lectures from various sectors of civil engineering.

Other information:
This course will replace course 488121S Fundamentals of Civil Engineering in Academic year 2020-21.

485305S: Modelling in Geoenvironmental Engineering, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Tuomela, Anne Marika
Opintokohteen kielet: Finnish
Leikkaavuudet:
   488111S  Modelling in Geoenvironmental Engineering  5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course unit is held in the spring semester, during period 4

Learning outcomes:
After the course the student can apply the numerical calculation methods in design and dimensioning of earth and geoenvironmental structures. The student can evaluate the influence of boundary conditions and material parameters in calculation results.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (5 h), design (60 h) and modelling assignments (70 h).

Target group:
Master students in the Civil Engineering program
Prerequisites and co-requisites:

Recommended optional programme components:
- 

Recommended or required reading:
Lecture handout and other materials delivered in lectures

Assessment methods and criteria:
Passing the course requires solving the given assignments and writing reports about them. The assignments are solved with computer modelling, which requires constant participation to the lectures.

Grading:
The course utilizes verbal grading scale pass/fail.

Person responsible:
University teacher Anne Tuomela

Working life cooperation:
The course includes guest lectures from an international consulting and engineering company.

Other information:
This course will replace course 488111S Modelling in Geoenvironmental Engineering

485306S: Geoenvironmental Engineering, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Tuomela, Anne Marika
Opintokohteen kielet: Finnish
Leikkaavuudet:

488131S Geoenvironmental Engineering 5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course unit is held in the autumn semester, during period 1

Learning outcomes:
The student knows norms and instruction which are related to contaminated sites. The students can choose the suitable remediation technique for contaminated soil. The student can calculate contaminant transport in soils. The student can also design geotechnical structures of industrial and domestic landfills and evaluate the needs for remediation of contaminated soils. Student knows how to use by-products from industry in different soil construction applications.

Contents:
Norms and instructions, a project work where student will discover a contaminated soil and make a proposal for remediation technique, properties of soil materials and industrial by-products, basis of geotechnical design for landfill environment, structures of dams and impoundments, geoenvironmental challenges in mining, remote sensing as a tool for geoenvironmental applications.

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures (44 h), group work (60 h) and independent work (31 h)

Target group:
Master students in the Civil Engineering program

Prerequisites and co-requisites:
485301A Basics of Geotechnics

Recommended optional programme components:
-

Recommended or required reading:
Lecture handout and other materials delivered in lectures

Assessment methods and criteria:
Written exam and exercises

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

Person responsible:
University teacher Anne Tuomela

Working life cooperation:
The course includes a visit to a site decided later and also guest lectures from professionals in industry and administration.

Other information:
This course will replace course 488131S Geoenvironmental Engineering

488127S: Field measurements, site investigations and geotechnical tests, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ali Torabi Haghighi
Opintokohteen kielet: English
Leikkaavuudet:
488118S Laboratory Exercises and Field Measurements in Environmental Engineering 10.0 op

ECTS Credits:
5 ECTS /133 hours of work

Language of instruction:
English

Timing:
The course unit is given during periods 1 and 2.

Learning outcomes:
Upon completion the student should be able to design field measurements and understand the quality of sampling and measurements in the field of environmental engineering. The student also improves skills of working in a team of fellow students to share expertise and execution responsibilities. The student understands the laboratory testing procedures and the associated parameters that help in estimating the soil mechanics and Geotechnical engineering and. The student knows how to use different methods for field measurement and sampling in water and geotechnical issues. The student can take considering the safety during the laboratory works and field measurements. After the course, the student can write detailed engineering reports.

Contents:
In the lectures: Units of measurements, error and mistake in laboratory works and field measurements, random and systematic error, precision and accuracy in laboratory work, planning field works, description of measuring site, securing results and material, sample preservation, subsoil exploration, direct & indirect methods of exploration, disturb and undisturbed samples, safety in field work, introduction on surveying, levelling, map and scale, different tests in soil mechanics laboratory.
Laboratory works in soil mechanics and geotechnical engineering: sieving test, hydrometer test, Atterberg limits test, proctor test, direct shear box test and oedometer test.
In the field: Working with GPS. Levelling and collecting data for preparing topography map. Soil sampling, surface water and groundwater sampling, Measuring velocity and discharge of river by using current meter and tracer.

Mode of delivery:
Face-to-face teaching, laboratory working

Learning activities and teaching methods:
Lectures (16 h), Fieldwork (20 h), Lab-work (9 h), Group work (88 h)

Target group:
Master students in the Water and Geo Engineering and Water and Environment study options

Prerequisites and co-requisites:
The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488115A Geomechanics

Recommended or required reading:
Field measurements and Laboratory work instruction, lecture materials

Assessment methods and criteria:
Two exams (40%), Report (50%) and assignments (10%), passing the exam is requirement for passing the course

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

Person responsible:
University Teacher Ali Torabi Haghighi

Working life cooperation:
No

485401A: Basics of Traffic Engineering, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Virve Merisalo
Opintokohteen kielet: Finnish
Leikkaavuudet:
488151A Basics of Traffic Engineering 5.0 op

ECTS Credits:
5 ECTS / 135 h of work

Language of instruction:
Finnish

Timing:
Period 1

Learning outcomes:
By completing the course the student knows the basics of modes of transport, the significance of traffic and transportation to society, traffic planning and research methods, transport economics and the external effects of transport.

**Contents:**
Modes of transport, Need for traffic and transportation, Transport planning and research, Economical and environmental impacts of traffic, Traffic safety.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures 28 h, exercises 22 h, self-study 85 h

**Target group:**
Students in the Bachelor's Programme of Civil Engineering

**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:**
Materials delivered during the lectures

**Assessment methods and criteria:**
Examination and exercises

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

**Person responsible:**
University teacher Virve Merisalo

**Working life cooperation:**
-

**Other information:**
-

**485402S: Advanced Course in Traffic Engineering, 5 op**

Voimassaalo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Virve Merisalo
Opintokohteen kielet: Finnish
Leikkaavuudet:

488152S Advanced Course in Traffic Engineering 5.0 op

**ECTS Credits:**
5 ECTS / 135 h of work

**Language of instruction:**
Finnish

**Timing:**
Period 2

**Learning outcomes:**
By completing the course the student understands the basics of transport policy and the significance of transport economics to society. The student becomes familiar with traffic safety and is able to analyse the problems of traffic safety and opportunity to improve it.

Contents:
Transport policy, transport economics, traffic safety

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h, exercises 22 h, self-study 85 h

Target group:
Students in the Master's Programme of Civil Engineering

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:
Materials delivered during the lectures

Assessment methods and criteria:
Examination and exercises

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

Person responsible:
University teacher Virve Merisalo

Working life cooperation:
Yes

Other information:
-

485403A: Basics of Road Engineering, 5 op

Voimassaalo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1-5, pass, fail
Opettajat: Veikko Pekkala
Opintokohteen kielet: Finnish
Leikkaavuudet:
488153A Basics of Road Engineering 5.0 op

ECTS Credits:
5 ECTS / 135 h of work

Language of instruction:
Finnish

Timing:
Period 3

Learning outcomes:
By completing the course student understands the basics of road design and construction, is able to calculate structure layers of road and is familiar with the maintenance of roads

Contents:
Road and street planning and design, lining, roads structure, maintenance of roads, basics of earthworks

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures 28 h, exercises 22 h, self-study 85 h

**Target group:**
Students in bachelor's programmes of environmental engineering

**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:**
Materials delivered during the lectures

**Assessment methods and criteria:**
Exam, assignment and seminar work

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

**Person responsible:**
Veikko Pekkala

**Working life cooperation:**
-

**Other information:**
-

---

485404S: Road Design and Construction, 5 op

**Voimassaolo:** 01.08.2019 - 
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuyksikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Veikko Pekkala
**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS / 135 h of work

**Language of instruction:**
Finnish

**Timing:**
The course unit is held in the spring semester during period 4

**Learning outcomes:**
By completing the course student is familiar with road structure and function, structural modernisation, pavements and the basics of earthworks. He/she is also able to design road computer aided.

**Contents:**
Function of road structure, road damaging, structural modernisation, pavements, Road design and construction

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures 28 h, exercises 32 h, self-study 75 h

**Target group:**
Students in the master's programmes of environmental engineering

**Prerequisites and co-requisites:**
485403A Basics of Road Engineering

**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:**
Materials delivered during the lectures

**Assessment methods and criteria:**
Exam and assignment(s)

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

**Person responsible:**
Veikko Pekkala

---

**485115S: Advanced topics on concrete technology, 5 op**

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
  466110S  Advanced topics on concrete technology  5.0 op
  460156S-01  Advanced Course in Concrete Technology I, examination  0.0 op
  460156S-02  Advanced Course in Concrete Technology I, laboratory exercises  0.0 op
  460156S  Advanced Topics Concrete Technology I  4.0 op

**ECTS Credits:**
5 ECTS credits / 132 hours of work

**Language of instruction:**
Finnish

**Timing:**
Autumn semester, periods 1-2

**Learning outcomes:**
After completing the course the student is able to manage the goal of the subject by broadening the knowledge to new concrete types and their design methods, testing and application conditions and also on concrete with special properties such as e.g. high-quality, high strength and self-compressing. He can also explain how to assess the structural condition of concrete

**Contents:**
Durability and defects of concrete structures, high-strength concrete, self-compacting concrete. Processing of secondary raw materials for the preparation of special concrete, utilization of fly ash, slag and dust

**Mode of delivery:**
Face-to-face and distance learning

**Learning activities and teaching methods:**
Lectures, excercises, case studies, laboratory sessions and self directed learning

**Target group:**
Students studying structural engineering
Prerequisites and co-requisites:
466109S Concrete technology

Recommended optional programme components:

Assessment methods and criteria:
Passed laboratory exercises and exam

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

485116S: Advanced topics on design of concrete structures, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohde: Finnish
Leikkaavuudet:
   466108S Advanced topics on design of concrete structures 6.0 op
   460149S Advanced Topics on Design of Concrete Structures I 4.0 op
   460149S-02 Advanced Course in Design of Concrete Structures I, exercises 0.0 op
   460149S-01 Advanced Course in Design of Concrete Structures I, examination 0.0 op

ECTS Credits:
5 ECTS / 135 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 1 and 2.

Learning outcomes:
Upon completion of the course, the student will be able to design reinforced concrete structures and pre-stressed concrete beam structures according to EN standards.

Contents:

Mode of delivery:
Face-to-face and independent study.

Learning activities and teaching methods:
Lectures and exercises 48 h, project work 24 h and independent work 63 h.

Target group:
Master level students in the study areas of structural engineering in the degree program of civil engineering.

Prerequisites and co-requisites:
Good knowledge of statics, solid mechanics, concrete structures, concrete technology, structural engineering and analysis methods.

Recommended optional programme components:
The course supports advanced courses in structural engineering and life-long learning.
Recommended or required reading:

Assessment methods and criteria:
The course is passed by partial exams during the course or by a final exam. A project work is also required.

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
Senior research fellow Antti H. Niemi

Working life cooperation:
-

Other information:
Substitutes the course 466108S Advanced topics on design of concrete structures in academic year 2020-21.

485113S: Advanced topics on building physics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Filip Fedorik
Opintokohteen kielet: English
Leikkaavuudet:

466112S Advanced topics on building physics 5.0 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
English

Timing:
Autumn, periods 1-2

Learning outcomes:
After completing the course the student can explain the different physical phenomena that affect the temperature and moisture behaviour of different structures. He can also study numerically the building-physical behaviour of structures and structural systems. He can use different software to simulate the behaviour and solve problems. He can assess the potential mould risk of structure based on temperature and relative humidity values measured on site

Contents:

Mode of delivery:
Face-to-face and distance learning

Learning activities and teaching methods:
Lectures, excercises, case studies and self directed learning

Target group:
Students studying structural engineering
Prerequisites and co-requisites:
466101A Introduction to building construction, 466111S Building physics

Recommended or required reading:
The material that is in English will be distributed at the lectures

Assessment methods and criteria:
Exercises and homework

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
Filip Fedorik

485025S: Advanced topics on Civil Engineering, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

485024S: Construction Consulting, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

485204S: Information modelling and automation in building construction and maintenance, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
466116S Information modelling and automation in building construction and maintenance 2.5 op
460182S-01 Automation of Building and Bridge Construction, Examination 0.0 op
460182S-02 Automation of Building and Bridge Construction, Exercises 0.0 op
460182S Automation of Building and Bridge Construction 5.0 op

ECTS Credits:
5 ECTS

Language of instruction:
Finnish

Timing:
Periods 3 and 4

Learning outcomes:
The course gives understanding about the possibilities of information modeling and automation in building construction, use and maintenance. Also it develops abilities to apply information modeling and automation in building construction and maintenance. Student will learn more about theories of information modeling and automation, different applications, software and systems, and possibilities of advanced information transferring techniques.

Contents:
Information modeling, automation and robotics in the initial data surveys, design, control of construction, as-built surveys and use and facilities management of buildings. 3-D coordinate systems in building construction process. Creation of measurement base for sites. 3-D measurement techniques and systems (robotic total station, UAS, 3-D fast surveying and modeling methods). Least squares optimization based redundancy and adjustment. Information modeling based design methods and software applications. Manufacturing automation in the factories for building components. Automated ground improvement methods and 3D-systems. Automated site construction systems and robots. Augmented reality methods and applications. Advanced maintenance methods and systems for buildings. Cloud based use and facilities management. 3-D city models. National and international Building Information Modeling (BIM) guidelines. Open information transfer formats and standards.

Learning activities and teaching methods:
Lectures, self study, exercises, site excursions, exam.

Prerequisites and co-requisites:
No specific prerequisites

Recommended optional programme components:
Information modelling and automation in infrastructure construction and maintenance

Recommended or required reading:
Will be announced in the class.

Grading:
Opintojaksolla käytetään numeerista arviointiasteikkoa 1-5. Numeerisessa asteikossa nolla merkitsee hylättyä suoritusta.

Person responsible:
Professor Rauno Heikkilä

485203A: Information modelling and automation in infrastructure construction and maintenance, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Tanja Kolli
Opintokohteen kielet: Finnish
Leikkaavuudet:
466115S Information modelling and automation in infrastructure construction and maintenance 5.0 op
460180S-01 Automation of Road Construction, examination 0.0 op
460180S-02 Automation of Road Construction, exercises 0.0 op
460180S Automation of Road Construction 5.0 op
Ei opintojaksokuvauksia.

A485223: Module of the Option/Structural Engineering, 60 op

Voimassaolo: 01.08.2017 -
Choose 60 ECTS

485109A: Numerical methods in structural engineering, 5 op

Voimassaolo: 01.08.2019 - 31.07.2021
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Leikkaavuudet:
- 485121S Numerical methods in structural engineering 5.0 op
- 466103A Project work in structural engineering 5.0 op

ECTS Credits:
5 ETCS / 135 hours of work

Language of instruction:
Lectures in Finnish. Lecture notes in English. Foreign students can participate by studying independently the material and by carrying out the exercise work and exam in English.

Timing:
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course during the 4th year of studies.

Learning outcomes:
Ability to carry out structural analysis by using advanced numerical simulation technology. Knowledge of and ability to develop methods for verification of model data and accuracy of numerical solutions. Ability to present results of calculations in writing. Knowledge of different variational and energy principles of mechanics and ability to apply them in structural analysis. Knowledge of the properties of different structural models and ability to formulate an appropriate and validated mathematical model for specific problems. Knowledge of some special features concerning the analysis and dimensioning of steel, concrete and timber structures. Knowledge of special features of plate and shell structures from the viewpoint of structural design.

Contents:

Mode of delivery:
Face-to-face and independent study.

Learning activities and teaching methods:
Lectures and exercises 48 h, project work 24 h and independent work 63 h.

Target group:
Master level students in the study areas of structural engineering and engineering mechanics in the degree programs of civil and mechanical engineering, respectively.

Prerequisites and co-requisites:
Basic knowledge of statics, solid mechanics and differential & integral calculus.

Recommended optional programme components:
The course supports advanced courses in structural engineering and engineering mechanics.
Recommended or required reading:
Lecture notes and other electronic material.

Assessment methods and criteria:
The course is passed by partial exams during the course or by a final exam. A project work is also required.

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
Senior research fellow Antti H. Niemi

Working life cooperation:
-

Other information:
-

485116S: Advanced topics on design of concrete structures, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
  466108S  Advanced topics on design of concrete structures  6.0 op
  460149S  Advanced Topics on Design of Concrete Structures I  4.0 op
  460149S-02 Advanced Course in Design of Concrete Structures I, exercises  0.0 op
  460149S-01 Advanced Course in Design of Concrete Structures I, examination  0.0 op

ECTS Credits:
5 ETCS / 135 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn semester, during periods 1 and 2.

Learning outcomes:
Upon completion of the course, the student will be able to design reinforced concrete structures and pre-stressed concrete beam structures according to EN standards.

Contents:

Mode of delivery:
Face-to-face and independent study.

Learning activities and teaching methods:
Lectures and exercises 48 h, project work 24 h and independent work 63 h.

Target group:
Master level students in the study areas of structural engineering in the degree program of civil engineering.

Prerequisites and co-requisites:
Good knowledge of statics, solid mechanics, concrete structures, concrete technology, structural engineering and analysis methods.

Recommended optional programme components:
The course supports advanced courses in structural engineering and life-long learning.
Recommended or required reading:

Assessment methods and criteria:
The course is passed by partial exams during the course or by a final exam. A project work is also required.

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
Senior research fellow Antti H. Niemi

Working life cooperation:
-

Other information:
Substitutes the course 466108S Advanced topics on design of concrete structures in academic year 2020-21.

485115S: Advanced topics on concrete technology, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Leikkaavuudet:
466110S Advanced topics on concrete technology 5.0 op
460156S-01 Advanced Course in Concrete Technology I, examination 0.0 op
460156S-02 Advanced Course in Concrete Technology I, laboratory exercises 0.0 op
460156S Advanced Topics Concrete Technology I 4.0 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
Finnish

Timing:
Autumn semester, periods 1-2

Learning outcomes:
After completing the course the student is able to manage the goal of the subject by broadening the knowledge to new concrete types and their design methods, testing and application conditions and also on concrete with special properties such as e.g. high-quality, high strength and self-compressing. He can also explain how to assess the structural condition of concrete

Contents:
Durability and defects of concrete structures, high-strength concrete, self-compacting concrete. Processing of secondary raw materials for the preparation of special concrete, utilization of fly ash, slag and dust

Mode of delivery:
Face-to-face and distance learning

Learning activities and teaching methods:
Lectures, exercises, case studies, laboratory sessions and self directed learning
Target group:
Students studying structural engineering

Prerequisites and co-requisites:
466109S Concrete technology

Recommended optional programme components:

Assessment methods and criteria:
Passed laboratory exercises and exam

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

485113S: Advanced topics on building physics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Filip Fedorik
Opintokohteen kielet: English
Leikkaavuudet: 466112S Advanced topics on building physics 5.0 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
English

Timing:
Autumn, periods 1-2

Learning outcomes:
After completing the course the student can explain the different physical phenomena that affect the temperature and moisture behaviour of different structures. He can also study numerically the building-physical behaviour of structures and structural systems. He can use different software to simulate the behaviour and solve problems. He can assess the potential mould risk of structure based on temperature and relative humidity values measured on site

Contents:

Mode of delivery:
Face-to-face and distance learning

Learning activities and teaching methods:
Lectures, exercises, case studies and self directed learning

Target group:
Students studying structural engineering

Prerequisites and co-requisites:
466101A Introduction to building construction, 466111S Building physics
Recommended or required reading:
The material that is in English will be distributed at the lectures

Assessment methods and criteria:
Exercises and homework

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
Filip Fedorik

466105S: Design of Steel Structures, 6 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: 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
485108A Desing of Steel Structures and Steel Construction 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 able to explain the basic nature of the crystalline structure of steel and its elastomeric material model. He / she is able to evaluate the effect of alloys, heat treatment and welding on the mechanical properties of steel. He / she can explain what happens to steel in the event of a fire and the basics of fire design. The student is able to design the joints of a steel structure frame and can dimension the steel structure under different load combinations. He / she is able to analyze stability problems and can explain inaccuracies and second order effects.

Contents:

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:
Degree students who study steel structure design.

Prerequisites and co-requisites:

Recommended or required reading:

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

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

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Kangaspuoskari, Matti Johannes
Opintokohteen 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:
The student can explain the basics of fatigue design of a welded structure. The student is able to design sheet metal structures and welded plate beam structures. He/she is able to analyze and design steel structures and their joints. They are able to analyze dynamically loaded structures and to evaluate the effect of vibrations on the functionality and usability of structures.

Contents:

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:**
Degree students who study steel structure design.

**Prerequisites and co-requisites:**

**Recommended or required reading:**

**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

---

461112S: Mechanical vibrations, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Advanced Studies
**Laji:** Course
**Vastuuysikkö:** Field of Mechanical Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Laukkanen, Jari Jussi
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 461019S-01 Mechanical Vibrations, examination 0.0 op
- 461019S-02 Mechanical Vibrations, exercises 0.0 op
- 461019S Mechanical Vibrations 6.0 op

**ECTS Credits:**
5 ects /135 hous of work

**Language of instruction:**
Finnish

**Timing:**
Lectures and exercises during the periods 3 - 4.

**Learning outcomes:**
The aim of this course is to familiarize students with the principles and phenomena of mechanical vibrations and show how different vibrations can be represented by a theoretical model and how detrimental vibrations can be avoided in structures and machines.
Learning outcomes: After the course, the student is capable of forming the equations of motion for a single and multi-degree-of-freedom systems and continuous models and is able to solve them using analytical, numerical and approximate methods. Moreover, the student is able to use finite element methods to solve basic vibration problems.

**Contents:**
Basic principles; Vibrations of single degree-of-freedom systems; Vibrations of multi-degree-of-freedom systems; Torsional vibration of a power drive chain; Longitudinal, transverse and torsional vibrations of a beam represented by a continuous model; Some approximation methods; Use of FEM in vibration analysis; Introduction to the theory of balancing; Experimental modal analysis.

**Mode of delivery:**
Face-to-face teaching
Learning activities and teaching methods:
This course will be based on lectures 45 h and exercises 30 h and 45 h self-study during periods 3 – 4 and 15 h for a project work. Students are required to take a final exam or mid-term exams.

Prerequisites and co-requisites:
First year mathematics, Strength of Materials I & II and Dynamics.

Recommended or required reading:

Assessment methods and criteria:
The grade of the course is based on midterm exams or a final examination. The student must pass the exercises before taking the examination.

Grading:
Numerical grading scale 1-5.

Person responsible:
Jari Laukkanen

485307S: Cold Climate Engineering, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Anssi Rauhala
Opintokohteen kielet: English
Leikkaavuudet:

488132S Cold Climate Engineering 5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course unit is held in the spring semester, during period 3

Learning outcomes:
After the course the student knows how permafrost and seasonally frozen ground affect different aspects of construction. The student can perform frost heave calculations and evaluate the need for ground frost insulation. The student knows how winter conditions are considered in road and street design. Student knows the basics of geothermal energy and energy efficient structures.

Contents:
Permafrost and seasonally frozen ground. Frost heave and ground frost insulation. Winter conditions related road, street and water supply design criteria. Geothermal energy. Energy efficient structures.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises (28 h), independent study (107 h).

Target group:
Master’s students in Civil Engineering

Prerequisites and co-requisites:
485301A Basics of Geotechnics, 485102A Introduction to structural design
Recommended optional programme components:
-
Recommended or required reading:
Lecture handout and other materials delivered in lectures

Assessment methods and criteria:
Examination and assignment(s)

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

Person responsible:
Ansi Rauhala

Working life cooperation:
No

Other information:
-

485202S: Building information modeling, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
  466114S  Building information modeling  5.0 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
Finnish

Timing:
Autumn semester, periods 1-2

Learning outcomes:
After completing the course the student is able to make 3D models of buildings and detail the connections between building elements and components. He can model different building materials and is familiar with one commercial software.

Contents:

Mode of delivery:
Face-to-face

Learning activities and teaching methods:
Lectures, exercises and self directed learning

Target group:
Students studying structural engineering

Recommended or required reading:
The material that is in English will be distributed at the lectures

Assessment methods and criteria:
Participation to lectures and exercises

Grading:
Pass or fail.

Person responsible:
Rauno Heikkilä

485112S: Project work in structural engineering, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

485111S: Advanced Topics on Structural Timber Design, 5 op

Voimassaolo: 01.08.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Antti Niemi
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

485002S: Advanced Practical Training, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Practical training
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

477005S Advanced Practical Training 5.0 op
460004S Practical Training II 5.0 op

ECTS Credits:
5 ECTS, 2 months working full-time

Language of instruction:
Finnish or English

Timing:
Student usually works in summer time.

Learning outcomes:
During the advanced practical training the student is exposed to his/her working environment from the point of view of his/her studies and becomes acquainted with another possible future job or to a different assignment already in a familiar working environment. The student can identify the problems of the working environment and can solve them. The student can apply theoretical knowledge in practical tasks. The student identifies the tasks appropriate for the Master of Science in Technology at his/her workplace.

Mode of delivery:
Working as employee
Target group:
Master’s students in Civil Engineering

Assessment methods and criteria:
Student has to show original references and leave the application. In addition she/he has to participate to seminar where she/he reports own summer job. In reference must be training time period and duties.

Grading:
Verbal scale Passed/Failed

Person responsible:
Saara Luhtaanmäki

Working life cooperation:
Yes.

461107A: Finite Element Methods I, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Lumijärvi, Jouko Veikko Juhani
Opintokohteen kielet: Finnish
Leikkaavuudet:

461033A  Finite Element Methods I  3.5 op
461033A-01 Finite Element Methods I, examination  0.0 op
461033A-02 Finite Element Methods I, exercises  0.0 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
Finnish

Timing:
Lectures and exercises, periods 1.-2.

Learning outcomes:
The aim of this course is for students to gain an understanding of the basic idea and restrictions of FEM. After this course, the student can explain the basic idea of the FEM. He/she can analyze simple truss-, frame- and plane structures and explain the theoretical background of the calculations.

Contents:
The basic idea of FEM and its use in static analyses of bars, beams and plane structures. Some general principles of the use of FEM.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures and exercises take place during periods 1.-2.

Target group:
Students of the bachelor’s stage of the Mechanical Engineering Degree Programme.

Prerequisites and co-requisites:
Strength of Materials I and II and Fundamentals of mechanical computing and programming

Recommended or required reading:

**Assessment methods and criteria:**
The grade of the course is based on a final exam. The student must pass the exercises before taking the examination.

**Grading:**
Numerical grading scale 1-5.

**Person responsible:**
Jouko Lumijärvi

---

**461104A: Strength of materials II, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuysikkö:** Field of Mechanical Engineering

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

**Opettajat:** Laukkanen, Jari Jussi

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 461011A-01 Strength of Materials II, examination 0.0 op
- 461011A-02 Strength of Materials II, exercises 0.0 op
- 461011A Strength of Materials II 7.0 op

**ECTS Credits:**
5 ECTS

**Language of instruction:**
Finnish

**Timing:**
Periods 1-2.

**Learning outcomes:**
The student can apply fatigue design principles in structural analysis and use fracture mechanics to evaluate the life of simple structures. He / she is also able to solve stability, buckling and buckling bending of rod and beam structures. The student is able to solve curve beam bending state and free and prevented torque situations. After completing the course, the student will have a general understanding of the different areas of strength and will be able to discuss the potential of strength design with experts in the field.

**Contents:**

**Mode of delivery:**
Contact teaching

**Learning activities and teaching methods:**
Lectures 45 h, exercises 45 h and independent learning 45 h. Homework.

**Target group:**
Compulsory for Mechanical Engineering Degree students.

**Prerequisites and co-requisites:**
Statics and Strength of Materials I.

**Recommended or required reading:**

**Assessment methods and criteria:**
The course can be completed with an intermediate exam or a final exam. You can take the exam only after you have successfully completed your homework.

**Grading:**
The course uses 1-5 numerical grading scale. On a numerical scale, zero indicates a failed performance.

**Person responsible:**
University Teacher Jari Laukkanen.
485991S: Master's Thesis Seminar, 0 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

485999S: Master's Thesis in Civil Engineering, 30 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Diploma thesis
Vastuuyksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:
30 ects
Language of instruction:
Finnish/English
Timing:
Recommended timing the spring term of the 2nd year of the master level.
Learning outcomes:
Upon completion of the thesis the student recognizes practical problems, she/he be able to create a research plan and research questions. She/He is able to plan the project and manage her/his own work according to the timetable. Student controls different kind of research methods and be able to apply skills learned during master's studies to solving asked research questions. She/he understand practical meanings of solutions, limited and know if there is some useful outputs. The student can also utilize different information sources and critically evaluate the information obtained. The student is able to produce clear and finalized text, in line with technical and scientific writing practices.
Contents:
The student defines the contents of his / her work, consulting the supervisor of the Master's thesis. The responsible person of degree programme accepts the contents, the subject and the topic of the thesis work.
Mode of delivery:
Individual work. The diploma thesis completes the master's degree studies.
Learning activities and teaching methods:
The Master's thesis work is supervised by a staff member of the Faculty and doing with industrial company.
Target group:
Civil Engineering Master's students
Prerequisites and co-requisites:
Master's level studies of Degree programme.
Assessment methods and criteria:
The thesis work is made independently by the student as planned. The thesis work is saved digitally and reviewed through the University of Oulu Laturi electronic thesis (E-thesis) submission system. Final written report will evaluate.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Thesis' supervisor
Working life cooperation:
Working in or with the industrial company.

485990S: Maturity Test, Civil Engineering, 0 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuysikkö: Civil Engineering field  
Arvostelu: 1 - 5, pass, fail  
Opintokohteen kielet: Finnish  

ECTS Credits:  
0 ects  

Language of instruction:  
Finnish, Swedish or English.  

Timing:  
After completion of the master's thesis.  

Learning outcomes:  
The student can produce text in popular form of the research field and thus show ones familiarity to the field.  

Contents:  
Depends on the topic of the thesis.  

Mode of delivery:  
Literary work.  

Learning activities and teaching methods:  
Exam  

Target group:  
Master Students of Civil Engineering  

Recommended optional programme components:  
Will be written after the Master's Thesis has been submitted for review.  

Assessment methods and criteria:  
Student writes an essay about the topic of the Master's thesis to show a good command of the content of the thesis.  

Grading:  
Pass or fail  

Person responsible:  
Supervisor of Thesis  

A485124: Civil Engineering, Intermediate Studies, 60 op  

Voimassaalo: 01.08.2018 -  
Opiskelumuoto: Intermediate Studies  

Laji: Study module  

Vastuuysikkö: Civil Engineering field  
Arvostelu: 1 - 5, pass, fail  
Opintokohteen kielet: Finnish  

Ei opintojaksokuvausia.  

Intermediate Studies  

485101A: Introduction to building construction, 5 op  

Voimassaolo: 01.08.2019 -  
Opiskelumuoto: Intermediate Studies  

Laji: Course  

Vastuuysikkö: Civil Engineering field  
Arvostelu: 1 - 5, pass, fail  
Opettajat: Liedes, Hannu Tapani  
Opintokohteen kielet: Finnish  

Leikkavuudet:  
466101A Introduction to building construction 5.0 op  
460116A-01 Introduction to Contruction Engineering, examination 0.0 op  
460116A-02 Introduction to Contruction Engineering, exercise work 0.0 op  
460116A Introduction to Building Construction 3.0 op
461105A: Technical thermodynamics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Lahtinen, Hannu Tapio
Opintokohteen kielet: Finnish
Leikkaavuudet:

ECTS Credits:
5 ETCS / 120 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 2nd autumn semester.

Learning outcomes:
After the course, the student can explain the principal laws of thermodynamics and their impact on energy conversions. Student can apply the energy balance equations for closed and open systems in the calculation of properties and path functions of different processes. The student can explain the theoretical foundations of combustion engines, gas and vapor power plants, and refrigerators and heat pumps. In addition, student can solve problems regarding fluid flow in pipes and heat and moisture transfer.
The course gives fundamental information of thermodynamics and its applications.

Contents:
Heat and moisture transfer and fluid flow in pipes; Principal laws in thermodynamics and basic concepts involved; Applications in production, transformation, transfer and use of energy.

Mode of delivery:
Implemented as Face-to-face -teaching.

Learning activities and teaching methods:
Lectures 30 h / exercises 30 h / independent work of solving homework problems 60 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:
Cengel, Y.A. & Boles, M.A., Thermodynamics; An Engineering Approach, Fifth edition in SI-units, 2006;

Assessment methods and criteria:
The course is passed by midterm exams or by a final exam. During the course two midterm exams are arranged. Every week exercises are organized, and part of the exercise problems are left for independent work.

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

Person responsible:
485103A: Building physics, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Filip Fedorik
Opintokohteen kielet: English

Leikkaavuudet:

<table>
<thead>
<tr>
<th>Reference</th>
<th>Type</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>466111S</td>
<td>Building physics</td>
<td>5.0 op</td>
</tr>
<tr>
<td>460160S-01</td>
<td>Building Physics, examination</td>
<td>0.0 op</td>
</tr>
<tr>
<td>460160S-02</td>
<td>Building Physics, exercises</td>
<td>0.0 op</td>
</tr>
<tr>
<td>460160S</td>
<td>Building Physics</td>
<td>3.5 op</td>
</tr>
</tbody>
</table>

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
English

Timing:
Autumn, Periods 1-2

Learning outcomes:
After completing the course the student can explain basic phenomenon of building physics. The student can analyse and describe heat, air and moisture transfer in buildings and also explain main causes of typical moisture damages. The student can explain factors affecting energy efficiency and can calculate the energy efficiency number. The student knows the calculation methods in acoustics.

Contents:

Mode of delivery:
Face-to-face and distance learning

Learning activities and teaching methods:
Lectures, exercises, case studies, and self directed learning

Target group:
Students studying structural engineering

Prerequisites and co-requisites:
466101A Introduction to building construction

Recommended or required reading:
The material that is in English will be distributed at the lectures
1) Lecture notes (mainly in Finnish)
2) Suomen rakentamismääräyskokoelman osat C1, C2, C3, C4 ja D3.

Assessment methods and criteria:
Exercises and exam

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
university lecturer Raimo Hannila

Other information:
This course will replace course 466111S Building Physics in Academic year 2020-21.

485022A: Fundamentals of built environment, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Hannu Tapani
Opintokohteen kielet: Finnish

Leikkaavuudet:
   454541A  Built Environment  5.0 op
   488142A  Environmental legislation and EIA  5.0 op

ECTS Credits:
5 ECTS

Language of instruction:
Finnish

Timing:
Period 4

Learning outcomes:
Having completed the course, the student masters the basics of contemporary environmental legislation. He / she will be familiar with the main features and content of the land use planning process, building legislation and regulations, and environmental legislation as well as related decrees and regulations. The student will be able to identify the steering effects of environmental laws in different environmental projects and to understand the basics of different planning processes and permit procedures and their impact assessment. He / she will be able to search for information and guidance related to environmental legislation and can apply it in a planning and research project.

Contents:
Finnish legal system, environmental legislation (including Land Use and Building Act, Environmental protection Act, Mining Act), international agreements and EU guidance where applicable, land-use planning hierarchy and processes, legal effects, environmental impact assessment (EIA), permit procedures.

Mode of delivery:
The course consists of contact teaching, lectures, project work guidance and presentation of group work. The course is a joint course of the Faculty of Technology in the degree programs of Construction and Civil Engineering, Oulu School of Architecture and Water Resources and Environmental Engineering. The lectures in the course are common to all. The students will make a group work, which will take into account the Learning Objectives of different degree programs. The student chooses the assignment according to his/ her own degree program.

Learning activities and teaching methods:
16 h lectures + 16 h seminars, independent studying. Total 133 h.

Target group:
Students of Construction and Civil Engineering, students of Oulu School of Architecture and students of Water Resources and Environmental Engineering.

Prerequisites and co-requisites:
Students of architecture: 454523A Neighborhood Design. Other units: -.

Recommended optional programme components:
-

Recommended or required reading:
Internet service on legal information Finlex Data Bank where applicable. (http://finlex.fi).
Assessment methods and criteria:
Assignment (40%), seminars (40%) and learning diary (20%).

Grading:
Grades 1-5 where 0 is failed.

Person responsible:
University teacher Hannu Liedes, University lecturer Anna-Kaisa Ronkanen and Professor Tarja Outila

Working life cooperation:
The course will be organized in co-operation with different degree programs in the Faculty of Technology and the content of the course will be delivered with experts in different fields. The assignments will be made in interdisciplinary groups. The assignments are problem-based and imitate real-life projects.

Other information:
The student will receive the ECTS credits according to his/her degree program requirements and/or by his/her own choice, however, the credits will always be recorded for the course for which the assignment was made. In principle the students of Construction and Civil Engineering will get credits for 4855022A Rakennetun ympäristön perusteet, the students of Oulu School of Architecture will get credits for 485022A Rakennettu ympäristö and the students of Water Resources and Environmental Engineering will get credits for 488142A Environmental legislation and EIA. The credits can only be recorded once.

485301A: Basics of Geotechnics, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
488115A Geomechanics 5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course unit is held in the autumn semester, during period 1

Learning outcomes:
Upon completion this course, the student will understand the fundamentals of Soil mechanics, foundation engineering and soil freezing and thawing.

Contents:
Origins and composition of soils, classification of soils, stress and strains in soils, mechanical properties of soils, bearing capacity of foundations, seepage analyses, freezing and thawing of soils, site investigations and in situ testing.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (30 h) and calculation exercises (10 h) also independent work (95 h)

Target group:
Students in Bachelor programs of civil engineering and environmental engineering

Prerequisites and co-requisites:
No

Recommended optional programme components:
- 

Recommended or required reading:
Lecture handout and other materials delivered in lectures, Principles of Geotechnical Engineering by Das B. M.

Assessment methods and criteria:
Examination

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

Person responsible:
Anne Tuomela

Working life cooperation:
No

Other information:
This course will replace course 488115A Geomechanics in Academic year 2020-21.

485302A: Foundation Engineering, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
   ay485302A  Foundation Engineering (OPEN UNI)  5.0 op
   488129S  Foundation Engineering  5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course unit is held in the autumn semester during period 2

Learning outcomes:
After completing the course, students know the basics of base construction plan, can identify geotechnical dimensioning limit states and use partial factor method. Student can describe different foundation methods, types and principles of typical foundation piles, excavation types, risks and principles of risk management, radon. Student knows the principles of foundation drainage and frost protection. Student knows the basics of how to design piled foundation. Student knows ultimate bearing capacity formula for shallow foundation (Eurocode).

Contents:

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures and exercises (28 h), self-study (107 h)

Target group:
Students in bachelor's program of civil engineering
**Prerequisites and co-requisites:**
485301A basics of Geotechnics

**Recommended optional programme components:**
-

**Recommended or required reading:**
Materials delivered in lectures

**Assessment methods and criteria:**
Exam and assignment(s)

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

**Person responsible:**
Veikko Pekkala

**Working life cooperation:**
No

**Other information:**
This course will replace course 488129S Foundation Engineering.

---

**485201A: Building information modeling and CAD, 5 op**

**Voimassaolo:** 01.08.2019 - 
**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Civil Engineering field

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

**Opettajat:** Antti Niemi

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ETCS / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the spring semester, during period 4.

**Learning outcomes:**
Upon completion of the course, student will know the basics of computer-aided modeling and design. The course enables application and development of modeling and design applications and further development as an independent user of various modeling systems and platforms.

**Contents:**

**Mode of delivery:**
Face-to-face and independent study.

**Learning activities and teaching methods:**
Lectures and exercises 30 h, independent study and project work 105 h.

**Target group:**
Bachelor level students in the degree program of civil engineering.

**Prerequisites and co-requisites:**
Basic course in mathematics.

**Recommended optional programme components:**
The course supports advanced courses in civil engineering.

**Recommended or required reading:**
Lecture and exercise material.

**Assessment methods and criteria:**
Continuous assessment of exercise work and home work.

**Grading:**
Passed/fail

**Person responsible:**
Antti H. Niemi and Pekka Rossi

**Working life cooperation:**
-

**Other information:**
-

---

485023A: GIs and geoinformatics, 5 op

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
494302A GIS and spatial data 5.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course unit is held in the autumn semester, during period 2

**Learning outcomes:**
After completion the student understands the basics of spatial data and geographical information systems (GIS) including especially the most important coordinate systems, map projections, Finnish map coordinates and satellite positioning, and knows how to visualize spatial data in various ways.

**Contents:**
The course provides basic information about the presentation and handling of spatially dependent geoscientific data and geographic information systems (GIS). The course considers the basics of spatial data, coordinate systems, map projections and map coordinates, satellite positioning, processing and visualization of spatial data. Computer exercises demonstrate preparation and visualization of geoscientific data in practice.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures and exercises totaling 40 h plus independent study 95 h

**Target group:**
Bachelor students in civil engineering

**Prerequisites and co-requisites:**
No specific prerequisites

**Recommended optional programme components:**
Recommended or required reading:
Lecture handout and other materials delivered in lectures

Assessment methods and criteria:
Examination and computer test

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

Person responsible:
Anssi Rauhala

Working life cooperation:
No

Other information:

485102A: Introduction to structural design, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Hannu Tapani
Opintokohteen kielet: Finnish
Leikkaavuudet:
466102A  Introduction to structural design  3.0 op
460117A-01 Introduction to Structural Design, examination  0.0 op
460117A-02 Introduction to Structural Design, exercise work  0.0 op
460117A  Introduction to Structural Design  6.0 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
Finnish

Timing:
Autumn semester, periods 1-2

Learning outcomes:
After completing the course the student is able to name technical regulations and instructions, which guide construction. After completing the course students can explicate principle of verifications and plastic theory on structure design and also different loads on structure. Student estimate design loads by calculation and design load effect in structures. Student can describe different structure and bracing systems.

Contents:
Regulations and supervising. The principle of design verification. The loads and effect. The principle of using of eurocode. The principle of plastic theory on on structure design. Structure systems. The joints of structures.

Mode of delivery:
Lecture room teaching

Learning activities and teaching methods:
Lectures and exercises

Target group:
Students studying structural engineering
Prerequisites and co-requisites:
461016A Statics and 460101A Strength of Materials I

Recommended or required reading:
Lecture notes (mainly in Finnish), Finnish law and legislation, National building code of Finland, Eurocode standards

Assessment methods and criteria:
Passed practical works and exam

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
University teacher Hannu Liedes

Other information:
This course will replace course 466102A Rakennesuunnittelun perusteet in Academic year 2020-21.

485105A: Concrete technology, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
   466109S  Concrete technology  5.0 op
   460155S-01 Concrete Technology, examination  0.0 op
   460155S-02 Concrete Technology, laboratory exercise  0.0 op
   460155S  Concrete Technology  4.5 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
Finnish

Timing:
Spring semester, periods 3-4

Learning outcomes:
After completing the course the student is able to specify concrete and the materials from which it is made. They can design normal concrete mixes and identify, describe and carry out the main laboratory tests relevant to the use of concrete on site.

Contents:
Cements and cementitious materials, aggregates for concrete, concrete mix design, properties of fresh and hardened concrete, laboratory tests, specification testing and compliance, environmental exposure classes.

Mode of delivery:
Face-to-face and distance learning

Learning activities and teaching methods:
Lectures, exercises, case studies, laboratory sessions and self directed learning

Target group:
Students studying structural engineering

Prerequisites and co-requisites:
466101A Introduction to building construction
Recommended optional programme components:
466101A Introduction to building construction

Recommended or required reading:
The material that is in English will be distributed at the lectures.
1) Lecture notes (mainly in Finnish),
4) Suomen Standardisoimisliitto ry. SFS-Standardisointi:
5) SFS-EN Standards

Assessment methods and criteria:
Passed laboratory exercises and exam

Grading:
Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:
Jorma Hopia

Other information:
This course will replace course 466109S in Academic year 2020-21.

485106A: Design of concrete structures, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Leikkaavuudet:
466107S Design of concrete structures 6.0 op
460147A Introduction to Design of Concrete Technology 4.0 op
460147A-01 Introduction to Design of Concrete Technology, examination 0.0 op
460147A-02 Introduction to Design of Concrete Technology, exercise work 0.0 op
460148S Design of Concrete Structures 4.0 op
460148S-01 Design of Concrete Structures I, examination 0.0 op
460148S-02 Design of Concrete Structures I, exercises 0.0 op

ECTS Credits:
5 ects

Language of instruction:
Finnish

Timing:
Lectures and exercising on periods 3 and 4.

Learning outcomes:
Upon completion of the course, the student will be able to design typical reinforced concrete structures to EN-standards.

Contents:
Strength and strain properties of concrete and reinforcing bars, time dependent properties. Limit state design of concrete beams and columns to EN standards. Service life design. Fire design. Anchoring and joints of reinforcing bars. Design of flanged cross sections, walls and wall like beams, and foundations carrying walls and columns.

Mode of delivery:
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures and exercises 48 h, project work 24 h and independent work 63 h

**Target group:**
Bachelor level students in the degree program of civil engineering

**Prerequisites and co-requisites:**
Basic knowledge of statics, solid mechanics, concrete technology and structural engineering

**Recommended or required reading:**

**Assessment methods and criteria:**
The course is passed by partial exams during the course or by a final exam. A project work is also required.

**Grading:**
The course utilises a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

**Person responsible:**
Senior research fellow Antti H. Niemi

**Other information:**
This course will replace course 466107S Design of concrete structures in Academic year 2020-21.

---

**485001A: Practical Training, 5 op**

- **Voimassaolo:** 01.08.2019 -
- **Opiskelumuoto:** Intermediate Studies
- **Laji:** Practical training
- **Vastuuysikkö:** Civil Engineering field
- **Arvostelu:** 1 - 5, pass, fail
- **Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS, 3 months working full-time

**Language of instruction:**
Finnish or English

**Timing:**
Student usually works in summer time.

**Learning outcomes:**
During the practical training the student is exposed to his/her working environment from the point of view of his/her studies and becomes acquainted with one of a possible future job. The student can identify the problems associated with the working environment and can propose improvements to them. The student will experience points of contact between working life and studies.

**Target group:**
Bachelor students of Civil Engineering

**Assessment methods and criteria:**
Student has to show original references and leave the application and report to tutor teacher. In reference must be training time period and duties.

**Grading:**
Verbal scale Passed/Failed
A485120: Civil Engineering, Basic Studies, 70 op

Voimassaolo: 01.08.2018 -
Opiskelumuoto: Basic Studies
Laji: Study module
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Basic Studies

485000P: Planning of Studies and Career, 1 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:
1 ECTS /28 hours of work
Language of instruction:
Finnish
Timing:
The course unit is held in the autumn semester, during periods 1 and 2.
Learning outcomes:
The aim of the course is to introduce new students to the university, academic studies, the department and the studies of his/her degree programme in the faculty of Technology.
Contents:
Issues related to the beginning of the studies. Goals, structure and contents of the studies in the Faculty of Technology. Preparing a personal study plan. Study technique and the library.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
Tutorials, information days organized by the faculty and by the degree programmes, independent studying.
Target group:
All first year students in degree programme in Civil Engineering
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
Participation to the tutorials and information sessions and doing the personal study plan. Student have to participate 2 times in Master's Thesis Seminars (485991S) and some exercises topics of Study skills and competences.
Grading:
Verbal scale Passed/Failed
Person responsible:
Reijo Saari

031010P: Calculus I, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Pauliina Uusitalo
Opintokohteen kielet: Finnish
Leikkaavuudet:
ay031010P Calculus I (OPEN UNI)  5.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish. The course will be lectured also in English.

Timing:
Fall, period 1

Learning outcomes:
Upon completion of the course, the student
- knows how to solve inequalities and equations with absolute value
- identifies the concepts of vector algebra
- can use vector algebra for solving the problems of analytic geometry
- can explain basic characteristics of elementary functions
- is able to analyse the limit and the continuity of the real valued functions of one variable
- can analyse the local minima and maxima of a function
- knows how to find the derivative for a function given with parametric representation
- is able to evaluate the basic calculation of the complex numbers and can rewrite a complex number in its exponential form
- knows the connection between the integral and area
- knows integral techniques such as integration by parts, a substitution method and a partial fraction composition
- can solve problems associated with the differential and integral calculus of the real valued functions of one variable.

Contents:
- Inequalities and absolute value
- Vector algebra and analytic geometry
- Concept of the function and elementary functions
- Monotonicity of the function, the inverse function
- Limit values
- Derivative as limit value of the difference quotient. Derivatives of elementary functions
- The extreme values of a function
- Parameter presentation of the curve, polar coordinates, complex numbers
- Integral function and definite integral, applications
- Integration by parts, substitution method and integration of rational functions

Mode of delivery:
Blended learning, course material is in Moodle learning environment
Learning activities and teaching methods:
Lectures 28 h / Group work 22 h / Self-study 85 h

Target group:
1. year students of technical sciences, mathematics and physics

Prerequisites and co-requisites:
-

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The course is completed with mid-term exams or a final exam. When completed with mid-term exams, exercise assignments are part of the continuous assessment. The assessment of the course is based on the learning outcomes of the course. 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:
Pauliina Uusitalo

Working life cooperation:
The course does not contain working live cooperation.

Other information:
-

031075P: Calculus II, 5 op

Voimassaalo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Pauliina Uusitalo
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay031075P Calculus II (OPEN UNI) 5.0 op
031011P Calculus II 6.0 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish. The course can be completed in English by intermediate exams or by a final exam.

Timing:
Spring semester, period 3

Learning outcomes:
Upon completion of the course, the student is able to examine the convergence of series and power series of real terms, can explain the use of power series e.g. in calculating limits, is able to solve problems related to differential and integral calculus of real and vector valued functions of several variables.

Contents:
Sequences, series, power series and Fourier series of real terms. Differential and integral calculus of real and vector valued functions of several variables.

**Mode of delivery:**
Online teaching

**Learning activities and teaching methods:**
Lectures 28 h / Group work 22 h / Self-study 85 h.

**Target group:**
-

**Prerequisites and co-requisites:**
The recommended prerequisite is the completion of the course 031010P Calculus I.

**Recommended optional programme components:**
-

**Recommended or required reading:**

**Assessment methods and criteria:**
Intermediate exams or a final exam. The exams are remote exams. It is possibility to take exams also at the university.
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:**
Pauliina Uusitalo

**Working life cooperation:**
-

**Other information:**
-

**031076P: Differential Equations, 5 op**

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Basic Studies
**Laji:** Course
**Vastuuysikkö:** Applied Mathematics and Computational Mathematics
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Ruotsalainen Keijo
**Opintokohleen kielet:** Finnish

**Leikkaavuudet:**
ay031076P  Differential Equations (OPEN UNI)  5.0 op
800320A  Differential equations  5.0 op
031017P  Differential Equations  4.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the spring, during period 4. It is recommended to complete the course at the 1th spring semester.

**Learning outcomes:**
The students can apply differential equations as a mathematical model. They can identify and solve various differential equations and they have knowledge on basic solvability of differential equations. The student can use the Laplace transform as a solution method.

**Contents:**
Ordinary differential equations of first and higher order.
Laplace transform with applications to differential equations.

**Mode of delivery:**
Online teaching, Stack/Moodle digital learning environment

**Learning activities and teaching methods:**
Lectures 28 h / Group work 22 h / Self-study 85 h.

**Target group:**
1. year students of engineering, mathematics and physics.

**Prerequisites and co-requisites:**
The recommended prerequisite is the completion of the course Calculus I.

**Recommended optional programme components:**
-

**Recommended or required reading:**
Recommended literature: Kreyszig, E: Advanced Engineering Mathematics;

**Assessment methods and criteria:**
The course can be completed by intermediate exams (2 exams) or by a final exam.
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:**
Keijo Ruotsalainen

**Working life cooperation:**
No

---

031021P: Probability and Mathematical Statistics, 5 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuysikkö:** Applied Mathematics and Computational Mathematics

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

**Opettajat:** Jukka Kemppainen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
ay031021P Probability and Mathematical Statistics (OPEN UNI) 5.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
Spring semester, period 3

**Learning outcomes:**
After completing the course the student
1. knows the key concepts of probability and the most important random variables,
2. will be able to use them in calculating probabilities and parameters of probability distributions,
3. is capable of analyzing statistical data by calculating interval and point estimates for the parameters,
4. will be able to formulate statistical hypotheses and test them,
5. knows the basics of linear regression.

Contents:
The key concepts of probability, random variable, parameters of probability distributions, estimation of
parameters, hypothesis testing, regression analysis.

Mode of delivery:
Online teaching

Learning activities and teaching methods:
Lectures 28 h/Exercises 20 h/Self study 87 h.

Target group:
The students in the engineering sciences. Other students are welcome, too.

Prerequisites and co-requisites:
The recommended prerequisites are the course 031010P Calculus I and some parts of the course
031075P Calculus II.

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:

Assessment methods and criteria:
Intermediate exams or a final exam. The exams are remote exams. It is possibility to take exams also at
the university.
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:
Jukka Kemppainen

Working life cooperation:

031078P: Matrix Algebra, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Matti Peltola
Opintokohteen kielet: Finnish
Leikkavuudet:
   ay031078P    Matrix Algebra (OPEN UNI)    5.0 op
   031019P    Matrix Algebra    3.5 op

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the autumn, during period 2. It is recommended to complete the course at the 1th
autumn semester.

Learning outcomes:
The student is able to apply arithmetic operations of matrices and can solve system of linear equations by matrix methods and can apply matrix factorizations to find the solution of the system of linear equations. The student is able to recognize the vector space and understands the concepts of basis and dimension of a vector space and can analyse matrices by the parameters, vectors and vector spaces of matrices. He /She knows how to calculate determinant, eigenvalues and eigenvectors of a square matrix, and is able to diagonalize matrices and apply diagonalization to the simple problems.

Contents:

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:
1. year students of technical sciences, mathematics and physics.

Prerequisites and co-requisites:
-

Recommended optional programme components:
-

Recommended or required reading:

Assessment methods and criteria:
The course can be completed by intermediate exams (2 exams) or by a final exam. 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 Peltola

Working life cooperation:
-

Other information:
-

780120P: Basic Principles in Chemistry, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Field of Chemistry
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
780117P General and Inorganic Chemistry A 5.0 op
780109P Basic Principles in Chemistry 4.0 op

ECTS Credits:
5 ECTS credits / 134 hours of work

Language of instruction:
Finnish
Timing:
The course is held in the autumn semester, during period 1

Learning outcomes:
Upon completion of the course, the student will be able to display an understanding of basic chemistry phenomenon; equilibrium of acids and bases, chemical equilibrium, redox reactions and stoichiometry.

Contents:
Introduction to chemistry, stoichiometry, redox reactions, chemical equilibrium, the equilibrium of acid and bases, buffer solutions, titration, thermodynamics.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
40 hours of lectures and 94 hours of self-study

Target group:
Biology, Geology, Process Engineering, Environmental Engineering compulsory.
Geography, optional.

Prerequisites and co-requisites:
The compulsory course in upper secondary school chemistry (1st course)

Recommended optional programme components:
The course is not included in the 25 ECTS credits entity of chemistry!

Recommended or required reading:

Assessment methods and criteria:
Final examination.

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

Person responsible:
Minna Tiainen

Working life cooperation:
No

761119P: Electromagnetism 1, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Field of Physics
Arvostelu: 1 - 5, pass, fail
Opettajat: Timo Asikainen
Opintokohteen kielet: Finnish
Leikkaavuudet:
  761113P-01   Electricity and magnetism, lectures and exam   0.0 op
  761113P-02   Electricity and magnetism, lab. exercises   0.0 op
  761113P   Electricity and magnetism   5.0 op
  766319A   Electromagnetism   7.0 op
  761103P   Electricity and Magnetism   4.0 op

ECTS Credits:
5 ECTS credits / 133 hours of work
- 761119P-01, Lectures and exam (4 cr)
- 761119P-02, Lab. exercises (1 cr)
Language of instruction:
Finnish

Timing:
Second fall term

Learning outcomes:
The student will be able to understand the basic concepts of electromagnetism and can apply this understanding to solve problems related to electromagnetism.

Contents:
Basic principles of electromagnetic phenomena and their physical and geometric interpretation. More detailed contents will be presented later.

Mode of delivery:
face-to-face teaching

Learning activities and teaching methods:
Lectures 32 h, 7 exercises (14 h), 2 laboratory exercises (3 hours/exercise), self-study 83 h

Target group:
For the students of the University of Oulu.

Prerequisites and co-requisites:
Knowledge of vector calculus and basics of differential and integral calculus.

Recommended optional programme components:
No alternative course units or course units that should be completed simultaneously.

Recommended or required reading:

Assessment methods and criteria:
Both parts (761119P-01 and 761119P-02) will be graded separately. The final grade of the course is the weighted average of the grades of part 1 (4 cr) and part 2 (1 cr).
761119P-01: Three small midterm exams or final examination
761119P-02: Two laboratory exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Numerical grading scale 0 – 5, where 0 = fail

Person responsible:
Timo Asikainen

461102A: Statics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: 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:

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.

461103A: Strength of materials I, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Lahtinen, Hannu Tapio
Opintokohteen kieleet: Finnish
Leikkaavuudet:
ECTS Credits:
5 ECTS / 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 spring semester, during periods 3 and 4. It is recommended to complete the course at the 1st spring semester.

Learning outcomes:
After the course, the student can determine stresses and strains of structures under loading. He/she can change the general stress and strain states from one coordinate system to another and can also apply constitutive equations in calculations. The student can dimension typical structures such as tension and compression bars, torsion bars and straight beams.

Contents:

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 Bachelor's degree students of mechanical engineering programme.

Prerequisites and co-requisites:
The recommended preceding course is 461102A Statics.

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:

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 looks into the most important principal concepts of strenght of materials and gives ability for dimensioning of simple structures such as straight bars in tension, compression or torsion loads and straight beams under bending moments.
Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Henri Jounila
Opintokohteen kielet: Finnish
Leikkaavuudet:
555263A Technology, Society and Work 2.0 op
555260P Basic Course in Occupational Safety and Wellbeing at Work 3.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. English material is also used.

Timing:
Periods 3-4.

Learning outcomes:
Upon completion of the course, the student will be able to:
- explain the basic terms of occupational safety and health
- assess the importance of occupational safety, health and well-being at work
- assess the significance of occupational safety in the improving of productivity and quality
- apply different safety analysis
- explain core issues of occupational safety and health management

Contents:
Occupational safety and health, safety management, safety culture, laws and standards, hazards and risks, occupational diseases and work accidents, safety analysis, occupational safety at shared industrial work sites, occupational safety card, HSEQ-assessment procedure, other current issues.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures and assignments 26 h / group work 40 h / tasks and self-study 68 h.

Target group:
Industrial Engineering and Management, Mechanical Engineering, Process Engineering and Environmental Engineering students.

Prerequisites and co-requisites:
-

Recommended optional programme components:
-

Recommended or required reading:
Mertanen V. 2015. Työturvallisuuden perusteet. Helsinki: Työterveyslaitos. Lecture materials. Other materials will be defined during the course.

Assessment methods and criteria:
Group work 0-5, the assessment of the tasks will be informed at the beginning of the course.

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

Person responsible:
MSc Henri Jounila

Working life cooperation:
-
Other information:
Substitutes courses 555260P Basic Course in Occupational Safety and Wellbeing at Work + 555263A Technology, Society and Work.

485021A: Construction Contracting, 5 op

Voimassaolo: 01.08.2018 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Liedes, Hannu Tapani
Opintokohteen kielet: Finnish
Leikkaavuudet:
  488119A Basics of infrastructure planning and development 5.0 op
  466113S Construction economics 5.0 op
  460165A-02 Introduction to Construction Economics I, practical work 0.0 op
  460165A-01 Introduction to Construction Economics I, examination 0.0 op

ECTS Credits:
5 ECTS

Language of instruction:
Finnish

Person responsible:
Hannu Liedes

Other information:
This Course replaces courses 466113S and 488119A.

555285A: Project management, 5 op

Voimassaolo: 01.01.2014 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
  555288A Project Management 5.0 op
  ay555285A Project management (OPEN UNI) 5.0 op
  555282A Project Management 4.0 op
  555280P Basic Course of Project Management 2.0 op

ECTS Credits:
5 ECTS credits.

Language of instruction:
Finnish. Check the course in English 555288A Project Management.

Timing:
Period 2.
Learning outcomes:
Upon completion of the course, the student will be able to:
- describe explain the essential concepts and methods related to project management
- apply project management methods to create a schedule for a project and calculate critical path
- understand essential concepts related to project cost management and able to apply earned value method and three point estimate to manage project costs
- recognises the essential tasks of project risk management

Contents:
Defining project management, project goals and objectives, project phases and project life-cycle management, project planning, organising and scope management, schedule management, cost management, earned value calculation and project risk management, project stakeholder management, project communications management, the role of project manager, new modes of project delivery

Mode of delivery:
The tuition will be implemented as web-based teaching.

Learning activities and teaching methods:
Web-based lectures 16h, self-study 118h

Target group:
Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:
No prerequisites exist.

Recommended optional programme components:
This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:
Lecture material, exercise book, Artto, Martinsuo & Kujala 2006. Projektiliiketoiminta. WSOY

Assessment methods and criteria:
Weekly assignments and final online exam

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

Person responsible:
Assistant professor Kirsi Aaltonen

Working life cooperation:
Videos from the industry’s projects

Other information:
Substitutes courses 555280P Basic Course of Project Management + 555282A Project Management.
Introduction to Information Retrieval

ECTS Credits:
1 ECTS credit / 27 hours of work

Language of instruction:
Finnish

Timing:
Architecture 3. spring semester, period III;
biochemistry 3. autumn semester;
obiology 3. autumn semester, period I;
chemistry 3. autumn semester, period I;
civil engineering 2. spring semester, period IV;
computer science and engineering 2. spring semester, period IV;
electronics and communications engineering 3. spring semester;
geosciences 2. spring semester, period IV;
geography 3. semester, periods I and III;
industrial engineering and management 3. year;
information processing sciences 1. or 3. year;
mechanical engineering 3. year;
machine learning and data mining 3. year;
process and environmental engineering 2. year, period II;
Master's degree students in industrial engineering and management 1st year.

Learning outcomes:
Upon completion of the course, the students:
- can search scientific information,
- can use the most important databases of their discipline,
- know how to evaluate search results and information sources,
- can use the reference management tool.

Contents:
Scientific information retrieval process, the most important databases and publication channels of the discipline, evaluation of the reliability of information sources and reference management tool.

Mode of delivery:
Blended teaching: classroom training, web-based learning material and exercises, a group assignment.

Learning activities and teaching methods:
Training sessions 8 h, group working 7 h, self-study 12 h

Target group:
Compulsory for all bachelor degree students of Faculty of information technology and electrical engineering, Faculty of Technology and Faculty of science. Compulsory also for those Master’s degree students in Industrial Engineering and Management who have no earlier studies in the information skills. Optional for the students of biochemistry.

Recommended optional programme components:
In biochemistry the course is completed as a part of 740376A Bachelor’s Thesis.

Recommended or required reading:
Web learning material Tieteellisen tiedonhankinnan opas

Assessment methods and criteria:
Passing the course requires participation in the training sessions and successful completion of the course assignments.

Grading:
pass/fail
Choose language studies

902150Y: Professional English for Technology, 2 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuysikkö: Languages and Communication
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English
Leikkaavuudet:
  902011P-05 TE3/ Professional English for Technology 2.0 op

Proficiency level:
CEFR B2 - C1

Status:
This course is the first English course for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).

Required proficiency level:
English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise. If you need to take English, but lack this background, please get in touch with the Languages and Communication contact teacher for your department to discuss individual solutions.

ECTS Credits:
2 credits. The workload is 53 hours.

Language of instruction:
English

Timing:
The course takes place in the autumn semester (periods 1 and 2).

Learning outcomes:
By the end of the course, you can
- create and deliver effective presentations of a product, a company and company processes,
- apply appropriate cultural, linguistic and technical knowledge when presenting a product or company,
- evaluate your own strengths and weaknesses in English-language communication, with a view to developing appropriate skills in future.

Contents:
Scheduled as the first course of your English studies, Professional English for Technology (PET) has a strong focus on developing speaking skills necessary for working life. During PET, you will explore a product or service from your own field, and give a variety of short presentations in connection with your product or service. In addition, PET helps you to develop an awareness of your own language skills, encouraging you to develop strategies and techniques for effective learning.

Mode of delivery:
Contact teaching and independent study

Learning activities and teaching methods:
Lessons 24 hours / independent work 29 hours. Lessons include regular pair and group work in class. Independent homework activities include team work for the preparation of four short presentations, vocabulary study and other small assignments. Active participation is essential.

Target group:
Students in the engineering programmes: TTK (PO1, YMP1, KO1, TuTa1, RaKy), TST (ST2, CSE2).
**Prerequisites and co-requisites:**
- 

**Recommended optional programme components:**
This course is offered as the first course of your English studies.

**Recommended or required reading:**
Course materials will be provided by the teacher in electronic form.

**Assessment methods and criteria:**
The course utilises continuous assessment that is based on the learning outcomes of the course, including full and active participation in class, and the successful completion of module assignments and class presentations.

Lue lisää opintosuoritusten arvostelusta yliopiston verkkosivulta.

**Grading:**
pass / fail

**Person responsible:**
Each engineering programme has its own Languages and Communication contact teacher for questions about English studies.

**Working life cooperation:**
-

**Other information:**
-

902142Y: Business Correspondence, 2 op

**Voimassaolo:** 01.08.2014 -
**Opiskelumuoto:** Language and Communication Studies
**Laji:** Course
**Vastuuysikkö:** Languages and Communication
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** English

**Proficiency level:**
CEFR B2 - C1 (All Levels)

**Status:**
This course can be chosen in partial completion of the English language requirement for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).

**Required proficiency level:**
English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise. If you need to take English, but lack this background, please get in touch with the Languages and Communication contact teacher for your department to discuss individual solutions.

**ECTS Credits:**
2 credits. The workload is 53 hours

**Language of instruction:**
English

**Timing:**
The course takes place in both autumn (periods 1 and 2) and spring (periods 3 and 4) semesters. Check the study guide for availability in your department.

**Learning outcomes:**
By the end of the course, you are expected to have demonstrated:
- the ability to write clear and effective business letters conveying information and details accurately,
- the ability to use an appropriate level of formality and style for business communications,
• mastery of the conventional formats and layouts of different types of business letters.

Contents:
The aim of this course is to introduce different types of business correspondence and the format used when communicating in writing. Types of correspondence include communication in business-to-business scenarios and between a business and the public.

Mode of delivery:
Self-access: the course operates within an online workspace, with online support from the teacher.

Learning activities and teaching methods:
Introductory session 2 hours / independent learning 51 hrs / optional text clinics. Assignments, instructions and course resources are available in the online course workspace. Completed assignments are submitted electronically to the teacher. The teacher provides feedback and any problems are discussed either by written electronic communication or at one of the optional text clinics.

Target group:
Students in the engineering programmes (TTK and TST)

Prerequisites and co-requisites:
-

Recommended optional programme components:
This is an elective course which can be taken after 902150Y PET by students in the engineering programmes (TTK and TST).

Recommended or required reading:
Course materials are provided in an electronic form that can be downloaded.

Assessment methods and criteria:
All assignments must be completed to a standard of effective business correspondence based on the learning outcomes of the course. In addition, there is a test at the end of the course.

Grading:
Pass/Fail

Person responsible:
Susan McAnsh

Working life cooperation:
-

Other information:
-

902145Y: Working Life Skills, 2 op

Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuysikkö: Languages and Communication
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

Proficiency level:
CEFR B2 - C1
(Alla levels)

Status:
This course can be chosen in partial completion of the English language requirement for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).

Required proficiency level:
English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise. If you need to take English, but lack this background, please get in touch with the Languages and Communication teachers for your department to discuss individual solutions.

**ECTS Credits:**
2 ECTS credits. The workload is 53 hours.

**Language of instruction:**
English

**Timing:**
The course takes place in both autumn (periods 1 and 2) and spring (periods 3 and 4) semesters. Check the study guide for availability in your department.

**Learning outcomes:**
By the end of the course, you are expected to
1. have demonstrated a good basic vocabulary related to job applications, meetings and negotiations,
2. have demonstrated an ability to create an effective CV and cover letter for a job application,
3. be able to communicate effectively and with a reasonable degree of fluency at job interviews and in meeting and negotiation contexts.

**Contents:**
The aim of this course is to help you to develop the English language skills needed to deal with situations related to everyday working life. The course focuses on four basic areas:
i) business communication
ii) social and cultural aspects of English in working life situations,
iii) applying for a job,
iv) a general introduction to the language of meetings and negotiations.

**Mode of delivery:**
Contact teaching and independent study

**Learning activities and teaching methods:**
Lessons 26 hours / independent work 27 hours. Active participation is essential. The course includes regular pair and group work in class and independent homework activities.

**Target group:**
Students in the engineering programmes (TTK and TST).

**Prerequisites and co-requisites:**
-

**Recommended optional programme components:**
This is an elective course which can be taken after 902150Y PET by students in the engineering programmes (TTK and TST).

**Recommended or required reading:**
Course materials will be provided by the teacher in electronic form.

**Assessment methods and criteria:**
The course utilises continuous assessment that is based on the learning outcomes of the course. In addition, full and active participation is required, course assignments must be completed, and students must achieve a grade of 70% in two tests during the course. Students will be asked to take an end-of course exam if they have not otherwise demonstrated that they have achieved the learning outcomes by the end of the course.
Read more about assessment criteria at the University of Oulu webpage.

**Grading:**
Pass/fail

**Person responsible:**
Susan McAnsh

**Working life cooperation:**
-

**Other information:**
902147Y: Academic Vocabulary for Science and Technology, 2 op

Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuysikkö: Languages and Communication
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

Proficiency level:
CEFR Level: B2-C1 (All levels)

Status:
This course can be chosen in partial completion of the English language requirement for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).

Required proficiency level:
English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise. If you need to take English, but lack this background, please get in touch with the Languages and Communication contact teacher for your department to discuss individual solutions.

ECTS Credits:
2 ECTS credits. The workload is 53 hours.

Language of instruction:
English

Timing:
The course takes place in both autumn (periods 1 and 2) and spring (periods 3 and 4) semesters. Check the study guide for availability in your department.

Learning outcomes:
By the end of the course, you are expected to
1) explain and apply general academic / scientific vocabulary from Coxhead's Academic Word List (AWL)
2) differentiate between informal (non-academic) and formal / academic language,
3) demonstrate use of academic vocabulary in a variety of writing and communication contexts.

Contents:
The general aim of this course is to activate and broaden your basic scientific vocabulary, i.e. the core vocabulary of scientific texts, which is principally the same regardless of the field (AWL). During this process, you will become aware of the strategies which best promote your skills to learn and memorise vocabulary. The ultimate aim is to help you gain the skills to read and write academic / scientific text and to discuss related topics. To help you achieve the learning outcomes, you will work on various written and oral activities which focus primarily on practicing vocabulary learning strategies, word formation, and the use of the most frequent academic vocabulary (AWL sublists).

Mode of delivery:
Contact teaching and independent study

Learning activities and teaching methods:
Lessons 26 hours / independent work 27 hours. The independent work includes a written academic essay or report; vocabulary tests; presentations, which will be given in class to small groups of students; and other homework assignments. Active participation is essential.

Target group:
Students in the engineering programmes (TTK and TST)

Prerequisites and co-requisites:
-

Recommended optional programme components:
This is an elective course which can be taken after 902150Y PET by students in the engineering programmes (TTK and TST).

**Recommended or required reading:**
Course materials will be provided by the teacher in electronic form.

**Assessment methods and criteria:**
Regular and active participation in the weekly sessions will be observed in continuous assessment that is based on the learning outcomes of the course. Satisfactory completion of the in-class/ homework assignments and the vocabulary tests is required. See more about assessment criteria, https://www.oulu.fi/forstudents/assesment-criteria.

**Grading:**
Pass/Fail

**Person responsible:**

**Working life cooperation:**
-

**Other information:**
-

---

**902121Y: Other Studies in English (level B2), 2 - 8 op**

**Voimassaolo:** 01.08.2008 -  
**Opiskelumuoto:** Language and Communication Studies  
**Laji:** Course  
**Vastuuysikkö:** Languages and Communication  
**Arvostelu:** 1 - 5, pass, fail  
**Opintokohteen kielet:** English  
**Voidaan suorittaa useasti:** Kyllä  

Ei opintojaksokuvauksia.

---

**Choose your mother tongue**

**901044Y: Second Official Language (Swedish), Written Skills, 1 op**

**Voimassaolo:** 01.08.2014 -  
**Opiskelumuoto:** Language and Communication Studies  
**Laji:** Course  
**Vastuuysikkö:** Languages and Communication  
**Opintokohteen kielet:** Swedish  

**Leikkaavuudet:**

901060Y    Second Official Language (Swedish), Written Skills    1.0 op

**Proficiency level:**
This course is only for Finnish speaking students with CEFR-level A2 in Swedish language. University of Oulu, Languages and Communication unit don’t offer Beginners courses in Swedish.

**Recommended optional programme components:**
-

**901045Y: Second Official Language (Swedish), Oral Skills, 1 op**

**Voimassaolo:** 01.08.2014 -
Opiskelumuoto: Language and Communication Studies  
Laji: Course  
Vastuuysikkö: Languages and Communication  
Opintokohteen kielet: Swedish  
Leikkaavuudet:  
901061Y Second Official Language (Swedish), Oral Skills 1.0 op

900081Y: Second Official Language (Finnish), Written Skills, 1 - 2 op  
Voimassaolo: 01.01.2015 -  
Opiskelumuoto: Language and Communication Studies  
Laji: Course  
Vastuuysikkö: Languages and Communication  
Opintokohteen kielet: Finnish

900082Y: Second Official Language (Finnish), Oral Skills, 1 - 3 op  
Voimassaolo: 01.01.2015 -  
Opiskelumuoto: Language and Communication Studies  
Laji: Course  
Vastuuysikkö: Languages and Communication  
Opintokohteen kielet: Finnish

Proficiency level:  
The course is intended for the students who’s schooling language is Swedish. See 900081Y Second Official Language (Finnish), Written Skills.

485980A: Bachelor’s Thesis, 8 op  
Voimassaolo: 01.08.2019 -  
Opiskelumuoto: Intermediate Studies  
Laji: Course  
Vastuuysikkö: Civil Engineering field  
Arvostelu: 1 - 5, pass, fail  
Opintokohteen kielet: Finnish

ECTS Credits:  
8 ects  
Language of instruction:  
Finnish, can be written in English if needed.  
Timing:  
The end of Bachelor's studies  
Learning outcomes:  
Upon completion of the thesis the student can create a research plan, and define a research problem and research questions. She/He is able to manage her/his own work according to the project plan. The student can also utilize different information sources and critically evaluate the information obtained. The student is able to produce clear and finalized text, in line with technical and scientific writing practices.  
Contents:  
The student chooses the theme for the thesis in cooperation with his/her supervisor.  
Mode of delivery:  
The thesis is written towards the end of the BSc studies, typically during the third year.  
Learning activities and teaching methods:  
Independent work.  
Target group:
Bachelor Students of Civil Engineering.

**Prerequisites and co-requisites:**
Basic and intermediate studies.

**Recommended optional programme components:**
Information Skills and Technical communication

**Assessment methods and criteria:**
BSc thesis and related maturity test.

**Grading:**
pass/fail

**Person responsible:**
The supervisor of Thesis

**Working life cooperation:**
Thesis' theme is often selected from the real research project or it is possible to do with industrial company.

---

900060A: Technical Communication, 2 op

**Voimassaolo:** 01.08.2005 - 31.07.2021

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuysikkö:** Languages and Communication

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

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- ay900060A Technical Communication (OPEN UNI) 2.0 op
- 470218P Written and Oral Communication 3.0 op

**Proficiency level:**
This course is not offered in English. It is only Finnish-speaking students.

**Status:**
This course unit is compulsory for students of Electrical Engineering, Computer Science, Communications Technologies and Engineering Mechanical Engineering, Process and Environmental Engineering.

**Required proficiency level:**
-

**ECTS Credits:**
2 credits

**Language of instruction:**
Finnish

**Timing:**
1st year: Process and Environmental Engineering
2nd year: Communications Technologies
3rd year: Geoscience; Mechanical Engineering; Electrical Engineering, Computer Science and Engineering Technologies

**Mode of delivery:**
Multimodal teaching

**Learning activities and teaching methods:**
Contact hours ca. 20 h and independent group work or self-study ca. 34 h.

**Target group:**

**Prerequisites and co-requisites:**
-

**Recommended optional programme components:**
-

**Recommended or required reading:**
Kauppinen, Anneli & Nummi, Jyrki & Savola, Tea: Tekniikan viestintä: kirjoittamisen ja puhumisen käsikirja (EDITA);
Nykänen, Olli: Toimivaa tekstiä: Opas teknikasta kirjoittaville (TEK) and material in Moodle study environment.

**Assessment methods and criteria:**
Active participation in contact teaching, independent study and completion of given assignments.
Read more about assessment criteria at the University of Oulu webpage.

**Grading:**
Pass / fail

**Person responsible:**
Kaija Oikarainen

**Working life cooperation:**
-

**Other information:**
All students are required to attend the first meeting of the course unit so the work groups can be formed and work started in a timely and efficient manner. When signing up for the course unit, you should keep in mind that completing it requires a responsible attitude and a strong commitment to the work because the teamwork-based exercises rely heavily on the participation and activity of the students.

If the student is involved in the University's student associations or functions in a position of trust in university government, student union administration or Oulun Teekkaryhdistys ry (or in its subordinate guilds), he/she may be relieved of some of the group communication exercises. These compensatory actions must always be agreed upon separately with the course unit's teacher. The student must present an official statement from a person in charge of the governing body or association, which details the student's tasks and involvement with that body or association. Participation that took place over five years ago does not entitle the student to any compensation.

---

**485981A: The Maturity Test for Bachelor's Degree, 0 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Intermediate Studies

**Laji:** Course
**Vastuuysikkö:** Civil Engineering field

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

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
0 ects

**Language of instruction:**
Finnish or Swedish.

**Timing:**
After completion of the bachelor's thesis.

**Learning outcomes:**
The student can produce mature text in popular form of the research field and thus show ones familiarity to the field.

**Contents:**
Depends on the topic of the thesis.

**Mode of delivery:**
Literary work

**Learning activities and teaching methods:**
Exam

**Target group:**
Bachelor Students of Civil Engineering

**Recommended optional programme components:**
Will be written after the Bachelor's Thesis has been submitted for review.

**Assessment methods and criteria:**
Student writes an essay in his/her native language about the topic of the Bachelor's thesis to show a good command of the language and the content of the thesis

**Grading:**
Pass or fail. Both the contents and language are assessed.

**Person responsible:**
Supervisor of Thesis

---

**A485122: Civil Engineering, Module preparing for the Option / Structural Engineering, 40 op**

**Voimassaolo:** 01.08.2018 -
**Opiskelumuoto:** Intermediate Studies
461104A: Strength of materials II, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Laukkanen, Jari Jussi
Opintokohteen kielet: Finnish

Leikkaavuudet:
- 461011A-01 Strength of Materials II, examination 0.0 op
- 461011A-02 Strength of Materials II, exercises 0.0 op
- 461011A Strength of Materials II 7.0 op

ECTS Credits:
5 ECTS

Language of instruction:
Finnish

Timing:
Periods 1-2.

Learning outcomes:
The student can apply fatigue design principles in structural analysis and use fracture mechanics to evaluate the life of simple structures. He / she is also able to solve stability, buckling and buckling bending of rod and beam structures. The student is able to solve curve beam bending state and free and prevented torque situations.
After completing the course, the student will have a general understanding of the different areas of strength and will be able to discuss the potential of strength design with experts in the field.

Contents:

Mode of delivery:
Contact teaching

Learning activities and teaching methods:
Lectures 45 h, exercises 45 h and independent learning 45 h. Homework.

Target group:
Compulsory for Mechanical Engineering Degree students.

Prerequisites and co-requisites:
Statics and Strength of Materials I.

Recommended or required reading:

Assessment methods and criteria:
The course can be completed with an intermediate exam or a final exam. You can take the exam only after you have successfully completed your homework.

**Grading:**
The course uses 1-5 numerical grading scale. On a numerical scale, zero indicates a failed performance.

**Person responsible:**
University Teacher Jari Laukkanen.

461106A: Dynamics, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Mechanical Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Koivurova Hannu
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 461018A-01 Dynamics, examination 0.0 op
- 461018A-02 Dynamics, exercises 0.0 op
- 461018A Dynamics 4.0 op

**ECTS Credits:**
5 ECTS credits / 120 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 2st spring semester.

**Learning outcomes:**
The aim of this course is to provide students with the ability to examine the relationship between the forces on a solid body and the resulting motion, position, speed and acceleration of the body. Learning outcomes: Upon completing the required coursework, the student knows and is able to explain the fundamental quantities and the base laws of the classical mechanics. He/she is able to choose an appropriate coordinate system and analyze the motion - position, velocity, and acceleration - of the parts of a device. The student is able to draw a free body diagram of a moving system, and compose and derive the equations of motion for a system using the direct momentum method, the work-energy method, and the impulse-momentum method.

**Contents:**
Introduction; Kinematics of a particle; Plane kinematics of a rigid body; Kinetics of a particle;. Basics of mechanical vibrations; Kinetics of a system of particles; Plane kinetics of a rigid body.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures 45 h / Exercise 30 h / Self-study 45 h.

**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:**

**Assessment methods and criteria:**
This course utilizes continuous assessment. During the course, there are three intermediate exams. In addition to this, the students will be asked to calculate homeworks, and theses homeworks will be assessed. The assessment of the course is based on the learning outcomes of the course. The more detailed assessment criteria are available on the Moodle Study Portal.

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

**Person responsible:**
University Lecturer Hannu Koivurova

---

461108A: Mechanics of materials, 5 op

**Voimassaolo:** 01.08.2015 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Field of Mechanical Engineering
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Koivurova Hannu
**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 90 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the Autumn semester, during periods 1 and 2. It is recommended to complete the course at the 3rd autumn semester.

**Learning outcomes:**
Upon completing the required coursework, the student knows the theoretical background of the strength of materials and he/she is able to apply the theory of the strength of materials to different kind of design problems needed in engineering mechanics. He/she understand the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior. He/she can discuss the basic mechanical principles underlying modern approaches for modelling of various types of materials under a different type of loadings. This provide students with exposure to the systematic methods for solving engineering problems in solid mechanics. He/she can also build the necessary theoretical background for further structural analysis and design courses.

**Contents:**
The general equations of mechanics. The stress and strain state. Different material models; Linear elastic material, isotropic, transverse-isotropic and orthotropic material models. The concept of strain energy. Theory of plasticity. Yield criterion, plastic flow rule and hardening. Limit state design. Introduction to visco elastic material and creep theory.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures 30 h / Exercise 30 h / Self-study 30 h.

**Target group:**
Students of the Bachelor Stage of the Mechanical Engineering Degree Programme

**Prerequisites and co-requisites:**
Recommended: Strength of Materials I and II and the knowledge of vector and matrix calculations.

**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:**
Assessment methods and criteria:
This course utilizes continuous assessment. During the course, there are 2 intermediate exams. In addition to this, the students will be asked to calculate homeworks, and theses homeworks will be assessed. The assessment of the course is based on the learning outcomes of the course. The more detailed assessment criteria are available on the Moodle Study Portal.

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

Person responsible:
University Lecturer Hannu Koivurova

461107A: Finite Element Methods I, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Lumijärvi, Jouko Veikko Juhani
Opintokohteen kielet: Finnish
Leikkaavuudet:

461033A Finite Element Methods I 3.5 op
461033A-01 Finite Element Methods I, examination 0.0 op
461033A-02 Finite Element Methods I, exercises 0.0 op

ECTS Credits:
5 ECTS credits / 132 hours of work

Language of instruction:
Finnish

Timing:
Lectures and exercises, periods 1.-2.

Learning outcomes:
The aim of this course is for students to gain an understanding of the basic idea and restrictions of FEM. After this course, the student can explain the basic idea of the FEM. He/she can analyze simple truss-, frame- and plane structures and explain the theoretical background of the calculations.

Contents:
The basic idea of FEM and its use in static analyses of bars, beams and plane structures. Some general principles of the use of FEM.

Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures and exercises take place during periods 1.-2.

Target group:
Students of the bachelor's stage of the Mechanical Engineering Degree Programme.

Prerequisites and co-requisites:
Strength of Materials I and II and Fundamentals of mechanical computing and programming
Recommended or required reading:

Assessment methods and criteria:
The grade of the course is based on a final exam. The student must pass the exercises before taking the examination.

Grading:
Numerical grading scale 1-5.

Person responsible:
Jouko Lumijärvi

485107A: Timber construction and product technology, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

485110A: Timber product technology and construction, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:
5 ETCS / 135 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the spring semester, during periods 3 and 4.

Learning outcomes:
Ability to design and dimension conventional load-bearing structures made of wood according to the requirements of the EN standard.

Contents:

Mode of delivery:
Face-to-face and independent study.

Learning activities and teaching methods:
Lectures and exercises 48 h, project work 24 h and independent work 63 h.

Target group:
Bachelor level students in the degree program of civil engineering.

Prerequisites and co-requisites:
Basic knowledge of statics, solid mechanics, timber construction and product technology as well as structural engineering.

**Recommended optional programme components:**
The course supports advanced courses in civil and structural engineering and timber structures.

**Recommended or required reading:**

**Assessment methods and criteria:**
The course is passed by partial exams during the course or by a final exam. A project work is also required.

**Grading:**
Numerical grading scale 1-5. Grade 0 stands for a fail.

**Person responsible:**
Senior research fellow Antti H. Niemi

**Working life cooperation:**
-

**Other information:**
-

---

**485108A: Design of Steel Structures and Steel Construction, 5 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
466105S  Design of Steel Structures  6.0 op

**ECTS Credits:**
5 ects

**Language of instruction:**
Finnish

**Timing:**
Periods 1 and 2

**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:**

**Mode of delivery:**
Face-to-face

**Learning activities and teaching methods:**
Lectures, exercises and self-study.

**Target group:**

**Prerequisites and co-requisites:**

**Recommended or required reading:**

**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 Kangasvuoaksari

**Other information:**
This course will replace course 466105S Design of Steel Structures in Academic year 2020-21.

485104A: Structural renovation of buildings, 5 op

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1-5, pass, fail
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
466117S Structural renovation of buildings 5.0 op

**ECTS Credits:**
5 ECTS credits / 135 hours of work

**Language of instruction:**
Finnish

**Timing:**
Autumn, Period 2

**Learning outcomes:**
After completing the course students can describe different structural materials and structural systems used in residential buildings in 1900-2000. They are able to identify and explain the typical risk structures and defects in those buildings. They can also explain the old design codes and recommendation used in Finland.

**Contents:**
Finnish house construction and typical details during 1900-2000. Standards, design recommendations and design methods used in Finland.

**Mode of delivery:**
Lecture room teaching

**Learning activities and teaching methods:**
Lectures and exercises

**Target group:**
Students studying structural engineering
Prerequisites and co-requisites:
Fundamentals of building construction and building physics

Recommended optional programme components:
-

Recommended or required reading:
Lecture material

Assessment methods and criteria:
Passed practical works and exam

Grading:
The course utilizes a numerical grading scale 1-5. Numerical scale zero stands for a fail.

Person responsible:
Senior research fellow Antti H. Niemi

Working life cooperation:
-

Other information:
This course will replace the course 466117S in academic year 2020-21.

A485121: Civil Engineering, Module preparing for the Option / Geo Engineering, 40 op

Voimassaolo: 01.08.2018 -
Opiskelumuoto: Intermediate Studies
Laji: Study module
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Geo Engineering

477052A: Fluid Mechanics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ainassaari, Kaisu Maritta
Opintokohteen kielet: Finnish
Leikkaavuudet:
  477301A  Momentum Transfer  3.0 op

ECTS Credits:
5 ECTS / 133 hours of work.

Language of instruction:
Finnish, can be completed in English as a book examination.

Timing:
Implementation in spring semester during 3rd period. It is recommended to complete the course at the second (Bachelolor's) spring semester.

Learning outcomes:
After the course the student is able to determine the viscosity of pure substances and mixtures and to estimate the effect of temperature and pressure on viscosity. The student is able to recognise the interactions between a solid body and flowing fluid and to distinguish the forces, their directions and to calculate their magnitudes. The student is able to formulate momentum balance equations and to solve these in order to calculate velocity distribution, flow rate and pressure drop. The student is able to distinguish laminar and turbulent flow regimes from others and is able to use the correct equations according to flow regime. After the course the student is able to design pipelines and other simple flow mechanical process equipment.

Contents:

Mode of delivery:
Face-to-face teaching in Finnish. Book examination in English.

Learning activities and teaching methods:
Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

Target group:
Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:
Knowledge of solving differential equations.

Recommended optional programme components:
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:
or

Assessment methods and criteria:
This course utilizes continuous assessment. During the course there are 3 intermediate exams in Finnish. The course can also be completed by final examination
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

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

Person responsible:
University teacher Kaisu Ainassaari

Working life cooperation:
No

488102A: Hydrological Processes, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:
ay488102A Hydrological Processes (OPEN UNI) 5.0 op
480207A Hydraulics and Hydrology 5.0 op

ECTS Credits:
5 ECTS credits / 133 hours of work
Language of instruction:
Finnish, but also option to complete the course in English.

Timing:
The course is held in the autumn semester during the period 1. It is recommended to complete the course at the 1st autumn semester of the international master program of environmental engineering.

Learning outcomes:
After the course, the student understands and can describe the main hydrological processes, water movements and hydraulics phenomenon quantitatively through mathematical methods. The student also understands and quantifies the relation between state and flow with relation to snowmelt, evaporation, infiltration and groundwater flow.

Contents:
Hydrological cycle, physical properties of water, distribution of water resources, water balance, precipitation, evapotranspiration, soil and ground water, infiltration, runoff, snow hydrology, hydrometry, water quality of rivers and lakes.

Mode of delivery:
Face-to-face teaching and independent work with two assignment reports.

Learning activities and teaching methods:
Lectures 24 h, exercises 16 h and independent work 93 h. Totally 133 h.

Target group:
Students in international master programs of environmental engineering

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following course or having corresponding knowledge prior to enrolling for the course unit: 477201A Material and Energy Balances and 477052A Fluid mechanics.

Recommended optional programme components:
The course is a prerequisite for most of master level studies.

Recommended or required reading:

Assessment methods and criteria:
The assignments must be returned and passed with threshold of 50% in order to get final examination. The final grade of the course is weighted average of assignment reports (80%) and examination (20%).

Grading:
The assignments must be returned and passed with threshold of 50% in order to get final examination. The final grade of the course is weighted average of assignment reports (80%) and examination (20%).

Person responsible:
University Lecturer Anna-Kaisa Ronkanen

Working life cooperation:
Examples solved in the lectures based on real problems

Other information:
The English version of the course is organized parallel to Finnish version of the course.

488144A: Water distribution and sewage networks, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Pekka Rossi
Opintokohteen kielet: English
Leikkaavuudet:
- 488135S Water distribution and sewage networks 5.0 op

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
English

Timing:
The course unit is held in the autumn semester, in period 2.

Learning outcomes:
Student knows and understands the systems and dynamics needed for water distribution and waste water networks. Student is able to do basic dimensioning for water distribution network and sewer system of an urban area.

Contents:
Water distribution and waste water network design and dimensioning, Pumping and storage tanks needed in distribution of water and collection of sewage waters, renovation of pipelines, special circumstances in water distribution, effects of cold climate and harmful hydraulic conditions.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (30 h), homework (45 h) and a design exercise (58 h).

Target group:
Students in master program of environmental engineering and in master program of civil engineering.

Prerequisites and co-requisites:
477052A Virtaustekniikka, Use of AutoCAD-program (488051A AutoCAD ja Matlab prosessi- ja ympäristötöniikan työkaluna or similar).

Recommended optional programme components:
The recommended prerequisite is the completion of the following course prior to enrolling for the course unit: 477052A Virtaustekniikka, 477312A Lämmön- ja aineensiirto 488102A Hydrological Processes and 488051A AutoCAD ja Matlab prosessi- ja ympäristötöniikan työkaluna or at least equivalent information about water management.

Recommended or required reading:
Lecture handout and other materials delivered in lectures. To the appropriate extent: RIL 237-1-2010 Vesihuoltoverkkojen suunnittelu, RIL 237-2-2010 Vesihuoltoverkkojen suunnittelu, RIL 124-2 Vesihuolto II, Mays Water distribution systems handbook

Assessment methods and criteria:
Exam and a design exercise.

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

Person responsible:
Postdoctoral Researcher Pekka Rossi

Working life cooperation:
Visit to a site of water distribution network building site, pumping station or water supply/sewerage company.

Other information:
Replaces the course 488135S Water distribution and sewage networks, 5 ects.
492300A: Rock mechanics, 5 op

Voimassaolo: 01.08.2016 - 
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Oulu Mining School
Arvostelu: 1 - 5, pass, fail
Opettajat: Zongxian Zhang
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS cr /133 hours of work

Language of instruction:
English

Timing:
Spring, period 3

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:

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

**485401A: Basics of Traffic Engineering, 5 op**

**Voimassaolo:** 01.08.2019 -
**Opiskelumuoto:** Intermediate Studies
**Laji:** Course
**Vastuuysikkö:** Civil Engineering field
**Arvostelu:** 1 - 5, pass, fail
**Opettajat:** Virve Merisalo
**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**
- 488151A Basics of Traffic Engineering 5.0 op

**ECTS Credits:**
5 ECTS / 135 h of work

**Language of instruction:**
Finnish

**Timing:**
Period 1

**Learning outcomes:**
By completing the course the student knows the basics of modes of transport, the significance of traffic and transportation to society, traffic planning and research methods, transport economics and the external effects of transport.

**Contents:**
Modes of transport, Need for traffic and transportation, Transport planning and research, Economical and environmental impacts of traffic, Traffic safety.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures 28 h, exercises 22 h, self-study 85 h

**Target group:**
Students in the Bachelor's Programme of Civil Engineering

**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:**
Materials delivered during the lectures

**Assessment methods and criteria:**
Examination and exercises

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

**Person responsible:**
University teacher Virve Merisalo

**Working life cooperation:**
-

**Other information:**
485403A: Basics of Road Engineering, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opettajat: Veikko Pekkala
Opintokohteen kielet: Finnish
Leikkaavuudet:

488153A Basics of Road Engineering 5.0 op

ECTS Credits:
5 ECTS / 135 h of work

Language of instruction:
Finnish

Timing:
Period 3

Learning outcomes:
By completing the course student understands the basics of road design and construction, is able to calculate structure layers of road and is familiar with the maintenance of roads

Contents:
Road and street planning and design, lining, roads structure, maintenance of roads, basics of earthworks

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 28 h, exercises 22 h, self-study 85 h

Target group:
Students in bachelor's programmes of environmental engineering

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:
Materials delivered during the lectures

Assessment methods and criteria:
Exam, assignment and seminar work

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

Person responsible:
Veikko Pekkala

Working life cooperation:
-

Other information:
-

488505A: Waste management and recycling, 5 op
Voimassaolo: 01.09.2018 -  
Opiskelumuoto: Intermediate Studies 
Laji: Course 
Vastuuysikkö: Field of Process and Environmental Engineering 
Arvostelu: 1 - 5, pass, fail 
Opettajat: Eva Pongracz, Jenni Ylä-Mella 
Opintokohteen kielet: Finnish 

Leikkaavuudet:  
488130A Waste management and resources recovery 5.0 op

ECTS Credits: 
5 cr/133 hours of work

Language of instruction: 
English

Timing: 
Spring, period 3-4.

Learning outcomes: 
After completing the course, the student will be familiar with the waste legislation and other policy instruments and is able to use the waste-related terminology. The student understands the responsibilities of the different actors and stakeholders in the municipal waste management system and knows the key waste minimization and recycling requirements. The student will also be familiar with the municipal waste collection system for households and able to calculate the recycling and recovery rates of recyclables. The student knows the key recycling technologies for the main waste fractions and can calculate treatment costs for the major streams.

Contents: 

Mode of delivery: 
Distance learning, starting 22.1.2021 in zoom. More detailed instructions for those who registered by e-mail on 21.1.2021. Lectures, lecture assignments and an exercise in Moodle. The course has compulsory assignment requirements and the course evaluation will be based on the grades of intermediate tasks. No exam.

Learning activities and teaching methods: 
Online and video lectures; lecture assignments and an exercise as a personal work.

Target group: 
Master’s students of process and environmental engineering; Bachelor’s students of environmental engineering; Minor subject students.

Recommended or required reading: 
Video lectures and information on recommended reading material will be provided during the course.

Assessment methods and criteria: 
Continuous evaluation. Completion of all personal lecture assignments and the exercise during the course are mandatory.

Grading: 
The evaluation is based on personal lecture assignments and an exercise during the course. Each intermediate task must be passed, and the scores obtained from assignments forms the final grade. The course uses a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible: 
D.Sc.(Tech.) Jenni Ylä-Mella
Other information:
This course replaces the course 488130A Waste management and resources recovery. The course can also be taken in Finnish in autumn term period 1. (See the course description in Finnish.)

485303A: Soil Mechanics, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Civil Engineering field
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits / 135 hours of work

Language of instruction:
Finnish

Timing:
The course unit is held in the spring semester, during period 4

Learning outcomes:
Upon completion this course, the student will understand 1) the fundamentals of consolidation theory, 2) calculation of settlement, 3) stability of slopes, 4) lateral earth pressures and calculations, 5) braced excavation, 6) bearing capacity of soils.

Contents:
Settlement calculation, consolidation settlement, shear strength of soils, stresses in soil from surface load, slope stability, bearing capacity, earth retaining structures.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (24 h) and calculation exercises (16 h) also independent work (95 h)

Target group:
Students in Bachelor program of civil engineering

Prerequisites and co-requisites:
No

Recommended optional programme components:
-

Recommended or required reading:
Lecture handout and other materials delivered in lectures, Principles of Geotechnical Engineering by Das B. M and Craig’s Soil Mechanics by Craig R.F.

Assessment methods and criteria:
Examination

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

Person responsible:
Anne Tuomela

Working life cooperation:
No

Other information:
-
A485123: Civil Engineering, Module preparing for the Option / Mining Engineering, 40 op

Voimassaolo: 01.08.2018 -  
Opiskelumuoto: Intermediate Studies
Laji: Study module 
Vastuuysikkö: Civil Engineering field 
Arvostelu: 1 - 5, pass, fail
Opintokohteen kiele: Finnish

Ei opintojaksokuvauksia.

Mining Engineering

771113P: Introduction to Geology I, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Oulu Mining School
Arvostelu: 1 - 5, pass, fail
Opettajat: Kari Strand
Opintokohteen kiele: 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:

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
Vastuuysikkö: 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:
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

771117P: Basic course in mineralogy, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuysikkö: Oulu Mining School
Arvostelu: 1 - 5, pass, fail
Opettajat: Pekka Tuisku
Opintokohteen kielet: Finnish

ECTS Credits:
5 ects

Person responsible:
Pekka Tuisku

461011A: Strength of Materials II, 7 op

Voimassaolo: - 31.07.2021
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Laukkanen, Jari Jussi
Opintokohteen kielet: Finnish

Leikkaavuudet:
461104A  Strength of materials II  5.0 op

ECTS Credits:
5 ects /135 hous of work

Language of instruction:
Finnish

Timing:
Lectures and exercises take place during the periods 1 - 2.

Learning outcomes:
The aim of this course is to provide students with a general view of the different areas concerning the strength of materials. Learning outcomes: Upon completion of the course, the student should be able to use the basic methods of fatigue strength estimation and fracture mechanics to estimate the life of simple structures. He/she is also able to solve the problem concerning the buckling of columns and beam columns. Moreover, the student is able to solve the problem of the bending of curved beams and free and warping torsion of beams.

Contents:
Basic methods of fatigue strength estimation; Basics of fracture mechanics; Buckling of columns and beam columns; Bending of curved beams; Free and warping torsion;

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
This course will be based on lectures 45 h and exercises 45 h and 45 h self-study during periods 1 - 2 and will have a final exam or mid-term exams.

**Prerequisites and co-requisites:**
Statics and Strength of Materials I

**Recommended or required reading:**

**Assessment methods and criteria:**
Midterm exams or one final exam is required. After the passed exercises a student is allowed to take part in an exam.

**Grading:**
Numerical grading scale 1-5.

**Person responsible:**
University Teacher Jari Laukkanen

461106A: Dynamics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Koivurova Hannu
Opintokohteen kielet: Finnish
Leikkaavuudet:

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>461018A-01</td>
<td>Dynamics, examination</td>
<td>0.0 op</td>
</tr>
<tr>
<td>461018A-02</td>
<td>Dynamics, exercises</td>
<td>0.0 op</td>
</tr>
<tr>
<td>461018A</td>
<td>Dynamics</td>
<td>4.0 op</td>
</tr>
</tbody>
</table>

**ECTS Credits:**
5 ECTS credits / 120 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 2st spring semester.

**Learning outcomes:**
The aim of this course is to provide students with the ability to examine the relationship between the forces on a solid body and the resulting motion, position, speed and acceleration of the body. Learning outcomes: Upon completing the required coursework, the student knows and is able to explain the fundamental quantities and the base laws of the classical mechanics. He/she is able to choose an appropriate coordinate system and analyze the motion - position, velocity, and acceleration - of the parts of a device. The student is able to draw a free body diagram of a moving system, and compose and derive the equations of motion for a system using the direct momentum method, the work-energy method, and the impulse-momentum method.
Contents:
Introduction; Kinematics of a particle; Plane kinematics of a rigid body; Kinetics of a particle; Basics of mechanical vibrations; Kinetics of a system of particles; Plane kinetics of a rigid body.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 45 h / Exercise 30 h / Self-study 45 h.

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:

Assessment methods and criteria:
This course utilizes continuous assessment. During the course, there are three intermediate exams. In addition to this, the students will be asked to calculate homeworks, and these homeworks will be assessed. The assessment of the course is based on the learning outcomes of the course. The more detailed assessment criteria are available on the Moodle Study Portal.

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

Person responsible:
University Lecturer Hannu Koivurova

461108A: Mechanics of materials, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Koivurova Hannu
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits / 90 hours of work

Language of instruction:
Finnish

Timing:
The course is held in the Autumn semester, during periods 1 and 2. It is recommended to complete the course at the 3rd autumn semester.

Learning outcomes:
Upon completing the required coursework, the student knows the theoretical background of the strength of materials and he/she is able to apply the theory of the strength of materials to different kind of design problems needed in engineering mechanics. He/she understand the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior. He/she can discuss the basic mechanical principles underlying modern approaches for modelling of various types of materials under a different type of loadings. This provide students with exposure to the systematic methods for solving engineering problems in solid mechanics. He/she can also build the necessary theoretical background for further structural analysis and design courses.

Contents:
The general equations of mechanics. The stress and strain state. Different material models; Linear elastic material, isotropic, transverse-isotropic and orthotropic material models. The concept of strain energy.
Theory of plasticity. Yield criterion, plastic flow rule and hardening. Limit state design. Introduction to viscoelastic material and creep theory.

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures 30 h / Exercise 30 h / Self-study 30 h.

**Target group:**
Students of the Bachelor Stage of the Mechanical Engineering Degree Programme

**Prerequisites and co-requisites:**
Recommended: Strength of Materials I and II and the knowledge of vector and matrix calculations.

**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:**

**Assessment methods and criteria:**
This course utilizes continuous assessment. During the course, there are 2 intermediate exams. In addition to this, the students will be asked to calculate homeworks, and theses homeworks will be assessed. The assessment of the course is based on the learning outcomes of the course. The more detailed assessment criteria are available on the Moodle Study Portal.

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

**Person responsible:**
University Lecturer Hannu Koivurova

---

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

**Voimassaolo:** 01.08.2017 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuysikkö:** 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 internal geophysical properties and the interactions between different spheres, can describe large scale transfer (movement) of rock material inside the Earth and on its surface (convention, plate tectons) and can name most common geophysical research methods.

**Contents:**

**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:

Assessment methods and criteria:
Variable grading and evaluation methods

Grading:
1-5/fall

Person responsible:
Kari Moisio

Working life cooperation:
No working life cooperation

492300A: Rock mechanics, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuysikkö: Oulu Mining School
Arvostelu: 1 - 5, pass, fail
Opettajat: Zongxian Zhang
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS cr /133 hours of work

Language of instruction:
English

Timing:
Spring, period 3

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:

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